TRANSACTIONS

OF THE

ROYAL SOCIETY

OF

CANADA

THIRD SERIES—VOLUME II

MEETING OF MAY 1908

TABLE OF CONTENTS

APPENDICES.

A.—Presidential Address.

B.—Biological Stations.

C.—Meteorological Service.

D.—Dominion Astronomical Observatory.

E. —Associated Societies.

TRANSACTIONS.

SECTION I.

SECTION II.

SECTION III.

SECTION IV.

LIST OF ILLUSTRATIONS.

PROCEEDINGS.

SECTION I.

SECTION II.

SECTION III.

SECTION IV.

THE ROYAL SOCIETY OF CANADA.

FOUNDER: HIS GRACE THE DUKE OF ARGYLL, K.T., &c.,
(WHEN GOVERNOR-GENERAL OF CANADA IN 1882.

OFFICERS FOR 1908-1909.

HONORARY PRESIDENT:

HIS EXCELLENCY THE RIGHT HON. EARL GREY, G.C.M.G., &c.

HONORARY VICE-PRESIDENT:

THE RT. HON. LORD STRATHCONA AND MOUNT ROYAL, G.C.M.G., &c.

PRESIDENT—DR. J. EDMOND ROY.
VICE-PRESIDENT—DR. GEORGE BRYCE.

HONORARY SECRETARY, ...	DR. JAMES FLETCHER
HONORARY TREASURER, ...	L. M. LAMBE

OFFICERS OF SECTIONS:

SEC. I.—French Literature, History, and Allied Subjects.

PRESIDENT, ...	MGR BÉGIN
VICE-PRESIDENT, ...	HON. RODOLPHE LEMIEUX
SECRETARY, ...	ERROL BOUCHETTE

SEC. II.—English Literature, History, and Allied Subjects.

PRESIDENT, ...	LT.-COL. WOOD
VICE-PRESIDENT, ...	ARCHBISHOP HOWLEY
SECRETARY, ...	DR. W. WILFRED CAMPBELL

SEC. III.—Mathematical, Physical, and Chemical Sciences.

PRESIDENT, ...	DR. H. T. BARNES
VICE-PRESIDENT, ...	DR. W. BELL DAWSON
SECRETARY, ...	DR. E. DEVILLE

SEC. IV.—Geological and Biological Sciences.

PRESIDENT, ...	PROF. MACALLUM
VICE-PRESIDENT, ...	MGR. LAFLAMME
SECRETARY, ...	W. HAGUE HARRINGTON

ADDITIONAL MEMBERS OF COUNCIL:[1]

SIR S. FLEMING, K.C.M.G.	COL. G. T. DENISON
DR. J. LOUDON	BENJAMIN SULTE
DR. DECELLES, C.M.G.	DR. ALEX. JOHNSON
T. C. KEEFER, C.M.G.	DR. SAUNDERS, C.M.G.
SIR JAMES GRANT, K.C.M.G.	DR S. E. DAWSON, C.M.G.

[1] The Council for 1908-1909 comprises the President and Vice-President of the Society, the Presidents, Vice-Presidents and Secretaries of Sections, the Honorary Secretary and the Honorary Treasurer, besides ex-Presidents of the Society during three years from the date of their retirement, and not more than four members of the Society who have formerly served on the Council, elected by the Council.

THE ROYAL SOCIETY OF CANADA.

LIST OF MEMBERS, 1908-1909.

I.—LITTÉRATURE FRANÇAISE, HISTOIRE, ARCHÉOLOGIE, ETC.

BEAUCHEMIN, NÉRÉE, M.D., *Yamachiche, P.Q.*
BÉGIN, MGR L.-N., Archevêque de Québec, *Québec.*
BOUCHETTE, ERROL, *Ottawa.*
BRUCHÉSI, MGR P.-N., Archevêque de Montréal, *Montréal.*
CHAPAIS, L'HON. THOMAS, docteur ès lettres, chevalier de la légion d'honneur de France, membre du conseil législatif, *Québec.*
CHARLAND, PÈRE PAUL-V., docteur ès lettres, *Fall River, Mass., E.-U.*
DAVID, L'HON. L.-O., *Montréal.*
DECAZES, PAUL, docteur ès lettres, *Québec.*
DECELLES, A.-D., C.M.G., docteur ès lettres, LL.D., *Ottawa.*
DIONNE, N.-E., docteur ès lettres, *Québec.*
GAGNON, ERNEST, docteur ès lettres, *Québec.*
GÉRIN, LÉON, *Ottawa.*
GOSSELIN, L'ABBÉ AUGUSTE, docteur ès lettres, *St-Charles de Bellechasse, P.Q.*
LANGELIER, L'HON. JUGE SIR FRANÇOIS, docteur en droit.
LEMAY, PAMPHILE, docteur ès lettres *Québec.*
LEMIEUX, L'HON. RODOLPHE, membre du conseil privé, docteur en droit, chevalier de la légion d'honneur de France, *Ottawa.*
MIGNAULT, PIERRE BASILE, docteur en droit, conseiller du roi, *Montréal.*
PAQUET, MONSIGNOR L.-A., *Québec.*
POIRIER, L'HON. PASCAL, officier de la légion d'honneur de France, *Shediac, N.-B.*
POISSON, ADOLPHE, docteur ès lettres *Arthabaskaville, P.Q.*
PRUD'HOMME, L'HON JUGE L.-A., *St-Boniface, Man.*
RIVARD, ADJUTOR, maître ès arts, *Québec.*
ROUTHIER, L'HON JUGE A.-B., docteur en droit et ès lettres, *Québec.*
ROY, L'ABBÉ CAMILLE, docteur ès lettres, licencié ès lettres de l'université de Paris, *Québec.*
ROY, JOSEPH-EDMOND, docteur ès lettres, *Ottawa.*
SULTE, BENJAMIN, *Ottawa* (ancien président).

II.—ENGLISH LITERATURE, HISTORY, ARCHÆOLOGY, ETC.

BRYCE, REV. GEORGE, M.A., LL.D., *Winnipeg, Man.*
BURWASH, REV. NATHANIEL, S.T.D., LL.D., Chancellor of Victoria College, *Toronto.*
CAMPBELL, W. WILFRED, LL.D., Archives Branch, *Ottawa.*
CLARK, REV. W., D.C.L., LL.D., Trinity University, *Toronto* (ex-president).
CRUIKSHANK, LT.-COL. E. A., *Ottawa.*
COYNE, J. H., M.A., *St. Thomas, Ont.*
DAWSON, S. E., C.M.G., Lit.D., *Ottawa* (ex-president).
DENISON, COL. G. T., B.C.L , *Toronto* (ex-president).
DOUGHTY, ARTHUR G., C.M.G., Lit.D., Dominion Archivist, *Ottawa.*
GORDON, REV. CHARLES W., LL.D., *Winnipeg.*
HANNAY, JAMES, LL.D., *Fredericton, N.-B.*
HOWLEY, MOST REV. DR. M. F., D.D., Archbishop of St. John's, *St. John's, Nfld*
JAMES, C. C., Deputy Minister of Agriculture, *Toronto.*
LESUEUR, W. D., B.A., LL.D., *Ottawa.*
LIGHTHALL, WILLIAM DOUW, M.A., B.C.L., *Montreal*
LONGLEY, HON. Mr. Justice, LL.D., *Halifax, N.S.*

MORGAN, HENRY J., LL.D., *Ottawa.*
MURRAY, GEORGE, B.A., *Montreal.*
MURRAY, REV. J. CLARK, LL.D., *Montreal.*
RAYMOND, REV. W. O., LL.D., *St. John, N.B.*
READE, JOHN, F.R.S.L., LL.D., *Montreal.*
ROSS, HON. GEO. W., LL.D., *Toronto.*
SCOTT, D. CAMPBELL, Department of Indian Affairs, *Ottawa.*
SCOTT, REV. FREDERICK GEORGE, *Quebec.*
SHORTT, ADAM, M.A., *Ottawa.*
WATSON, J., M.A., LL.D., Queen's University, *Kingston.*
WILLISON, JOHN S., *Toronto.*
WITHROW, REV. W. H., D.D., *Toronto.*
WOOD, LT.-COL. WILLIAM, *Quebec.*
WRONG, GEORGE M., M.A., University of Toronto, *Toronto.*

III.—MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES.

BAKER, ALFRED, M.A., University of Toronto, *Toronto.*
BARNES, H. T., D.Sc., McGill University, *Montreal.*
BOVEY, H. T., M.A. (Cantab.), LL.D., D.C.L., M. Inst. C.E., F.R.S.
COX, JOHN, M.A. (Cantab.), McGill University, *Montreal.*
DAWSON, W. BELL, MA.., Ma. E., D.Sc., M. Inst. C.E., *Ottawa.*
DEVILLE, E., LL.D., Surveyor-General, *Ottawa.*
DUPUIS, N. F., M.A., F.R.S.E., Queen's University, *Kingston.*
ELLIS, W. H., M.D., Toronto University, *Toronto.*
FLEMING, SIR SANDFORD, K.C.M.G., LL.D., C.E., *Ottawa* (ex-president).
GIRDWOOD, G. P., M.D., McGill University, *Montreal.*
GLASHAN, J. C., LL.D., Inspector of Public Schools for City of Ottawa, *Ottawa.*
GOODWIN, W. L., D.Sc., Queen's University, *Kingston.*
HAMEL, MONSIGNOR, M.A., Laval University, *Quebec* (ex-president).
HARKNESS, JAMES, M.A., (Cantab. & Lond.), McGill University, *Montreal.*
HOFFMANN, G. C., F.I.C., M.M.S., LL.D., *Ottawa.*
JOHNSON, A., LL.D., Vice-Principal Emeritus of McGill University, *Montreal* (ex-president).
KEEFER, T. C., C.M.G., LL.D., C.E., *Ottawa* (ex-president).
KING, W. F., C.M.G., LL.D., Dominion Observatory, *Ottawa.*
LOUDON, J., M.A., LL.D., *Toronto* (ex-president).
MCGILL, A., Chief Analyst, *Ottawa.*
MACKENZIE, A. STANLEY, Dalhousie University, *Halifax.*
MCLENNAN, J. C., Ph.D., Toronto University, *Toronto.*
MCLEOD, C. H., M.E., McGill University, *Montreal.*
MILLER, W. LASH, Ph.D., University of Toronto, *Toronto.*
OWENS, R. B., M.Sc., McGill University, *Montreal.*
RUTTAN, R. F., M.D., C.M., McGill University, *Montreal.*
SHUTT, F. T., M.A., F.I.C., F.C.S., Chemist, Central Experimental Farm, *Ottawa.*
STUPART, R. F., Superintendent, Meteorological Service, *Toronto.*
WALKER, J. WALLACE, M.A., Ph.D., McGill University, *Montreal.*

IV.—GEOLOGICAL AND BIOLOGICAL SCIENCES.

ADAMI, J. G., F.R.S., M.A., M.D. (Cantab. and McGill), LL.D., F.R.S.E., McGill University, *Montreal.*
ADAMS, FRANK D., Ph.D., D.Sc., F.R.S., F.G.S., McGill University, *Montreal.*
AMI, HENRY M., M.A., D.Sc., F.G.S., Geological Survey, *Ottawa.*
BAILEY, L. W., M.A., Ph.D., University of New Brunswick, *Fredericton.*
BARLOW, A. E., M.A., D.Sc., Geological Survey, *Ottawa.*

BELL, ROBERT, B.Ap.Sc., M.D., LL.D., F.G.S., F.R.S., Geological Survey, *Ottawa*.
BETHUNE, REV. C. J. S., M.A., D.C.L., *Guelph, Ont.*
BURGESS, T. J. W., M.D., *Montreal.*
COLEMAN, A. P , M.A., Ph.D., University of Toronto, *Toronto*.
ELLS, R. W., LL.D., F.G.S.A., Geological Survey, *Ottawa.*
FLETCHER, JAMES, LL.D., F.L.S., F.E.S.A., Dominion Entomologist, *Ottawa.*
FOWLER, JAMES, M.A., Queen's University, *Kingston.*
GRANT, SIR J. A., K.C.M.G., M.D., F.G.S., *Ottawa* (ex-president).
HAY, G. U., M.A., D.Sc., *St. John, N.B.*
HARRINGTON, W. HAGUE, P. O. Department, *Ottawa.*
LAFLAMME, MGR J. C. K., D.D., M.A., chevalier de la légion d'honneur de France, Laval University, *Quebec* (ex-president).
LAMBE, LAWRENCE M., F.G.S., Geological Survey, *Ottawa.*
MACALLUM, A. B., Ph.D., University of Toronto, *Toronto.*
MACOUN, J., M.A., F.L.S., Geological Survey, *Ottawa.*
MACKAY, A. H., LL.D., B.Sc., Superintendent of Education for Nova Scotia, *Halifax.*
MATTHEW, G. F., M.A., D.Sc., *St. John, N.B.*
MILLS, T. WESLEY, M.A., M.D., McGill University, *Montreal.*
NICHOLLS, A. G., M.A., M.D., McGill University, *Montreal.*
PENHALLOW, D. P., B.Sc., M.Sc., D.Sc., McGill University, *Montreal.*
POOLE, H. S., M.A., C.E., F.G.S., Assoc. R. S.M., *Halifax*.
PRINCE, E. E., B.A., F.L S., Dominion Commissioner of Fisheries, *Ottawa*.
SAUNDERS, W., C.M.G., LL.D., F.L.S., F.E.S.A., Director Dominion Experimental Farms, *Ottawa* (ex-president).
TAYLOR, REV. G. W., *Wellington, B.C.*
WHITEAVES, J. F., LL.D., F.G.S., Geological Survey, *Ottawa.*
WRIGHT, R. RAMSAY, M.A., B.Sc., University of Toronto, *Toronto.*

CORRESPONDING MEMBERS.

HIS GRACE THE DUKE OF ARGYLL, K.T., G.C.M.G., &c.

BONNEY, T. G., D.Sc., LL.D., F.R.S., *London, England.*
BRYCE, RT. HON. JAMES, D.C.L.
CLARETIE, JULES, de l'Académie française, *Paris, France.*
GANONG, DR. W. F., *Northampton. Mass.*
HIGGINSON, THOMAS WENTWORTH, LL.D. (Harvard), *Cambridge, Mass*.
METZLER, W. H., Ph.D., F.R.S. Edin., Mathematical Professor, Syracuse University, *Syracuse, N. Y.*
OSBORN, DR. HENRY FAIRFIELD, *New York, N.Y.*
OSTWALD, WILHELM, *Leipzig.*
PARKER, SIR GILBERT. M.P., D.C.L., *London, England.*
SCUDDER, DR. S. H., *Cambridge, Mass., U.S.A.*

RETIRED MEMBERS.

BOURASSA, NAPOLÉON, *Montreal.*
CALLENDAR, HUGH L., M.A. (Cantab.), F.R.S., *London, Eng.*
CHERRIMAN, J. B., M.A., *Ryde, Isle of Wight.*
FABRE, HECTOR, C.M.G., officier de la légion d'honneur, *Paris, France.*
HAANEL, E., Ph.D., Director of Mines, *Ottawa.*
LEMOINE, SIR J.-M., *Québec* (ancien président).
MACGREGOR, J. G., M.A., D.Sc., F.R.S., F.R.S.E., *Edinburgh, Scotland.*
MAIR, CHARLES, *Prince Albert, N.W.T.*
OSLER, W., M.D., *Oxford, Eng.*
PARKIN, G. R., C.M.G., LL.D., *Toronto.*
ROBERTS, C. G. D., M.A., *New York.*
RUTHERFORD, E., B.A., (Cantab.), A.M., *Manchester, Eng.*

LIST OF PRESIDENTS.

1882-'83	Sir J. W. Dawson.
1883-'84	L'honorable P. J. O. Chauv
1884-'85	Dr. T. Sterry Hunt.
1885-'86	Sir Daniel Wilson.
1886-'87	Monsignor Hamel.
1887-'88	Dr. G. Lawson.
1888-'89	Sir Sandford Fleming, K.C.
1889-'90	L'abbé Casgrain.
1890-'91	Very Rev. Principal Gran
1891-'92	L'abbé Laflamme.
1892-'93	Sir J. G. Bourinot, K.C.M.G
1893-'94	Dr. G. M. Dawson, C.M.G.
1894-'95	Sir J. Macpherson LeMoine.
1895-'96	Dr. A. R. C. Selwyn, C.M.G.
1896-'97	Most Rev. Archbishop O'Br
1897-'98	L'honorable F. G. Marcha
1898-'99	T. C. Keefer, C.M.G.
1899-1900	Rev. Professor Clark, D.C
1900-1901	L. Fréchette, C.M.G., LL.D.
1901-1902	President Loudon, LL.D.
1902-1903	Sir James A. Grant, K.C.M M.D., F.G.S.
1903-1904	Col. G. T. Denison, B.C.L.
1904-1905	Benjamin Sulte.
1905-1906	Dr. Alex. Johnson.
1906-1907	Dr. Wm. Saunders, C.M.G.
1907-1908	Dr. S. E. Dawson, C.M.G.
1908-1909	Dr. J. Edmond Roy.

ROYAL SOCIETY OF CANADA

PROCEEDINGS FOR 1908

TWENTY-SEVENTH GENERAL MEETING

SESSION I. (Tuesday, May 26.)

The Royal Society of Canada held its twenty-seventh general meeting in the Normal School Building, Elgin Street, Ottawa.

The President, Dr. Dawson, took the chair at 10 o'clock a.m., and called the meeting to order. The roll was then called by the Secretary.

PRESENT:

President, Dr. S. E. Dawson.

Vice-President, Dr. J. E. Roy.

Honorary Secretary, Dr. James Fletcher.

Honorary Treasurer, Mr. L. M. Lambe.

The following members, in their Sections, were present at the roll call, or arrived later during the session.

SECTION I.—Present: Mr. E. Bouchette, Mgr. Bruchesi, Dr. DeCelles, Mr. Gérin, Abbé Gosselin, Hon. P. Poirier, Dr. J. E. Roy, Mr. Sulte, and the Honourable R. Lemieux, who was introduced at this meeting.

Apologies were received from Mgr. Bégin, Mgr. Paquet, Judge Prud'homme, the Abbé Camille Roy.

SECTION II.—Present: Rev. Dr. Bryce, Dr. W. Wilfred Campbell, Lt.-Col. Cruickshank, Mr. Coyne, Dr. Dawson, Col. Denison, Dr. Doughty, Dr. Hannay, Archbp. Howley, Mr. James, Dr. LeSueur, Mr. Lighthall, Dr. Morgan, Mr. Geo. Murray, and Mr. D. C. Scott.

Apologies were received from Rev. Dr. Burwash, Rev. Dr. Clark, Rev. J. C. Murray, Rev. Dr. Raymond, Dr. J. Reade, Rev. Dr. Withrow, Mr. J. S. Willison, and Lieut.-Col. Wood.

SECTION III.—Present: Prof. Baker, Dr. Barnes, Dr. Bell Dawson, Dr. Deville, Sir Sandford Fleming, Dr. Girdwood, Dr. Glashan, Dr. Goodwin, Dr. Hoffmann, Dr. Johnson, Dr. Keefer, Dr. Loudon, Mr. A. McGill, Prof. McLennan, Prof. W. L. Miller, Prof. McLeod, Dr. Ruttan, Mr. Shutt, Mr. Stupart, and Dr. King, who was introduced at this meeting.

Apologies were received from Prof. Dupuis and Mgr. Hamel.

SECTION IV.—Present: Dr. Adami, Dr. Adams, Dr. Ami, Dr. Bailey, Dr. Barlow, Dr. Bell, Dr. Ells, Dr. Fletcher, Prof. Fowler, Sir James Grant, Dr. Hay, Mr. Harrington, Mr. Lambe, Prof. McCallum, Dr. Wesley Mills, Dr. Penhallow, Prof. Prince, Dr. Saunders, Dr. Whiteaves, and Dr. A. G. Nicholls, who was introduced at this meeting.

Apologies were received from Rev. Dr. Bethune, Dr. Burgess, Mgr. Laflamme, Prof. Macoun, Dr. MacKay, Dr. Poole, Rev. G. W. Taylor.

PRESENTATION OF MEMBERS.

The following new members were formally presented to the Society and welcomed by the President.

Section I.—The Honourable R. Lemieux, presented by Prof. Roy.

Section II.—Dr. James Hannay, presented by Dr. Wilfred Campbell and Dr. George Hay.

Section III.—Dr. W. F. King, presented by Sir Sandford Fleming and Mr. R. F. Stupart.

Section IV.—Dr. A. G. Nicholls, presented by Dr. Adami and Dr. Ami.

The Honorary Secretary then read the following gracious letter from His Excellency the Governor-General, the Patron and Honorary President of the Society:

Government House,
Ottawa, May 20th, 1908.

My dear Mr. Dawson,

I shall be obliged if you will convey to the members of the Royal Society an expression of my personal regret at my inability to be present at the meeting, on Monday the 25th.

I leave Ottawa on Thursday night for Toronto with Her Excellency and the whole of my household, and shall remain there for a fortnight. On Monday the 25th I have an engagement of long standing to unveil a statue of the late Queen Victoria, and so cannot possibly be with you at the meeting of the Royal Society on that day.

I hope that you may have a most successful gathering, and that the good work already accomplished by the Society may be still furthered by this year's proceedings.

It is a disappointment to me to lose the pleasure of meeting the many able and distinguished gentlemen whom you have convened to Ottawa on the 25th, and I hope that it may be possible for you to arrange that their next visit to Ottawa may be at a season when it will be possible for Her Excellency and myself to enjoy the pleasure of receiving them at Government House.

I remain, with my kind regards,

Yours truly,

GREY.

In another letter to the President, His Excellency expressed his intention of being present at a special meeting, which it is hoped to arrange to hold during the Tercentenary Celebration of the Founding of Quebec, in July next, in the following words:—"I notice that you are to have a special meeting of the Society during the Tercentenary Celebration at Quebec, and I look forward with much pleasure to being able to attend at that time."

REPORT OF COUNCIL, 1908.

The Council of the Royal Society of Canada have the honour to present their annual report as follows:—

1. Printing of Transactions.

The Proceedings and Transactions for 1907 have been published as Vol. I, Series iii, and make a volume of 1228 pages, containing 153 illustrations and maps. This is the largest volume yet published by the Society, and contains many long and valuable papers. 7,650 copies of authors' separates have been distributed to Fellows of the Society and other contributors. There has been delay in the issue of some of these separates, and the Council must again draw the attention of authors to the chief causes to which this delay is due. By far the most important of these is the long time taken by contributors in returning their printer's proofs; the other is that, heretofore, the printers have waited until a full forme of 16 pages is ready before that is locked up and struck off. One forme may contain the completion of a paper, a whole paper, and also the beginning of another; thus, it was necessary for the revised proofs of all of these papers to be returned before the forme could be struck off. To obviate this trouble the Publishing Committee hope in future to arrange with the printers to lock up each paper separately and strike off the extras at once, so that Fellows who have returned their proofs promptly may not be at a disadvantage from the negligence of less considerate authors. This will increase the cost of publishing somewhat, but it seems to be the only way of meeting the difficulty. The Council is glad to report the publication of the elaborate General Index to the First and Second Series of the Proceedings and Transactions from 1882 to 1906, a volume of 133 pages, which has been prepared with much labour and care by Mr. Benjamin Sulte. This index gives additional value to the two series of transactions which have appeared, as it renders reference easy, and the large mass of valuable information contained in these volumes is now readily available to all who have need of consulting them.

Another work of importance which was issued by the Royal Society at the same time as the above was Dr. N. E. Dionne's *Inventaire Chronologique des livres, brochures, journaux et revues, publiés en langue anglaise dans la Province de Québec, de 1764 à 1906.* This is a volume of 228 + 21 pages, which will be gladly welcomed by all students of Canadian history. It forms a sequel to Dr. Dionne's previous list of the works which have appeared in the French language.

2.—BULLETIN No. 1.

In accordance with Rule X, as amended in 1905, two important papers have been issued in bulletin form on recommendation of Section III; these were:—1, "On the Amount of Radium present in Typical Rocks in the immediate neighbourhood of Montreal," by Prof. A. S. Eve and Doctor A. B. McIntosh; and 2, "On the Amount of Radium Emanation in the Atmosphere near the Earth's surface," by Prof. A. S. Eve. These papers were distributed on June the 21st, 1907, and are also included in the present volume of transactions.

3.—MEMBERSHIP.

At the last general meeting the Council suggested to the Society the advisability of considering whether the time had not arrived to again increase the number of Fellows of the Society. After consideration, recommendations were made by the various sections, but as all the sections were not unanimous, it was thought best to refer this subject, with some other matters, to a select committee named by the President—"to consider the rules of the Society and report upon any amendments which may seem to be necessary." This committee has met and will report during the present meeting of the Society.

4.—ELECTIONS.

On March the 4th last notices were sent out to all the members of the various Sections of the number of vacancies existing in each Section, and on the 15th of the same month, in accordance with the rules, a printed list of the candidates nominated was transmitted to every Fellow of the Society, and voting papers were sent out. At a council meeting, held on April 27th, the Honorary Secretary reported that this election had resulted in the following gentlemen being duly elected:—

Section I.—The Hon. Rodolphe Lemieux, the Hon François Langelier, Mr. P. B. Mignault, and Mr. Adjutor Rivard.

Section II.—Prof. G. M. Wrong.

Section III.—Dr. W. F. King, Professor James Harkness, and Professor A. Stanley McKenzie.

Section IV.—Professor A. G. Nicholls.

5. Accounts.

The accounts have been audited by experts in the usual manner, and the vouchers are in the hands of the Honorary Treasurer.

The following is a statement:—

1907.			Ottawa, May 11th, 1908.
	To balance brought forward as per page iv of the Proceedings for 1907		$1,330 14
May 23.	—Assistant for Professor Rutherford's lecture	$ 10 00	
"	—Messenger service at annual meeting	12 00	
" 27.	—Working lantern—W. K. Kissick	1 50	
June 27.	—Providing lantern	3 00	
"	—John Robertson—balance for cartage	1 00	
"	—Canadian Express Co.	1 35	
"	—R. J. Taylor—printing	57 00	
"	—James Hope & Sons	3 85	
"	—Ottawa Transfer Co	1 00	
July 17.	—"The Journal"—advertising	12 00	
"	—"Ottawa Free Press"—advertising	13 50	
Aug. 7.	—Insurance of exchanges — Caledonian policy	18 50	
" 28.	—American delivery.—F. W. Myers & Co.	11 96	
"	—Mortimer & Co.—Canadian delivery	99 97	
"	—The Canadian Pacific Ry. Co.—freight.	1 15	
"	—The Ottawa Paper Box Co	40	
"	—William Notman & Son	1 00	
"	—The Toronto Engraving Co., Ltd	53	
"	—M. G. Bristow—typewriting	2 60	
"	—R. P. King—engrossing	5 00	
"	—"Grip, Limited."	128 75	
"	—The Dominion Express Co	2 05	
Sept. 24.	—The Mortimer Co., Ltd	618 34	
Oct. 30.	—B. Chevrier—typewriting	2 50	
Nov. 5.	—B. Sulte—proofreading	40 00	
"	—Witness Printing House—printing	141 50	
"	—Canada Paper Co.	13 44	
1908.			
Jan. 7.	—Ottawa Electric Co.	1 00	
Mar. 31.	—Mortimer & Co.—on account of binding	125 25	
			$1,330 14

1907.			
Nov. 5.—To amount on account of Government Grant			$3,000 (
1908.			
Mar. 13.—To amount on account of Government Grant			2,000 (
			$5,000 (
1907.			
Dec. 16.—Paid Express Company..............$	3	20	
" —Freight—delivery, European Exchanges.	120	25	
" —Blaiklock Bros—Ocean freight	15	23	
" —Grip Engraving Co.—illustrations.....	160	88	
" —Toronto Engraving Co.—illustrations..		40	
" —Railway Freight		76	
" 20.—Ottawa Electric Co.	1	00	
" —Printing Transactions—on account....	1,250	00	
" 27.—Mortimer & Co.—illustrations........	189	15	
1908.			
Feb. 24.—B. Sulte	20	00	
" —Crown Lithographing Co............	3	00	
" —Purchase of scarce volumes...........	5	00	
" —Toronto Engraving Co.—illustrations..	160	00	
" —Grip Engraving Co.—illustrations.....	39	18	
" —Toronto Litho. Co.—illustrations......	90	00	
" —John Robertson—storage	48	00	
" —Paid Express	1	00	
Mar. 12.—Printing Transactions—on account...	750	00	
" 27.—Mortimer & Co.—printing and binding.	600	00	
April 4.—Insurance.	78	75	
" 22.—R. R. King—engrossing	10	00	
" —Grip Engraving Co..................	7	00	
" —Crown Lithographing Co.........	3	00	
" —Proofreading, French	40	00	
" —Express charges	7	84	
May 6.—Grip Engraving Co.—illustrations.....	147	00	
May 11.—Mortimer & Co.....................	79	84	3,830
Balance..........			$1,169

6.—The Tercentenary Celebration at Quebec.

An event of great moment in the history of our country is the celebration which is to be held next July in the ancient City of Quebec, in commemoration of the foundation of that city as a habitable home for civilized man. Three hundred years ago Samuel de Champlain built the first permanent home and founded the City of Quebec, which has been the scene of so many deeds of unsurpassed heroism and nobility, equally on the part of those who have striven for its capture or for its protection.

Considering the great national importance of this celebration and the strong appeal which it makes to every Canadian in all parts of the Dominion, it was thought to be imperative on the Society to assist to the fullest extent of its power, in making the occasion memorable in the annals of the country. The Council, therefore, decided to hold a special meeting at Quebec and officially to take part in the celebrations, and also at the same time to convene the Congress of Imperial and Colonial Meteorologists, to be held this summer under the auspices of the Society, and which it was found could not be held as was originally proposed, during this meeting. In January last the following letter was received from His Worship the Mayor of Quebec:—

Mayor's Office,
Quebec, 29th January, 1908.

Dr. S. E. Dawson, C.M.G.,
General President,
Royal Society of Canada.

Dear Sir,

At the unanimous request of the Executive Committee, having in hand the preparations of the *fêtes* to mark the Tercentenary of the Founding of Quebec, and with the entire concurrence of several members of the Society resident in Quebec, whom we have taken the liberty of consulting on the subject, I have the honour to formally and most cordially invite the Royal Society of Canada to hold its forthcoming Annual Meeting in Quebec, during the week of festivities to be arranged here for the month of August next.

The exact date of the celebration will be fixed by His Excellency the Governor-General, upon receipt of a message at present awaited from His Majesty the King, signifying the date at which we may expect the presence of His Majesty's representative for the occasion.

We have the assurance from the Provincial Government of Quebec that, either the Legislative Council Chamber, or the Legislative Assembly Chamber, will be gladly placed at the disposal of the Society for its public sessions, at which it is the desire of our Executive that appropriate and public eulogies of Champlain may be made, in both the English and French languages, by members of your learned Society.

We shall deem it a personal favour if you will take the present invitation into consideration at the earliest possible moment, and can assure you of our best endeavours to contribute to the success of your meeting, and also of the most cordial welcome from the citizens of Quebec, should you honour them by accepting this invitation.

I have the honour to be, Sir,

Your obedient servant,

J. Geo. Garneau,

Mayor,

President Quebec Tercentenary Committees.

In reply to this letter the President sent the following answer:—

Ottawa, February 4th, 1908.

His Worship J. George Garneau,
Mayor of Quebec.

Dear Sir,

I have the honour to acknowledge receipt of your letter dated January 29th, inviting the Royal Society to hold the forthcoming annual meeting at Quebec during the week of the Champlain Celebration in the month of August next, and I have to express my warmest acknowledgments and thanks for the honour done to the Society in sending the invitation and providing for such accommodation as is necessary for its meetings.

It is a source of sincere regret to me that it is not feasible to change the date of meeting from its regular time in May. On each of the three or four occasions in the past twenty-five years when the Society has met elsewhere than at Ottawa the change was made on a vote of the Society at its preceding annual meeting, but the subject was not brought before the last annual meeting.

The change of place and date is not possible this year, moreover, because the Society, in accordance with a resolution of previous years, has invited the Superintendents of the Meteorological Service of Great Britain and the Colonies to assemble here at its next meeting in May, and the date and place were fixed when the invitations were sent out. The invitations were sent last September through the Imperial Colonial Secretary, the Earl of Elgin. Some have been accepted and some are waiting the action of their respective governments. The correspondence extended as far as Australia, New Zealand and Singapore, and you will readily see how impossible it is to make a change at this late date.

I will, however, bring your letter before the Council at its first meeting, and I think that it is more than possible that the Society will decide to hold a special meeting at Quebec in July. I am sure they will consider it an honour and a privilege to assist in commemorating a person so worthy and so noble in every respect as Samuel de Champlain.

Yours truly,

(Signed) S. E. DAWSON,

President, Royal Society of Canada.

This letter was acknowledged by His Worship Mayor Garneau as follows:—

Mayor's Office,

Quebec, February 20th 1908.

Dr. S. E. Dawson,

President of the Royal Society of Canada,

Ottawa.

Dear Sir,

I have the honour to acknowledge receipt of your letter dated February 4th, 1908, in response to the invitation which I had the pleasure of extending, through you, to the Royal Society of Canada, on behalf of our Tercentenary Committee, to hold its next annual meeting in Quebec in the month of August.

Your letter has been submitted to our Executive Committee, which fully understands from it, how impossible it would be for you to change the date of the session already arranged for next May, and the Committee desires me to thank you most warmly for your kind response, and to express the pleasure and gratification which it affords them to look forward to the special meeting proposed to be held here next July.

Yours truly,

J. GEO. GARNEAU,

Mayor of Quebec.

President of the Executive Committee of the Tercentenary Celebration.

These letters were duly laid before the Council, and the suggested arrangements met with unanimous approval. A day has been set apart by the Programme Committee for a special meeting of the Society and for the participation of our members, as such, in the ceremonies. The Council hopes that there will be a good attendance of the Fellows on this unique occasion of doing honour to our country, more especially as our Honorary President and Patron, His Excellency the Governor-General has signified his intention of being present at the meeting.

The matter of transportation and accommodation at Quebec is being considered by a special committee, and an announcement will be made to the Fellows as soon as it is known definitely what is decided upon. A point of much importance in making these arrangements is for the committee to know as soon as possible how many Fellows of the Royal Society will be able to attend the Celebration. A notification of all who hope to be able to attend may be given at this meeting, or as soon after as possible, either to Prof. Edmond Roy, or to the Honorary Secretary. As far as can be learnt at present there will be ample accommodation for all at reasonable rates.

7.—The 1909 Meeting of the British Association for the Advancement of Science.

The following interim report has been received from the chairman of the committee appointed by the Royal Society of Canada to deal with this important matter:—

British Association Meeting, 1909.

As reported last year, the Winnipeg Executive has been organized and is proceeding with its preparations for the meeting of 1909. The chairman of this committee was appointed an Honorary Vice-President of the Winnipeg Executive, and is thus able to supply full information to the Royal Society.

Correspondence has been kept up with the officers of the British Association for the Advancement of Science, and a number of meetings of the Winnipeg Executive have been held. The expectation is that about five hundred visiting scientists may come from Great Britain. The official party will number probably from eighty to one hundred.

Applications have also been made by several members of the American Association for the Advancement of Science, wishing cooperation. The American Association will likely hold its meeting in St. Paul, or Minneapolis, just before the Winnipeg meeting.

The Winnipeg Executive, with the approval of the British Association's officers, have fixed upon August 25th, 1909, as the date of the opening meeting, and the sessions will continue for a week.

Dr. Bryce has, at the wish of the Winnipeg Executive, had conference with the railway and steamship authorities. It is hoped that Canadian railways may give a round trip to Winnipeg for one fare.

The Winnipeg Executive have appointed committees on, 1, Buildings; 2, Entertainment; 3, Finance; 4, Handbook; 5, Excursions; 6, Printing.

While it has not been possible for this committee of the Royal Society to meet during the present year, yet the chairman having been in touch with several members of the Society, ventures to suggest the following points for consideration:—

1. That to show special honour to the British Association a strong deputation of the Society should be appointed to be present at the meeting in Winnipeg on August 25th, 1909;

2. That a special selection of this delegation, consisting of leading members of the Science Sections of the Royal Society, should be chosen to accompany the party of visiting scientists (200, probably) going from Winnipeg to the Pacific Coast, immediately after its meeting in Winnipeg. Such a deputation would be of much service in bringing before the visitors the resources of the country.

All of which is respectfully submitted.

GEORGE BRYCE.
Chairman of Committee.

Winnipeg, April 13th, 1908.

8.—THE CENTENARY CELEBRATION OF THE GEOLOGICAL SOCIETY OF LONDON.

The Royal Society was represented at the Centenary Celebration of the Founding of the Geological Society of London by two delegates from Section IV, Prof. Frank D. Adams and Dr. Henry M. Ami, both of whom are also Fellows of that august society. The following congratulatory address was presented on behalf of our Society:—

Royal Society of Canada.

To Sir Archibald Geikie, K.C.B., Sc.D., D.C.L., LL.D., Sec. R.S.,
President of the Geological Society of London.

Dear Sir,

The Royal Society of Canada desires to convey to you and to the Fellows of the Geological Society of London their congratulations on this the Centenary Celebration of the Founding of your distinguished Society. It is not given to many scientific societies to have been in existence one hundred years, and geological science practically dates back to the period when your founders banded themselves together and formed the first geological society.

It is highly gratifying to note the remarkable progress which has been achieved in geological science during the century of the existence of your society. Not only in the British Isles, but also throughout the Empire, and in every quarter of the globe your example has been followed and geological societies established, all of which have contributed to the vast amount of knowledge acquired and gathered in publications and museums for the benefit of mankind.

In extending to you its sincere congratulations upon the noble work which you have done in geological science throughout the world, the Royal Society is not unmindful of the very prominent part which your society has played in Canada. When the Geological Survey of Canada was founded in 1842, it was on the recommendation of four of the Past-Presidents of the Geological Society of London that Lord Stanley, then Secretary of State for the Colonies, at the request of Sir Charles Bagot, Governor-General of Canada, designated Sir William E. Logan as "Provincial Geologist," or Head of the Geological Survey. Nor can we forget the manner in which Sir Henry de la Beche and his colleagues of Her Majesty's Geological Survey of Great Britain came forward and volunteered assistance to Logan in his labours, not only in the way of chemical analysis, but also in the determination of new fossils, which could not be done in Canada at that time, and without which a geological survey could not be satisfactorily conducted.

In your transactions, proceedings and quarterly journals is embodied a large amount of useful knowledge bearing on the geology of British North America, dealing with those portions of our continent which now constitute the Dominion of Canada and our sister colony of Newfoundland. In the writings on Canadian geology and geological explorations by Bigsby, Lyell, Palliser, Rae, Baddeley, the Earl of Selkirk, Jukes, Owen, Hector, W. B. and P. P. Carpenter, Bunbury, Richard Brown, T. Rupert Jones, Robert Ettridge, Sr., Sutherland, Haughton, Hinde and other contributors, are to be found a rich mine of excellent material. To you, Mr. President, and to the Fellows of the Geological Society of London, Canada owes a deep debt of gratitude also for the encouragement, hearty co-operation and valuable assistance given by your society to Canadian geologists. In countless ways you have stimulated their zeal and made them feel at home in your meetings and discussions. Among the links which bind the Royal Society of Canada to the Geological Society of London may be mentioned the fact that Sir William Dawson, the first President of the Royal Society of Canada, was for many years one of the distinguished Fellows of your Society, one on whom you had repeatedly bestowed honours and distinctions. Among other distinguished Fellows of your Society who were founders of the Royal Society of Canada may be mentioned, Dr. T. Sterry Hunt, Dr. George M. Dawson, former Director of the Geological Survey of Canada, Dr. A. R. C. Selwyn, who for twenty-five years was Director of the Geological Survey of Canada, Dr. Robert Bell, Chief Geologist of the Survey, Dr. B. J. Harrington, Professor of Chemistry and Mineralogy of McGill University, Sir Sandford Fleming, Sir James Grant, and Dr. J. F. Whiteaves, Palæontologist and Zoologist of the Geological Survey of Canada, whom you honoured this very year, 1907, with the Lyell Medal, for his distinguished contributions to palæontology.

To the present generation of Fellows of your Society Canada owes a further debt of gratitude for their generous aid and writings on many critical points in geology and palæontology and who by counsel and advice on knotty points in nomenclature, classification, etc., have rendered most valuable assistance.

In common with our brethren from various portions of the world who have come to London to celebrate this anniversary of the founding of your Society, we present to you the sincere felicitations of the Royal Society of Canada, and wish your Society a continued career of increasing activity.

FRANK D. ADAMS, } *Delegates.*
HENRY M. AMI, }

London, September twenty-sixth, one thousand nine hundred and seven.

Subsequently this address was suitably engrossed and forwarded to the officers of the Geological Society of London, and in due course the following acknowledgment was received:—

Geological Society of London,
Burlington House, W.,
February 19th, 1908.

Dear Sir,

On behalf of the Geological Society of London we ask you to express to the Council of the Royal Society of Canada, our sense of the honour conferred upon the Society by the fact that the Royal Society of Canada was represented on the occasion of the celebration of the Centenary of the Society by such distinguished delegates as Professor F. D. Adams and Dr. H. M. Ami, whom it was a great pleasure to welcome among our other guests on that historic occasion.

We are sending a copy of the "History of the Geological Society," which we hope the Council of the Royal Society of Canada will accept for its Library as a small memento of the Centenary Celebration.

We are, dear sir,

Your obedient servants,

ARCH. GEIKIE,

President.

W. W. WATTS,

EDMUND J. GARWOOD,

Secretaries.

on behalf of the Geological Society of London.

To the President of the
Royal Society of Canada.

9.—CONGRESS OF IMPERIAL AND COLONIAL METEOROLOGISTS IN 1908.

In continuation of the negotiations reported in the Report of Council last year, correspondence has been continued with the object of perfecting the arrangements for holding this important gathering of meteorologists from all parts of the British Empire. Invitations were sent to every British Colony and the leading officials of the various governments engaged in meteorological work were consulted as to the most suitable place and time for meeting and the subjects to be discussed. The original invitation sent out to the governors of the respective colonies, was as follows:—

ROYAL SOCIETY OF CANADA.

Proposed Meeting of Imperial and Colonial Meteorologists in 1908

My Lord (Sir):

We have the honour to bring to Your Excellency's notice a proposal for a meeting of Imperial and Colonial Meteorologists for the purpose of discussing the co-ordination of the meteorological work of the various parts of the Empire.

The importance of co-operation between different countries for the solution of the wider questions of meteorology has long been recognized on the Continent of Europe, and meetings of directors of meteorological institutes and observatories are held, from time to time, for the consideration of questions concerning joint action and uniformity of organization.

The meetings are also found to be useful on account of the opportunity which they afford for the personal exchange of views and the comparison of experience of methods employed under various conditions of climate and of social surroundings.

Such international meetings have not yet been held outside Europe, and the number of Imperial and Colonial representatives who attend them is very small, although the British Empire includes the widest possible diversities of climate and many of the most favourable positions for observations of international importance are on her soil.

It is suggested that a meeting of British and Colonial meteorologists might be held with advantage in 1908 in Canada, which has had a long experience of a meteorological service, fully organized under especially favourable conditions, in co-operation with the United States.

In view of this the Royal Society of Canada desires to make its forthcoming meeting in May, 1908, an occasion for special attention to meteorology in its scientific and economic bearing, and would be glad to have delegates from the various British Colonies present to read papers and to assist in the discussion of the various questions which will arise.

Dr. W. N. Shaw, F.R.S., Director of the Meteorological Office, and Sir John Eliot, K.C.I.E., F.R.S., formerly Meteorological Reporter to the Government of India, have expressed their willingness to take part in the meeting, and it is expected that other meteorologists of the United Kingdom will also be present with those of the Canadian Dominion.

The advantages which are anticipated from such a meeting are not only those that would naturally follow from an exchange of views as to methods of organization or of the tabulating and publication of results. The development of the science in the direction of tracing the laws of sequence of seasons is altogether dependent upon the effective co-operation of workers over very wide areas. Such co-operation has already yielded results of great importance for countries bordering on the Indian Ocean, and the extension of such work is among the most important economic services that the study of meteorology can render to the countries concerned.

It is understood that as has been customary in the International Meteorological Conferences, all expenses of those attending will be borne either by themselves or by the government represented.

We beg that Your Excellency may be graciously pleased to lay this suggestion before your Ministers for their favourable consideration, and we venture to hope that your Government will see their way to send delegates to the proposed meeting at Ottawa, in May, 1908.

We have the honour to be, Sir,

Your Excellency's obedient servants,

(Signed) S. E. DAWSON.
President.

" JAMES FLETCHER.
Secretary.

" R. F. STUPART,
Chairman of Committee

Proposed Meeting of Imperial and Colonial Meteorologists in 1908.

To consider the best means of obtaining co-operation between the various meteorological organizations of the Empire with regard to the following matters:

1. Uniformity of practice as regards instrumental equipment, hours of observation, instructions and forms for observers, formulæ and tables of reduction, with the modifications necessary for special types of climate and conditions of service.

2. Forms and methods of publication of results from stations of the several orders, (*a*) for local use, and (*b*) for general meteorological purposes.

3. Scales and projections for Weather Charts and Meteorological Maps.

4. The discussion of observations for local and general purposes. Selection of years for mean values, etc.

5. Co-operative researches dealing with extensive portions of the earth's surface.

(*a*) The combination and discussion of normal meteorological observations for large parts of the earth's surface. (*e.g.*, The rainfall relations of the Indian Ocean and the continents bordering thereupon, or the persistent air currents of the Atlantic Ocean and their relation to the fluctuations of pressure in the neighbouring land areas. The pressure and rainfall relations of the Globe (Solar Physics Commission). The Relations of Climate and Health. (Sir Lauder Brunton's Committee of the South African Meeting of the British Association). The phenomena of local winds.

(*b*) Instrumental equipment for special observations, such as solar radiation, terrestrial magnetism, atmospheric electricity, or seismological observations.

Royal Society of Canada.
Ottawa, Canada, December 14th, 1907.

My Lord,

With reference to the invitations recently issued to their Excellencies of various British Colonies, praying that they would be pleased to bring the subject of a Meteorological Congress at Ottawa, in May, 1908, to the attention of their Ministers with the object of sending delegates to the said Conference, we, the undersigned officers of the Royal Society of Canada, respectfully ask that Your Lordship will, on behalf of the Royal Society of Canada, be pleased to extend that invitation to all British Colonies not included among those to which invitations were addressed, and forwarded through the Department of the Honourable the Secretary of State for Canada, and the Colonial Office in London. From a meteorological point of view it is most desirable that Mauritius and the African Protectorates should be represented.

We would, further, respectfully inform Your Lordship that the Conference will most probably devote some attention to meteorological questions affecting the practical interests as represented by the Board of Trade, the Board of Agriculture and Fisheries, the Scottish Fishery Board, the Board of Education, or the Army Medical Department, and it might be expedient that someone who can deal with matters from that point of view should be present.

We would also respectfully suggest that the presence of someone from the Colonial Office would be of great assistance in furnishing the Conference with information that may be required about the various colonies which have no representative present.

We have the honour to be,
Your Lordship's obedient servants,

(Signed) S. E. DAWSON,
President.
" JAMES FLETCHER,
Secretary.
" R. F. STUPART,
Chairman of Committee.

The Right Honourable
The Earl of Elgin and Kincardine,
London.

It was subsequently found that the month of May was inconvenient for some of the gentlemen who had expressed a wish to attend this conference, and through the courtesy of the Honourable the Secretary of State for Canada, the following notice of postponement was despatched:

> With reference to the proposed Imperial Meteorological Congress, we regret to learn by answers from many scientific men invited, that the month of May is an inconvenient time for the majority of those whose presence is essential to the success of the meeting, and it appears also from the correspondence that the months of July, August or September would be much more convenient.
>
> We have now the honour to inform you that from July 22nd to July 27th of this year an important celebration will be

held at Quebec, to commemorate the tercentenary of the founding of that city in 1608 by Samuel de Champlain and the commencement of our National History. At the same time the battlefields of Wolfe, Montcalm and Levis will be dedicated as a Public Park in memory of the great events which transpired there. This celebration is appealing very strongly to the people of Canada and to the Dominion and Provincial Governments, and H.R.H. the Prince of Wales has signified his intention to assist at the ceremonies. Under circumstances so unusual the Royal Society of Canada has been invited to hold a special meeting at Quebec, and a resolution to that effect will doubtless be passed at the meeting in May next. It is, therefore, proposed that the Meteorological Conference shall meet at Quebec during the week following the tercentenary celebration. Further information will be sent later, as soon as the details are decided upon. Great interest has been taken in the celebration in England and elsewhere. Besides the squadron of H.R.H. the Prince of Wales the navies of France and the United States will be represented and many distinguished persons are expected to be present.

We hope that you will find the change of date will answer your convenience better than the first fixed, and we hope also that the interest of the occasion will add another inducement to attend.

Arrangements are now made for holding the Meteorological Congress in Quebec during the Tercentenary Celebration, and it is hoped that many of the Fellows of our Society will arrange to be present to do honour to our visitors. Many men of eminence and of world-wide reputation have expressed their intention of being present, and there will be delegates from all our leading Canadian universities.

10.—Deceased Members.

Dr. Napoleon Legendre.—Little by little the ranks are thinning out of those whom the Marquis of Lorne first called to form the Royal Society and who were our Charter Members. This year the Council regrets to record the death of Dr. Napoléon Legendre, a member of Section I, which occurred in Quebec on the 16th of December, 1907. Dr. Legendre closely followed to the grave his colleagues, Casgrain, Lusignan, Faucher de Saint-Maurice and Marmette, who belonged to his literary group.

Dr. Legendre was received as an advocate in 1865; but his modest and simple tastes soon made him give up the active and busy life of the bar to enter the administrative service in which he was able to give full scope to his artistic soul. He first tried his hand at novel writing, and in 1872 published "Sabre et

Scalpel," in the *Album de la Minerve,* but he finally devoted his talent and his pen to the writing of short articles which were vivid with actuality, and also of sprightly narratives and novelettes full of quaint humour. He delighted above all in singing of the humble and small occurrences of life, of the charms and joys of home. Among other literary works of Dr. Legendre, mention may be made of: "Echos de Québec," two volumes (1876); "A mes enfants" (1876); "Les Perce-neige," poems (1886); "Mélanges" (1887); "Nos Ecoles" (1890); "La Langue française au Canada."

To the Transactions of this Society he contributed some of its best productions in the French language, among others: "La Province de Québec et la langue française" (1884); "La race française en Amérique" (1885); "La langue que nous parlons" (1887); "Réalistes et Décadents" (1890); "A propos de notre littérature nationale" (1895); "Frontenac" (1898).

Dr. Legendre made a cult of the French language, and endeavoured at all times to fathom its depths so as to fully express its clearness and purity. Thoroughly familiar with Canadian history and with the European literary movement, he was a charming and interesting conversationalist, whose agreeable company was much sought by men of letters.

The last years of the life of this gentle, sympathetic scholar, were condemned by sickness to a forced inactivity; but his artistic temperament made him such a charming prose writer and sweet facile poet, that his contributions to the literature of his country will doubtless long remain to the adornment and honour of Canadian letters.

THOMAS MACFARLANE (Contributed by Mr. A. McGill).

It is with feelings of profound regret that we record the death of Mr. Thomas Macfarlane, one of the original members of Section III. His long connection with the Society, extending over twenty-five years, and his ever active interest in its welfare, made him conspicuous, and developed in his fellow members a confidence and a feeling of security, as in one who would never fail us, when needed. A readiness to accept responsibilities entailed through official relationship or through the relationship of blood and friendship, was, indeed, a marked and a noble characteristic of the deceased, and causes those who knew him, and especially those who knew him intimately, to feel his loss very keenly.

Mr. Macfarlane was born in Renfrewshire, Scotland, in March, 1834. Nothing can better enable us to appreciate the indomitable perseverance and the intellectual activity of the deceased than such facts as the following: He left school at the age of eleven, to enter a lawyer's office. At the same time he fitted up a room at home, as a laboratory, in which he made himself familiar with the practical side of chemistry. In the evenings he walked three miles to attend lectures in chemistry at the Andersonian University, in Glasgow. Two years later he obtained a position in McClintock's Chemical Works, near Pollockshaws; and, after four years' experience there, he accepted a position in the Modum Smelting Works at Drammen, Norway. Desiring to possess a more systematic knowledge of the natural sciences than his arduous self study had enabled him to acquire, he went to Freiberg, where he attended the School of Mines, and obtained a degree in Engineering. Here he made the acquaintance and won the friendship of many celebrated scientific men, notably of Professor Clemens Winckler, with whom he maintained close, friendly relations until death.

While at Freiberg, the Director of the Modum Smelting Works at Drammen, died, and the position was offered to Mr. Macfarlane, and accepted. It is worthy of remark that a position of this kind, requiring not only technical knowledge, but the ability to manage a large business, and to control men, was offered to a young Scotchman, who, but four or five years previously, was acquainted with no other language than his mother tongue. The truth is that Mr. Macfarlane possessed a very remarkable facility in acquiring languages. While in Norway, he interchanged lessons in English for lessons in Norwegian, with the Lutheran pastor; and in a similar manner, he acquired a thorough and practical knowledge of Swedish, Danish, German and French. Especially in German was he thoroughly at home; and had made himself familiar not alone with the language, but with the literature of Germany. The masterpieces of Lessing, Goethe, Schiller, and others, he was able to quote to purpose, on every occasion, and with keen appreciation of their beauty and forcefulness.

Mr. Macfarlane came to Canada in 1860, as manager of the Acton Copper Mine, and the Capelton Mine, in the Eastern Townships. In 1865 and 1866 he was employed, under Sir William Logan, on the Geological Survey of Canada. In 1868 he was employed by the Montreal Mining Company to examine the company's property on Lake Superior, and was the discoverer of the celebrated Silver Islet Mine. Later, he examined mining locations in Colorado, Utah, Nevada and Ecuador, S.A.

In 1886 he was appointed Chief Analyst to the Department of Inland Revenue of Canada, an office which he held until his death, on the 10th of June, 1907.

To every official position held by him, Mr. Macfarlane brought the intelligence of a keen and thoroughly trained mind, and the conscientiousness of profound Christian conviction, together with the energy

and courage born with him, and possessed by him in full measure to within a moment of his sudden death.

But while faithful to every trust assumed by him, Mr. Macfarlane was a man of too wide sympathy and too active intellect to be satisfied with the performance of professional duty. Questions religious, social and political interested him, and received serious and thoughtful consideration at his hands. Especially during his later years was he interested in the problems of Imperial Federation. In this matter he was in touch with the leaders of the movement, and was by them regarded as an authority upon the questions of finance connected with the main problem. Among the many handsome floral tributes laid upon his coffin, was a laurel wreath, with orchids bearing the inscription, "From the British Empire League, by request of the President to Sir Sandford Fleming."

In 1882 Mr. Macfarlane was chosen one of the original members of the Royal Society of Canada; was elected vice-president of Section III in 1885, and president of the Section in 1886.

A list of important papers published by him appears in the report of the Royal Society for 1894. This list includes thirteen papers upon geological and mineralogical subjects published in the *Canadian Naturalist*; two papers published in the Reports of the Geological Survey; three papers published in the Transactions of the American Society of Mining Engineers; four papers published in the Transactions of this Society; one paper in the *Analyst* (London, Eng.), and an exhaustive Essay on Imperial Federation, entitled, "Within the Empire," published in 1891 by James Hope & Co., Ottawa.

Subsequently to 1893, Mr. Macfarlane presented the following papers to this Society, and these appear in the Transactions for the years given:—

1895. "On the Estimation of Starch."
1902. "An improved method of producing concentrated manure from human refuse."
1903. "On the Analysis of Cheese."
1905. "On the Determination of the Constituents of Gluten."
1906. "On the Conservation of Nitrogen in Manure."
" "On the Metallic Currency of the British Empire."

In 1887 Mr. Macfarlane published a highly interesting account of a visit to South America, primarily a record of observation, but interspersed with much philosophical comment. In this volume he expresses his profound conviction regarding the relation of Church and State, a subject which he later amplified in an address before the Diocesan Synod at Ottawa. He was enthusiastically fond of music, and one of his last public addresses was given in this building, in 1906, upon the subject of a visit during the previous year to Norway and Sweden, in the course of which lecture he treated the national music of Scandinavia, and sang a number of the national folk-songs, in illustration.

Mr. Macfarlane married at the age of twenty-four, and is survived by his wife, three sons and six daughters. A very touching evidence of his love of wife and family is given in some verses pencilled on a scrap of paper very shortly before his death, and evidently intended to be set to music. It may be permitted to quote the following:—

Whosoe'er has shared life's burden
  With a true and tender wife,
Let his care be ever kindest,
  To her faults be he the blindest,
Cherish her as his life,
    As his life.

When at last her eyes he closes
  And her spirit soars on high,
Let him find her in the mansion
  Where true souls find full expansion;
Let him calm and trustful die,
    Let him die.

(Supplementary Notes sent by Mr. R. G. Leckie, of Sudbury, Ont.)

At school he was always the leader among boys of his own age, not from physical prowess, nor excellence in games, but rather from character, an unflinching love of truth which characterized him all through life. A boy in trouble could always find in Tom Macfarlane a judicious adviser and trustworthy friend. The friendships of his boyhood and youth lasted all through life and were dear to him. An old friend could always be sure of a heartfelt welcome expressed in the kindly eye and hearty voice.

When a lad, he took up the temperance cause and worked in its interests with much ardour. Being possessed of a good voice and some knowledge of music, the meetings were made enjoyable by glees, catches and choruses. He was an excellent performer on the flute, and organized a fife and drum band in connection with the boys' temperance society. In this and other ways he greatly advanced the cause, and all through life lived absolutely up to its principles.

Music was one of his chief enjoyments both at home and in church. His residence in Germany enabled him to increase his musical knowledge and cultivate a taste for classic art.

His reading was not confined to scientific works, for while other lads were idling he was enjoying with avidity Scott, Galt, Dickens and

Thackeray. He took great interest in the town library and devoted considerable time to its interests.

Mr. Macfarlane's first situation was in a lawyer's office in Pollockshaws, but this was not quite congenial. He had a small laboratory fitted up in the pantry at home and there he spent most of his spare hours in study and experimenting. The chemical text-books of that day were simple, but when, through the influence of Mr. Walter Crum of Thornliebank, one of the leading chemists of the day and president of the Cavendish Society, Mr. Macfarlane was able to obtain a complete set of the publications of that great society, his joy knew no bounds, and most excellent use he made of every volume.

He soon obtained a situation with a chemical manufacturer in Glasgow, and while there was able to take a course of study in the Andersonian, or what is now the West of Scotland Technical College. Dr. Penny was then professor of chemistry, an accomplished chemist and successful instructor.

The position of chemist at the Modum Cobalt Works, Norway, was offered him and accepted. Desiring to acquire further theoretical and technical knowledge he went after a couple of years to the Freiberg School of Mines, where he soon became prominent.

The Saxon Government, which at that time had a practical monopoly of the Cobalt business, selected Macfarlane to take charge of its works in Norway, where he remained until the ore deposits decreased in value, and were no longer capable of being operated to a profit.

While in Norway, he made a careful study of the geology of Telemarken, Ringerike and rocks of the Drammen Valley. This was subsequently of much value to him, when working out geological problems in Canada and their correlation to similar phenomena in Scandinavia.

The memories of Norwegian life were always dear to him, and with an old friend or two he continued an interesting correspondence up to the last.

In 1860, Macfarlane came out to Canada and was soon offered charge of mining and smelting operations at Actonvale and Capelton in the Eastern Townships.

His knowledge and experience were recognized by Sir William Logan, who offered him a position on the Geological Survey. The publications of the Survey bear testimony to his industry and thoroughness.

He was a devout and sincere christian, tolerant and liberal, but an ardent supporter of the Church of England and a hearty worker in every good cause. When manager of the mines at Acton, over five hundred men were employed, probably eighty per cent of whom were Roman Catholics. The Protestants were divided, each struggling for their own sects and finding it impossible to support four clergymen when one would be sufficient for the field. Macfarlane suggested a conference of all the Protestants to discuss the question of consolidation. After much consideration, a large majority decided to join the Church of England, so that Presbyterians, Methodists, Baptists and Episcopalians formed one congregation, working with zeal and harmony. A commodious church with rectory was built, and the clergyman supported by a good salary. The mission is in existence still, and the good it has done is an example of how the work of the Christian church can be advanced by mutual concessions and the earnest co-operation of its members in the common cause of the Master.

An incident illustrat[illegible] of his character is related by one who knew him well. Chatting with his old friend Kirby, author of "Le Chien d'Or," after [illegible] of the Royal Society, Kirby, speaking of his increasing [illegible] sadly, "I am now just waiting! waiting." Macfarlane [illegible] "Well, I am nearing that stage myself, but I am work[illegible] So [illegible] was with him up to the last, finding a [illegible] work well done, but always ready for the [illegible]

[illegible] HARRINGTON.

[illegible] Harrington is a severe loss not only [illegible] University and the country at large. [illegible] disposition, he was one of those men [illegible] of its solid work almost unawares, [illegible]

[illegible] 1848, he was educated chiefly at home [illegible] where he graduated with honours in [illegible] medal in geology. After taking his [illegible] Sheffield Scientific School of Yale Uni- [illegible] candidates who first received the degree [illegible] school.

[illegible] out in Prince Edward Island, [illegible] Dawson in the preparation of a report on [illegible] Geological Survey of Canada.

[illegible] lecturer in mineralogy at McGill Univer- [illegible] thirty-six years. In 1872 he succeeded [illegible] mineralogist to the Geological Survey [illegible] in 1879 in order to give all his atten- [illegible] he became David Greenshields Pro- [illegible]. In these pioneer days of university [illegible] mining and metallurgy, thus combining the [illegible] During the last years of his life he had the

great satisfaction of seeing these departments properly manned, and of planning the splendid chemistry and mining building erected for the university by Sir William Macdonald.

In the course of his long service Dr. Harrington received many tempting offers of more lucrative posts, but remained faithful to the work to which he had devoted his life, choosing rather to employ such opportunities for the promotion of those who worked under him. How he served the university may be partly gathered from the resolution passed by the Academic Board at the time of his death.

"The members of the board rejoice that he lived to see his department splendidly housed and equipped. But they remember that he was one of the early makers of McGill University; and that for most of his thirty-six years of service, while fulfilling for long periods the duties of three chairs, in chemistry, in mineralogy, and in mining, in cramped quarters and with inadequate means, he yet succeeded by devoted personal labour in training many hundreds of men who now fill with credit important posts in Canada and the United States. His deep interest in his old pupils won their lasting confidence, so that they rarely took an important step without seeking his ever-ready counsel; and thus the university was bound by strong ties to the great industries and interests of practical life. These he further assisted by many investigations which, as he would have wished, were of a character to render unobtrusive but helpful service rather than to catch the eye of the world."

"Within the university his aid will be missed on every hand;—in the Library Committee; especially in the museum, which owes much to his loving care, and is enriched by many collections secured by his efforts and often given out of personal regard for himself; but most of all in the daily conduct of affairs. For behind his gracious amiability was always to be felt a fine sense of honour, a high and courageous spirit which could give a fearless expression of opinion without risk of offence. His irresistible kindness provoked affection and charmed away vexation and discontent, as surely as his sincere and upright character commanded respect. And thus he was a bond of union among his colleagues, and a perpetual spring of cheerful eagerness for work done with supreme conscientiousness, regardless of recognition or reward."

Not less will he be missed at the gatherings of the Royal Society. Early elected a Fellow, he was a regular attendant at the meetings and contributor to its proceedings; and more than once filled the presidency of Section III. He was also president of the Natural History Society of Montreal, and vice-president of the chemical section of the British Association for the Advancement of Science at the Toronto meeting.

Dr. Harrington's published work included several important reports for the Geological Survey of Canada, and a life of Sir William Logan, the first Director. But mainly it consisted of numerous papers on chemical and mineralogical subjects.

Hundreds of letters, which gave him the keenest satisfaction, came to him from old pupils in all parts of the world, couched in terms of affection and confidence. Wherever one met a colleague in this Society, or one of his contemporaries at Yale, or an old graduate of McGill, one of the first and warmest enquiries would be for Dr. Harrington. Wherein did the charm of this loveable personality consist? Its solid structure was the sincerity, the unselfish kindness of the true christian gentleman. But this was adorned with many beautiful traits. He cared for the real things of life, the things which are free to all who will have them—for he could not consciously have enjoyed a pleasure won at another's cost,—things essentially blessed, by the divine decree, that they shall not wither but rather increase and multiply by fruition, since who so takes of them thereby makes more to share with others. Therefore he loved the close ties of family and the home; he loved little children, with whom he was ever a child; all young people, for he never lost his boyish and adventurous spirit; and friends, whose foibles and weaknesses he gently put aside, choosing rather to dwell on the good that was in them. He loved his daily work, and the recurring beauty of the physical world, and music; and he passionately loved flowers. Deep in midwinter he would be planning for his garden, and with the first freedom of the closing session his delight was to snatch a few days in early spring to sow and plant at Metis for the coming summer. Rich in these joys that overflowed upon others, his chivalrous nature was rewarded with the unbought grace of life, drew forth the best qualities of those around him, and stored up a lasting memory in the affections of all who were privileged to know him.

Edwin Gilpin.

Dr. Edwin Gilpin was born at Halifax, N.S., on October 28th, 1850. He was the eldest son of the late Very Rev. Dean Gilpin and Amelia McKay Gilpin, daughter of the Hon. Mr. Justice Haliburton ("Sam Slick").

His early education was received at the Halifax Grammar School. In 1867, at the age of sixteen, he matriculated at King's College, Windsor, N.S., and graduated B.A. in 1871, having won a number of prizes, among the more important being the "Alumni," "General Williams," and "Almon-Welsford."

Following his college education he took special courses in mining, geology and chemistry, and then began the practical study of his profession among the collieries of Pictou County, and the principal mining districts of England and Newfoundland.

His election to membership in the Nova Scotia Institute of Natural Science and in the Institute of Mining and Mechanical Engineers of Newcastle-on-Tyne took place in 1873. In this year also he qualified for and received his Degree of M.A. from King's College. In 1874 he was made a Fellow of the Geological Society of London.

In 1875 he married Florence Ellen, eldest daughter of Lewis Johnstone, M.D., of Stellarton, N.S.

Under Prof. Lawson he took a course in analytical chemistry at Dalhousie College, Halifax, in 1877.

In April, 1879, was appointed Inspector of Mines for the Province of Nova Scotia.

In December, 1880, he received a letter from the directors of the company owning the Foord Pit at Stellarton, highly commending him for "the very great assistance you have rendered at great personal risk of life following the disastrous explosion at our Foord Pit."

In September, 1881, the Government appointed him secretary and member of the Board of Examiners of Colliery Officials for the Province. This was followed in October, 1886, by his appointment to the office of Deputy Commissioner of Public Works and Mines, which position he held until his death.

He was elected a Fellow of Section IV of the Royal Society of Canada, in December, 1891.

Dalhousie College, in April, 1892, conferred on him the Honorary Degree of Doctor of Laws, in recognition of "Scientific Research in Mineralogy and Geology." During the same month he was elected an honorary member of the Mining Society of Nova Scotia.

In June, 1895, the Government appointed him a commissioner to inquire into the "Causes, history and effects of the fires in the coal seams of Pictou County." In November of the same year the Nova Scotia Institute of Natural Science elected him president.

King's College conferred on him, in 1903, the Honorary Degree of Doctor of Science. In March of the following year he was created by His Majesty a Companion of the Imperial Order, in recognition of his contributions to scientific literature and long service under the Government.

The late Dr. Gilpin was a member of a large number of literary and scientific societies, both at home and abroad, he was a prolific writer on the subjects embraced by his profession, and besides, almost constant contributions of papers to the numerous societies with which he was connected, was the author of a number of valuable published works on the Mineralogy and Geology of his native Province.

Some months prior to his death Dr. Gilpin's friends noticed with some alarm that his health was failing, and on the advice of his physician, he consented to take a well earned holiday. While apparently benefiting somewhat from the rest, he suffered a stroke of apoplexy on July 9th, 1907, and his death followed in a few hours.

11.—Government Work, Literary and Scientific.

In accordance with a time honoured custom an invitation was extended to the chief officers in charge of important Scientific and Literary Departments of the Government Service to supply the Council, for printing with their report, an abstract of the leading features of the work carried on under their charge during the past year.

Valuable abstracts of this nature have been received from Prof. E. E. Prince, the Commissioner of Fisheries for the Dominion (*Appendix B*); Mr. Stupart, Superintendent of the Meteorological Service of Canada (*Appendix C*); and Dr. W. F. King, Chief Astronomer and Superintendent of the Astronomical Observatory (*Appendix D*).

12.—Associated Societies.

The following Associated Societies have sent in reports:

Society.	Place.	Delegate.
Nova Scotia Institute of Science.	Halifax	Dr. R. W. Ells.
Ontario Historical Society	Toronto	Barlow Cumberland.
The Literary and Historical Society of Quebec	Quebec	Mr. Parmelee.
Natural History Society of New Brunswick	St. John	W. J. Wilson.
Niagara Historical Society	Niagara	Miss Janet Carnochan
Ottawa Literary and Scientific Society	Ottawa	Dr. T. B. Flint.
Royal Astronomical Society of Canada, Toronto Branch	Toronto	Joseph Pope.
Royal Astronomical Society of Canada, Ottawa Section	Ottawa.	J. S. Plaskett.
New Brunswick Historical Society	St. John	S. D. Scott.
Numismatic and Antiquarian Society of Montreal.	Montreal	G. Durnford.
Women's Historical Society of the County of Elgin.	St. Thomas	J. H. Coyne.
Elgin Historical and Scientific Institute	do	Herbert S. Wegg.
Institut Canadien Français	Ottawa	Rodolphe Girard.
Natural History Society of Montreal	Montreal	Prof. Norton Evans.
Ottawa Field-Naturalists' Club	Ottawa	A. E. Attwood.
Cercle Littéraire et Musical de Montréal.	Montreal	Marc Sauvalle.
Entomological Society of Ontario	Guelph	Arthur Gibson.
Women's Canadian Historical Society	Toronto	Mrs. Thompson.
Natural History Society of British Columbia	Victoria	W. F. Sylvester.
Hamilton Scientific Association	Hamilton	Dr. J. Fletcher.
Nova Scotia Historical Society	Halifax	Hon. L. G. Power.
Canadian Institute	Toronto	R. F. Stupart.
Botanical Club of Canada	Ottawa	Dr. A. H. MacKay.
Wellington Field-Naturalists' Club	Guelph	L. Cæsar.
New Brunswick Loyalists' Society	St. John	S. D. Scott.

Resolutions as follows were then passed:—

1. Moved by Prof. A. B. Macallum, seconded by Mr. J. H. Coyne:

That the Report of the Council, as just read, be adopted.

2. Moved by Prof. F. D. Adams, seconded by Dr. G. C. Hoffmann:

That the minutes of the last meeting, as printed in the Volume of Transactions, be confirmed.

3. Moved by Dr. Wilfred Campbell, seconded by Dr. George Bryce:

That the following be the General Publication Committee of the Society: Dr. S. E. Dawson, convener; Dr. LeSueur, Dr. Fletcher, Mr. Sulte and Mr. Lambe.

4. Moved by Dr. Girdwood, seconded by Mr. F. T. Shutt:

That the following be a Committee for the Nomination of Officers for the Society for next year: Sir Sandford Fleming, Sir James Grant, Dr. A. Johnson, Mr. Sulte and Mr. Duncan Scott.

SPECIAL COMMITTEE ON RULES.

Dr. E. Deville, Secretary of the Special Committee, appointed by the President last year to consider the rules of the Society and report upon any amendments which might seem to be necessary, reported as follows:

The Committee met at 4 p.m., Monday, 25th of May, Dr. S. E. Dawson, president, in the Chair. Present:—Messrs. Bouchette, Campbell, Deville, Doughty, Sir Sandford Fleming, Fletcher, Lambe, Macallum, Roy and Sulte.

Mr. Bouchette, on behalf of Hon. Senator David, submitted the following amendment:

"Que dans le but de donner plus d'éclat et d'intérêt aux réunions de la Société Royale et de stimuler le zèle de ses membres, il soit résolu:

"Que les réceptions des nouveaux membres soient faites, à l'avenir, en séance publique et que le récipiendaire soit tenu de lire, à cette occasion, un travail où il devra faire une appréciation des œuvres littéraires ou scientifiques de son prédécesseur et de son rôle dans la Société."

It was agreed that the proposition was an excellent one, but is already provided for in the rules.

The following amendment to Rule No. 3 proposed by Mr. W. D. Lighthall, was read to the meeting:

"That the constitution be so amended that the Honorary President shall be the Premier of Canada for the time being, and that a stated number of Honorary Vice-Presidents be elected, who shall be members of the Dominion Privy Council."

It was moved in amendment to the amendment, by Sir Sandford Fleming, seconded by Dr. Roy, that the amendment be not adopted, and that the following be substituted as an addition to Rule No. 3:

"In cases in which the Council is of opinion that in the interests of the advancement of science or literature, it is desirable that persons be elected as members of the Society other than as elsewhere provided, they may once in every two years recommend for election as Honorary Vice-Presidents, not more than two (2) persons who, in their opinion, are such that their election will be of signal benefit to the Society."—*Carried.*

The motion to amend Rule 6 was now taken up and, after further amendments, was adopted as follows:

That the Fellows shall be persons resident in the Dominion of Canada or Newfoundland, who have published original works or memoirs of merit, or have rendered eminent services to literature or science.

The number of members in each section shall, in general, be limited to thirty, but may be increased to forty if any section should so desire, in the manner hereinafter indicated.

Nominations to the membership of the Society may be made at any time, and each nomination paper shall be signed by three members of the Section to the membership of which the candidate is nominated. No person shall be nominated whose consent to that end has not previously been obtained. Only those candidates nominated on or before the fifteenth day of February shall be eligible at the ensuing annual meeting. The Honorary Secretary shall keep a record of the nominations, and on or before the first of March, he shall transmit to each member of the Society a printed list of all such nominations, arranged in alphabetical order, indicating the Section to the membership of which each is nominated and giving the qualifications of the candidates and the names of their proposers.

Any candidate whose name shall have been in a previous list of candidates but who shall not have been elected, shall, if his proposers, or any of them, so request in writing before the fifteenth of February immediately preceding the election, be a candidate at such election and his name shall be placed in alphabetical order with those of the new candidates for that election. The nomination, however, of a candidate shall not be valid for more than five years from the date thereof. Any additional qualifications of a candidate may be set forth in a supplementary certificate signed by three members of the Section.

The Honorary Secretary shall also, on or before the first day of March, forward to the members of each Section a printed ballot containing the names of all those nominated to that Section. Each member may then vote for that number of candidates which the Section is permitted by the regulations to elect, the vote to be indicated in each case by placing the mark (×) opposite the name of each or any of such number of candidates, and the ballot signed with the name of the member, may be returned on or before the first of April to the Honorary Secretary, who shall report to Council, at a meeting to be held before the annual meeting, the number of votes obtained by each candidate. Should any of these have obtained a majority of the whole section, the Council shall so report to the Society.

Should no candidate receive a majority of the votes of a Section, or should the number of candidates eligible to a section not receive each a majority of votes in such Section, then the Council shall, at the next annual meeting, refer the matter back to the Section to select names from among the candidates nominated and recommend them to the Society for election. If there be two or more vacancies, the selection shall be made by a separate vote for each vacancy, and the votes of at least two-thirds of the members of the Section present at the meeting shall be necessary for selection. The selection shall be reported to the Society on the first day of the meeting at 2.30 p.m., unless otherwise ordered at the time by the Section, and shall be decided by vote of the majority of the members of the Society present at the meeting.

Each Section shall have the power to increase its number to forty by electing not more than four new members annually. The proposal to elect additional members shall be made by resolution of the section reported to the general meeting of the Society, otherwise no such new member or members shall be elected for that year. This clause shall cease to operate as soon as the total number in any section shall have reached forty.

Another amendment to Rule No. 6, proposed by Prof. C. H. McLeod, providing for the secrecy of the ballot, was held over for further consideration.

The Treasurer gave notice of the following amendment to Rule No. 7, which he proposes to move:

"Any member failing to pay his subscription for two years shall forfeit the privilege, (1) of voting in any of the affairs of the Society, and, (2) of making nominations to fill vacancies until the subscription is paid."

The proposed amendment was approved by the Committee.

The Honorary Secretary asked when the last amendment to Rule No. 7 should be put into force, but no decision was reached by the Committee.

E. Deville,
Secretary.

5. It was moved by Mr. Bouchette, seconded by Dr. Campbel
That the report of the Committee on Rules be adopted.—*Carrie*

6. Moved by Prof. Macallum, seconded by Sir Sandford Flemin
That the amendments to Rules Nos. 3 and 6, recommended by t Committee on Rules, be adopted.—*Carried.*

There was considerable discussion on the proposed amendmen before they were adopted by the Society.

7. It was moved by Dr. Johnson, that the Special Committee Rules be continued.—*Carried.*

Dr. Alexander Johnson presented a printed letter which he h issued to all the Fellows of the Society, dealing with the question an increased grant to the Society to defray the expenses of membe and delegates attending the annual meetings, and he presented a motio seconded by the Rev. Dr. Bryce:

That a deputation should be appointed to wait on the Governme to further this end.

8. It was moved by Mr. Bouchette, seconded by Mr. Gérin:

That Dr. Johnson's motion be referred to a Committee to be nor inated by the President, to report as soon as possible, and the followi Committee was nominated:

Dr. Johnson, mover of the original motion, convener; Sir Jam Grant, Col. Denison, Dr. Wilfred Campbell, Dr. Saunders, Mr. Bo chette.—*Carried.*

9. It was moved by Dr. Saunders, seconded by Dr. Girdwood:

That in accordance with the recommendation of the Council special meeting of the Society shall be held in Quebec in connectio with the Tercentenary Celebrations, next July.—*Carried.*

Presentation of New Fellows.

Dr. James Hannay was presented to the President by Dr. Georg Hay, and Dr. Wilfred Campbell.

Dr. W. F. King was presented by Sir Sandford Fleming and M R. F. Stupart.

Dr. A. G. Nicholls was presented by Dr. Adami and Dr. Ami.

The President received all these gentlemen and welcomed them i the name of the Society.

Dr. Wilfred Campbell spoke in high terms of the literary work o Professor G. M. Wrong, who had hoped to be present, but who had been prevented, owing to press of university work.

At noon the Society adjourned to enable the Sections to organize in their respective rooms.

AFTERNOON SESSION. (Tuesday, May 26th).

The Society re-assembled in general session at 2.30 p.m., when the presentation of Reports from the Delegates of Affiliated Societies was proceeded with, and reports from the following societies were read:—

The Elgin Historical and Scientific Institute, by Mr. J. H. Coyne.

Women's Historical Society of the County of Elgin, by Mr. J. H. Coyne.

The Ottawa Field-Naturalists' Club, by Mr. A. E. Attwood

The Entomological Society of Ontario, by Mr. A. Gibson.

The Ontario Historical Society, by Mr. Barlow Cumberland.

The Society adjourned at 3.30 p.m., and the Fellows met in their various sections.

EVENING SESSION. (Tuesday, May 26th).

At 8 p.m. the President, Dr. S. E. Dawson, C.M.G., delivered his Presidential Address, "A Plea for Literature," in the large assembly hall of the Normal School. This address was listened to with great interest by a large and attentive audience, and a vote of thanks, proposed by Dr. W. D. LeSueur, and seconded by Mr. George Murray, was adopted enthusiastically.

SESSION II. (Wednesday, May 27th).

The Society re-assembled in general session at 11.30 a.m.

Dr. Deville read the following interim report from Section III.

"The Secretary of Section III reports that the following resolution has been adopted unanimously by the section: Section III recommends that the Council be instructed to memorialize the Governor-General on the subject of the Reform of the Almanac, asking His Excellency to bring the need of a new Calendar to the attention of the Imperial Government with the view of steps being taken to obtain the assent of all civilized nations thereto."

10. Moved by Dr. Johnson, seconded by Professor Loudon:

That this report of Section III be adopted.

The motion being put to the Society was carried unanimously.

Reports were presented from the following societies:

Royal Astronomical Society (Ottawa Branch), by Mr. J. S. Plaskett.

New Brunswick Natural History Society, by Mr. W. J. Wilson.

Institut Canadien Français, by Mr. Rodolphe Girard.

Natural History Society of Montreal, by Professor Norton Evans.

New Brunswick Historical Society, by Mr. S. D. Scott.

New Brunswick Loyalists' Society, by Mr. S. D. Scott.

Nova Scotia Historical Society, by Hon. L. G. Power.

Quebec Literary and Historical Society, by Mr. Parmelee.

Niagara Historical Society, by Col. Cruikshank.

Numismatic and Antiquarian Society of Montreal, by Mr. George Durnford.

Women's Canadian Historical Society, by Mrs. Thompson.

Presentation of a New Member.

Professor Roy presented the Hon. Rodolphe Lemieux to the President, giving a *résumé* of his literary work. Mr. Lemieux was received by the President and welcomed as a Fellow of Section I. In acknowledging the honour which had been paid him, Mr. Lemieux spoke of the good work which had been done by the Fellows of the Royal Society since its foundation, and stated that it would always be his endeavour to advance the welfare of the Society and the cause of French literature in Canada.

Dr. Barnes, of Montreal, explained to the Society, on the invitation of the Council, the objects of the British Science Guild, and answered questions as to the scope and nature of its proposed work.

The following report (2) was read from Section III:

"The Secretary of Section III reports that the following resolution was adopted by the Section:—That Section III endorse the objects and aims of the British Science Guild as set forth in their pamphlets now before the Section and recommend that this be referred to the general meeting for endorsation by the Royal Society."

(Signed.) E. Deville,
Secretary.

11. Moved by Dr. H. T. Barnes, seconded by Dr. Bryce:

That the Royal Society of Canada endorses the objects and aims of the British Science Guild as set forth in their pamphlets now before the meeting.—*Carried.*

The following report (3) was read from Section III:

The Secretary of Section III reports that a resolution has been adopted by the Section directing the officers to nominate Professor Wilhelm Ostwald as corresponding member, in succession to Professor Berthelot.

Professor Ostwald is well-known as eminent in both literature and science; a number of members of Section III and of professors in

Canadian universities have studied under him, and from 1892 to the present time there has always been at least one student from Canada in his laboratory.

(Signed) E. DEVILLE,
Secretary.

12. Moved by Prof. W. Lash-Miller, seconded by Dr. Deville and Dr. Barnes:

"As instructed by Section III, I beg to move that Professor Wilhelm Ostwald, of Leipzig, be elected a correspondent member of the Society.—*Carried.*

The following report was read from a Committee appointed by the President to report on Dr. Johnson's motion with regard to the travelling expenses of Fellows attending the annual meeting of the Society. The Committee considering it not advisable to approach the Government at present to ask for assistance, and feeling that something should be done to aid those Fellows who, living at a great distance, cannot afford to attend the annual meetings, would suggest that the Royal Society use a portion of the surplus at its disposal, not arising from the Government grant, in order to meet the ordinary travelling expenses. The Committee further believes that the question of the permanent endowment of the Royal Society of Canada should be considered, and for the purpose of studying that question in a preliminary manner begs leave to be allowed to meet from time to time during the year, and to report at the meeting in 1909.

(Signed) ALEXANDER JOHNSON,
Convener.

13. Moved by Dr. Johnson, seconded by Dr. Campbell:

That the report of the Committee on Travelling Expenses be adopted and be authorized to act in connection with it for the next annual meeting.—*Carried.*

NOTICES OF MOTION.

The following notice of motion was made by Mr. Errol Bouchette. While it was not in order to discuss it at this meeting, he wished to have it entered on the minutes for discussion at the next annual meeting, when he would move it formally, or he would leave the matter to the Council, if they considered it better, to refer the matter to the permanent Committee on Regulations.

1. Considering that the population of the Dominion of Canada—originally composed of two social groups, both essentially Canadian

désire. Les documents formant cette consultation seront transmis au secrétaire général.

Il est proposé par M. Benjamin Sulte, appuyé par M. l'abbé Gosselin qu'en la personne de M. Napoléon Legendre, la Société Royale a perdu un de ses membres qui avait acquis une réputation enviable dans les lettres même avant la fondation de la Société Royale, et qui a été à l'origine de cette institution, l'un de ses membres les plus actifs. La section I désire exprimer à sa famille le regret qu'elle éprouve de le voir disparaître.

Le secrétaire communique à la section la lettre de démission de Sir James Lemoine et la décision du Conseil de l'accepter en conservant au démissionnaire le titre de membre de la Société Royale du Canada.

Il est proposé par M. Benjamin Sulte, appuyé par M. Edmond Roy :—

Que la section éprouve un très vif regret de se séparer de Sir James Lemoine. Elle comprend que par suite de son âge avancé, il est impossible à celui-ci de se rendre aux séances annuelles et de prendre une part active aux travaux ; mais elle espère qu'un membre aussi distingué ne privera pas complètement la Société Royale des avantages qu'elle peut tirer de son expérience et de ses lumières. Cette proposition est adoptée.

Il est proposé par M. le sénateur Poirier, appuyé par M. Errol Bouchette :—

Que la section I approuve en principe la proposition transmise par M. le sénateur David au comité des règlements, relativement à la manière de présenter les nouveaux membres, et à l'opportunité de prononcer des discours ou de lire des travaux en ces occasions. Elle constate avec plaisir que lors de la présentation des nouveaux membres cette année on a mis en pratique la proposition de M. David, et elle espère que la chose se continuera aux séances à Québec lors des fêtes de Champlain, ainsi qu'aux séances annuelles subséquentes.

Cette proposition est adoptée.

Il est proposé par M. Léon Gérin, appuyé par M. l'abbé Gosselin :—

Que le comité de lecture et de revision des manuscrits se compose cette année de M. le sénateur Pascal Poirier, de M. Benjamin Sulte, et de M. J.-Edmond Roy, que les auteurs de travaux lus et acceptés, sauf revision, soient priés de les transmettre au secrétaire de la section, lequel les soumettra au comité de revision et les remettra, après leur revision, au secrétaire général, pour publication.

Cette proposition est adoptée.

On trouvera ci-après une liste des travaux lus et acceptés.

Le bureau suivant est élu pour l'année 1908-9.

Président—Sa Grandeur Monseigneur Bégin.
Vice-Président—L'honorable Rodolphe Lemieux.
Secrétaire—M. Errol Bouchette.

(Signé) ERROL BOUCHETTE,
Secrétaire.

LISTE DES TRAVAUX LUS ET ACCEPTÉS.

Les travaux qui suivent ont été adoptés et renvoyés au comité de revision:—

1.—"L'influence éducatrice de la Religion." Par Mgr L.-A. Paquet.

2.—"Les Acadiens déportés à Boston, en 1755-56, et ce qu'ils sont devenus." Par M. le sénateur Pascal Poirier.

3.—"La Baie d'Hudson." Par l'honorable juge L.-A. Prud'homme.

4.—"Etude sur Bertrand de la Tour et ses œuvres." Par M. J.-Edmond Roy.

5.—"Jean-Baptiste Bouchette." Par M. Benjamin Sulte.

6.—"Contribution à la géographie sociale du Canada français." Par M. Léon Gérin.

7.—"Le vrai monument Champlain—ses œuvres éditées par Laverdière." Par M. l'abbé Auguste Gosselin.

8.—"Les Intendants en France et au Canada." Par M. A.-D. DeCelles, C.M.G.

9.—"Le problème des races dans l'Ouest canadien." Par M. le sénateur Philippe Roy. Présenté par M. Errol Bouchette.

10.—"Officiers et fonctionnaires canadiens et français après 1760." Par M. Régis Roy. Présenté par M. Benjamin Sulte.

11.—"Le chevalier de Niverville." Par M. Benjamin Sulte.

12.—"Les gouverneurs du Canada depuis la cession jusqu'à nos jours (1759-1908)." Par M. F.-J. Audet. Présenté par M. Benjamin Sulte.

13.—"Michel Leneuf de la Valtière." Par M. Placide Gaudet. Présenté par M. le sénateur Poirier.

14.—"Une page de l'histoire de l'Acadie (1713-1720)." Par M. Placide Gaudet. Présenté par M. Benjamin Sulte.

REPORT OF SECTION II.

The Section submits the following report:—

The Section has held five meetings, including that of the Landmarks Association, whose report will be submitted for the transactions by the Secretary, Lt.-Col. Cruikshank.

Much good work has been done by our Section this year, and several very able and interesting historical and other papers were read and discussed, a list of which is appended.

The following officers have been elected for the ensuing year:—

President—Lt.-Col. Wood.

Vice-President—His Grace Archbishop Howley.

Secretary—Dr. Wilfred Campbell.

Printing Committee—The President, the Secretary, and Dr. LeSueur.

The able Presidential Address of Dr. Doughty was full of suggestion for the members of the Section.

The Section passed a resolution with reference to the current deterioration of English language and pronunciation. It was resolved that a committee should be formed for the purpose of taking action in the matter.

(Signed) WILFRED CAMPBELL,
Secretary.

List of Papers read before Section II.

1.—Presidential Address, Dr. A. G. Doughty, C.M.G.

2.—"The Story of the Queen's Rangers—Origin of the Regiment; Its part in Revolutionary War; Simcoe in Command; List of Officers, 1771." By Dr. Hannay.

3.—"Matthew Cocking's Journal of a Journey from York Factory to the Saskatchewan Country (1772-73)." Edited with Introduction and Notes, by Lawrence J. Burpee. Presented by Dr. Wilfred Campbell.

4.—"The Proposed Centennial Celebration of the Arrival of the First Selkirk Colonists (1812-1902)." By Rev. Dr. Bryce.

5.—"The Leroux Documents." By Mr. W. D. Lighthall.

6.—"The Talbot Papers—Concluding Portion (1816-1853)." By Mr. J. H. Coyne.

7.—"A Heroine-Saint of Canada—La Mère de l'Incarnation." By Lt.-Col. William Wood.

8.—"The Administration of Sir James Craig." By Lt.-Col. Cruikshank.

9.—"The History of Agricultural Organization in Ontario." By Mr. C. C. James.

10.—"The Old Royal Coat-of-Arms at Placentia." By the Most Rev. Dr. Howley, Archbishop of St. John's, Newfoundland.

11.—"The Identity of the Animals and Plants mentioned by the Early Voyageurs to Eastern Canada and Newfoundland." By Dr. W. F. Ganong.

12.—"George Heriot, Deputy Postmaster-General of Canada, from 1799 to 1816—A Short Sketch of his Career, with some reference to his Literary and Artistic Works." By J. C. A. Heriot. Presented by Mr. W. D. Lighthall.

13.—"The House of Many Mansions." A poem. By Edward William Thompson. Presented by Mr. Duncan Campbell Scott.

14.—"The Sacrificial Rite of the Blackfoot; the story of the Solar Myth upon which was founded the ceremony described." By Robert N. Wilson, Indian Agent for the Blood Indians. Presented by Mr. Duncan Campbell Scott.

15.—"On the Sub-kingdoms of Sodor and Man." By the late Thos. Macfarlane.

16.—"Haliburton ('Sam Slick')—A Sketch and Bibliography." By A. H. O'Brien, M.A. Presented by Dr. Doughty.

Subsequent to the reading of the report of Section II, it was pointed out by the Honorary Secretary that no provision had been made for the election of additional members to the Section for the ensuing year 1908-1909, and the question was asked if Section II did not wish to make any elections under the new rule. Dr. Campbell, the Secretary, replied, that the question had been considered by the members of the Section present, and it was not the wish of Section II to elect any new members during the next year.

Referring to the final resolution in the report of Section II, Dr. Johnson, thought that this resolution was very similar to one proposed last year, which the Society decided was hardly within the scope of the work of the Royal Society, and could be better looked after by the distinctly educational institutions of the country. There were other matters of a similar nature which could be considered with equal propriety, such as good manners and obedience to the laws of the country.

Prof. Macallum opposed the adoption of the report without protest, believing that it was an undignified position for the Society to take.

Mr. Lighthall pointed out that the Section merely asked for a committee and wished to put themselves on record as protesting against what they believed to be a growing evil.

Introduction of a New Member.

The Most Reverend Doctor Howley, Archbishop of St. John's, Newfoundland, having entered the room, was presented to the President, and welcomed as a member of Section II.

His Grace expressed his pleasure at being able to be present at the meeting and of coming into personal contact with the other Fellows of the Royal Society. This, heretofore, had been impossible owing to the distance at which he lived from the headquarters of the Society and his engrossing ecclesiastical duties.

REPORT OF SECTION III.

The Third Section submits the following report for the session of 1908:—

The Section held five meetings with a very large attendance, nineteen members being present, as follows:—Dr. W. Lash Miller, president; Prof. A. Baker, Dr. H. T. Barnes, Dr. E. Deville, Sir Sandford Fleming, Dr. G. P. Girdwood, Dr. J. C. Glashan, Dr. W. L. Goodwin, Dr. G. C. Hoffmann, Dr. A. Johnson, Dr. T. C. Keefer, Dr. W. F. King, Prof. J. Loudon, Mr. A. McGill, Dr. J. C. McLennan, Prof. C. H. McLeod, Dr. R. F. Ruttan, Mr. F. T. Shutt, Mr. R. F. Stupart.

Twenty-four papers were presented, twenty-two being read in full and two by title; a list of the papers is appended.

The officers elected for the ensuing year are:—

President—Dr. H. T. Barnes.

Vice-President—Dr. W. Bell Dawson.

Secretary—Dr. E. Deville.

A publication committee, consisting of the retiring president, the officers of the Section, and Drs. McLennan and Glashan was appointed.

A resolution of Section IV, recommending that the Government be memorialized to undertake the Bibliography of Canadian Scientific Literature, was concurred in by Section III.

The question of increasing the membership of the Section was duly considered and the following resolution was adopted:

"That the membership of Section III be increased to 40, to be "reached by electing each year such additional number of members "as may be determined from year to year; and that in 1909, there be "four members elected, including any vacancies that may occur."

It is the wish of the Section that such papers as are recommended by the publication committee, be printed in bulletin form with the least possible delay in the manner provided by sub-clause II of Clause 10 of the Regulations.

E. DEVILLE,
Secretary.

List of Papers read.

1.—"The Nitrogen Compounds in Rain Water as collected at Ottawa." By Frank T. Shutt, M.A., F.I.C.

2.—"On the Radio-activity of Potassium and other Alkali Metals." By Prof. J. C. McLennan and W. T. Kennedy.

3.—"On Variations in the Conductivity of Air enclosed in Metallic Receivers." By C. S. Wright. Communicated by Prof. J. C. McLennan.

4.—"On an Improvement in the Method of Determining Visibility Curves." By C. S. Wright. Communicated by Professor J. C. McLennan.

5.—"On the Microstructure of Heusler's Magnetic Alloys." By H. A. McTaggart. Communicated by Prof. J. C. McLennan.

6.—"On the Secondary Rays excited in different Metals by the Beta Rays from Radium." By V. E. Pound. Communicated by Prof. J. C. McLennan.

7.—"On the Charges gained by Insulated Metallic Conductors surrounded by other Conductors, and the Relation of these Charges to the Volta Effect." By J. K. Robertson. Communicated by Prof. J. C. McLennan.

8.—"The Ice Problem in Hydraulic Power Development." By John Murphy, M.A.I.E.E. Communicated by Prof. H. T. Barnes.

9.—"Recent Russian Work on River Ice Formation." By Prof. H. T. Barnes.

10.—"Outline of Analytical Spherical Geometry." By S. Beatty, B.A., Fellow, University of Toronto. Presented by Prof. Alfred Baker.

11.—"Some New Symmetric Function Tables." By Dr. W. H. Metzler, F.R.S.C., Syracuse University.

12.—"Absorption of the Radioactive Emanations in Charcoal." By R. W. Boyle, M.Sc. Communicated by Prof. H. T. Barnes.

13.—"The Need of a 'Rational Almanac." By Moses B. Cotsworth, F.G.S., of York, England. Presented by Sir Sandford Fleming, K.C.M.G.

14.—"The Secondary Gamma-Rays due to the Gamma-Rays from Radium C." By Prof. A. S. Eve, D.Sc. Communicated by Prof. H. T. Barnes.

15.—"Local Temperature Forecasting." By Profs. C. H. McLeod and H. T. Barnes.

16.—"A Note on the Zamboni Pile." By Prof. A. S. Eve, D.Sc Communicated by Prof. H. T. Barnes.

17.—"On a Standard of High Resistance." By Dr. H. L. Bronson. Communicated by Prof. H. T. Barnes.

18.—"Deficient Humidity of the Atmosphere." By Profs. T. A. Starkey and H. T. Barnes, McGill University.

19.—"Wireless Time Signals from the St. John Observatory of the Canadian Meteorological Service." By D. L. Hutchinson. Communicated by R. F. Stupart.

20.—"A Study of the Bunsen Ice Calorimeter." By F. H. Day, B.Sc. Communicated by Prof. H. T. Barnes.

21.—"The Production of Hydrogen Peroxide by Aluminum." By Geo. W. Shearer, M.Sc. Communicated by Prof. H. T. Barnes.

22.—"Some Phenomena of the Persistence of Vision." By Prof. Frank Allen, University of Manitoba. Communicated by Prof. H. T. Barnes.

23.—"Researches in Physical Chemistry carried out in the University of Toronto during the past year." Communicated by Dr. W. Lash Miller.

24.—"The Inorganic Constituents of the Water of the Ottawa River." By Frank T. Shutt, M.A., F.I.C., and A. Gordon Spencer, M.Sc.

Report of Publication Committee of Section III.

The publication committee of Section III recommend that all the papers presented to the Section be printed in the Transactions.

They further recommend that the following papers be printed in bulletin form:—

1.—"On an Improvement in the Method of Determining Visibility Curves." By C. S. Wright.

2.—"On the Charges gained by Insulated Metallic Conductors surrounded by other Conductors, and the Relation of these Charges to the Volta Effect." By J. K. Robertson.

3.—"On the Absorption of the different types of Beta-rays, together with a study of the Secondary Rays excited by them." By V. E. Pound.

4.—"On the Radio-activity of Potassium and other Alkali Metals." By Prof. J. C. McLennan and W. T. Kennedy.

5.—"On the Constitution and Properties of Heusler's Alloys, including a Study of their Microstructure." By H. A. McTaggart.

6.—"The Secondary Gamma-rays due to the Gamma-rays of Radium C." By Prof. A. S. Eve.

7.—"Some further Results on the Absorption of Thorium Emanation by Charcoal." By R. W. Boyle.

20. Moved by Mr. E. Deville, seconded by Dr. Barnes:

That the rules be suspended, and that such papers as are recommended for immediate publication by the publication committee of Section III be printed in bulletin form, with the least possible delay in the manner provided by sub-clause II of Clause 10 of the Regulations, so far as the funds available will allow.—*Carried.*

REPORT OF SECTION IV.

Section IV begs to report that five sessions were held, and were attended by a large number of members. Twenty-one papers were presented, the majority of which were read in full. These papers were of more than usual interest and value, and gave rise in many cases to full and very interesting discussions. The list of papers is appended to this report.

In regard to the question of membership two motions were offered and carefully considered, and it was decided to recommend that the membership of the Section be increased to forty, and that the number of members elected annually for the next three years should be three, exclusive of those elected to fill vacancies.

Section III unites with Section IV in asking the Council to memorialize the Government asking it, on behalf of Canadian Science and its proper representation, to aid in compiling the Bibliography of Canadian scientific publications, in association with the International Catalogue of Scientific Literature; that it be brought to the attention of the Government that no less than twenty other governments directly subsidize the cataloguing of the scientific literature of these countries and that Canada is left almost solitary in its absence of due representation.

The following officers have been elected for the ensuing year:—

President—Dr. A. B. Macallum, F.R.S.

Vice-President—Mgr. J. C. K. Laflamme.

Secretary—Mr. W. Hague Harrington.

All of which is respectfully submitted.

(Signed) W. HAGUE HARRINGTON,
Secretary.

List of papers attached.

1.—"Experiments in keeping Frogs in an Artificial Habitat." By Dr. T. Wesley Mills.

2.—"Some Facts and Thoughts with regard to Right-handedness, and an attempt to explain why Man is Right-handed." By Dr. G. P. Girdwood.

3.—Life-histories of some little-known Canadian Lepidoptera." By Dr. J. Fletcher.

4.—" Cellular Osmosis and Heredity." By Dr. A. B. Macallum, F.R.S.

5.—" Bibliography of Canadian Geology and Palæontology for the Year 1907." By Dr. H. M. Ami.

6.—" Bibliography of Canadian Zoology for 1907 (exclusive of Entomology)." By Lawrence M. Lambe, F.G.S.

7.—" Bibliography of Canadian Entomology for 1907." By Rev. Prof. C. J. S. Bethune.

8.—" Bibliography of Canadian Botany for 1906 and 1907." By Dr. A. H. Mackay.

9.—" Geological Cycles in the Maritime Provinces of Canada." By Dr. G. F. Matthew.

10.—" On the Nepheline Syenites and Associated Alkali Syenites of Eastern Ontario." By Dr. Frank D. Adams, F.R.S., and Dr. Alfred E. Barlow, M.A., (with the permission of the Director of the Geological Survey).

11.—" On Dawsonite." By Richard P. D. Graham, B.A., Demonstrator in Mineralogy, McGill University. Presented by Dr. Frank D. Adams.

12.—" On the Dyke Rocks connected with the intrusion of Mount Royal." By John A. Allan, B.A., of McGill University, and Dr. Frank D. Adams, F.R.S.

13.—" A Method of Preparing Gelatine Plates for Museum or Class Purposes." By Prof. F. C. Harrison, Bacteriological Laboratories, Macdonald College, Que. Presented by Dr. Fletcher.

14.—" Bile Salt Media for Water and Milk Analyses." By Prof. F. C. Harrison. Presented by Dr. Fletcher.

15.—" The Egg and Larva of the Singing Fish of the Pacific Coast (Porichthys)." By Prof. E. E. Prince.

15.—" On the Egg and curious Egg Case of the Chimera (Hydrolagus)." By Prof. E. E. Prince.

17.—" On the growing point theory of the Production of Double Monsters." By Dr. J. G. Adami, F.R.S.

18.—" Pathological Data bearing upon Adaptation, Variation and Evolution." By Dr. J. G. Adami, F.R.S.

19.—" The British Association Meeting at Winnipeg in 1909." By Rev. Dr. Bryce.

20.—" Early Wild Flowers of England and Canada—a Comparison." By Dr. G. U. Hay.

21. Moved by Mr. J. H. Coyne, seconded by Prof. Baker,

That the Society desires to express to Mr. Stupart its thanks for his interesting lecture on the Circulation of the Atmosphere, a subject of interest to all members of the community.—*Carried.*

22. Moved by Mr. F. T. Shutt, seconded by Prof. A. B. Macallum:

That the hearty thanks of the Royal Society be tendered to Dr. J. F. White, Principal of the Normal School, for the considerate manner in which he has opened the commodious Normal School building to the Society and has afforded every facility, both for the general meetings and for the meetings of the sections.—*Carried.*

No further business being brought forward, the retiring president then declared the twenty-seventh annual session closed.

EVENING SESSION. (Thursday, May 28th).

At 8 o'clock p.m. the Fellows and delegates assembled at the Russell House at the Annual Supper, at which the retiring president, Dr. S. E. Dawson, presided.

APPENDIX A

A PLEA FOR LITERATURE

By S. E. Dawson, C.M.G., Lit. D.

PRESIDENT'S ADDRESS

A PLEA FOR LITERATURE.

It will be my endeavour to direct your attention for a short time this evening to some of the objects aimed at in founding the Royal Society which appear to have attracted less than their legitimate share of popular interest; to some of the functions which the Society is performing and may perform, and to indicate some directions in which it may develop. My remarks will be concerned chiefly with the first two sections—the literary sections. The scientific sections express the activities of a scientific era. They deal with material things and make their appeal to the practical genius of the age. They need neither explanation nor apology; for, in popular opinion, science is held to have a basis of real utility which is lacking in literature. The attention of mankind is focussed as never before on the advance of science as it strides from victory to victory over the world of matter; but let us step out of the blaze of noon and rest awhile in the quiet shade of the world of the spirit.

In providing so largely for literature, as distinguished from science, the founders of our Society were following French models. The Royal Society of London, founded in 1660 "for improving Natural Knowledge," has steadily observed the limitations of its charter; but Cardinal Richelieu, twenty-five years previously (in 1635), had founded the French Academy for purely literary objects. That great statesman recognized the power of literature, and, for two hundred years, the French language and literature dominated Europe, and the Academy exists to this day a power in the world of literature, as is the Royal Society of London a power in the world of science.

During the formation of our Society the view was strongly advocated that it should be organized after the pattern of the Royal Society of London and with the same limitations. There were many, however, among those called to Lord Lorne's counsels who were familiar with the traditions of French literature. Broader views prevailed, and the objects of the French Academy, together with the objects of the Royal Society of London, were covered by the different sections of the one Royal Society of Canada. In this way Science and Literature can give each other support. The influence of small bands of students of different subjects is combined, and an institution was founded upon the broad basis of the experience of two races, two nationalities, and two languages —a counterpart of Canada itself.

The Society has passed the period of adolescence, and, this year, both series of its "Transactions" are rendered available to all by an index covering the whole twenty-four volumes, prepared with great labour by one of the fellows of Section One. The wealth of research over the whole fields of Science and Literature thrown open to scholars is now manifest, and the founders of the Society have been justified by the results. To have built on so wide a plan showed an abiding faith in the future of our country, then only commencing to enter upon its astonishing period of expansion. It would have been natural for men of little faith to have founded some institution for the cultivation of Applied Science; but here is an institution for nourishing the intellectual life of the country—to follow the study of Science and Literature into every field, and for their own sakes—not for any immediate material return. It would have been far simpler to have followed precedent than to have traced out a new course; and it would have been far easier to have copied the Royal Society of London than to inaugurate a Society upon a new plan adapted to meet the intellectual requirements of a country so constituted as ours.

It is impossible to overlook the fact that, as the years pass, there is a growing tendency to exalt Science at the expense of Literature; and the complaint that "Letters are neglected and Science is all in all" is too well founded. An idea is prevalent among the practical men who control the purse-strings of the age that there is a certainty and utility about knowledge of the material world which Literature does not possess, and this tendency is evident by the large endowments bestowed of late years upon science in the older colleges, by the number of new scientific institutions formed, and by the increasing throngs of students following strictly scientific studies; while what used to be known as "the humanities" are correspondingly undervalued, and have to rely on the endowments of former generations. In this respect our Society has been assisted by the French traditions in favour of Literature, for Literature was always patronized by the French kings and honoured by the French Court. The love of letters in old France passed oversea into Canada with the cultivated officials and highly educated ecclesiastics who came over from time to time. The literary exercises of the Jesuits' College at Quebec were graced by the presence of the Governor and his little court, and we read of one occasion where the son of a wheelwright of Quebec—the youthful Jolliet, afterwards to be the discoverer of the Mississippi—took a brilliant part in the public exercises of the College and the Intendant Talon—great statesman though he was—thought it not beneath his dignity to take part with the students, and spoke like the rest in Latin with fluency and correctness. Quebec was then a small village—the gateway of a great unknown wilderness. Though the stress of life was very great and the people had to be practical, yet they could take an interest in Latin discussions on philosophical questions. Jolliet was no worse a canoe-man because of his knowledge of Latin—nor, 2,000 years before that, was Socrates less staunch a foot soldier at Potidea and Delium because of his devotion to moral philosophy.

And yet those who wished to confine the Royal Society of Canada within the limits of the Royal Society of London were not altogether without reason. There is undoubted truth in Lord Beaconsfield's remark, when offering a baronetcy to Tennyson, "that it is in the nature of things that the tests of merit cannot be so precise in literature as in science," and, as Lord Macaulay says, "the province of literature is a debatable land." What may be possible in a highly centralized country like France is out of the question in a decentralized country like Canada, where local patriotisms still obstruct that organic unity which we all hope will be realized in future years. The appraisal of current literature, especially of poetry, is, fortunately, not one of the functions of our Society; for no institution ever has been devised which could so isolate itself from the time-spirit enveloping it as to anticipate the literary judgments of even the next succeeding generation. Posterity is the only infallible judge; for, although, as Pope tells us,

> Most have the seeds of judgment in their mind,

the ripening of those seeds is retarded or prevented by the dominating spirit of the age. It took seven years to sell the first edition of 1,300 copies of "Paradise Lost," and Milton received ten pounds for his share; but the nation was then in the full tide of reaction against the Puritans, and Butler's "Hudibras" was the popular poem of the period. No conceivable Academy would have crowned "Paradise Lost" then, or for two generations after. "All men," as Cicero says, "by a certain hidden faculty approve or condemn works of art or letters," but they do so infallibly, only after the mists of the age clear away. Great works in poetry originate independently of stimulation or reward.

> Fame is the spur that the clear spirit doth raise
> (That last infirmity of noble mind)
> To scorn delights, and live laborious days.

The passion of creative art will neither be encouraged nor discouraged. Most of the greatest works in Literature were written before copyright was thought of. Dante could not help writing his great poem. Neither Shelley, nor Keats, nor Tennyson, nor Browning, were drawn into literary pursuits by any outward force. Horace, in his well-known ode, sets forth the inducement—the spur of fame. He writes:

"I shall not wholly die, and a large portion of my being will escape Death. I have built a monument more enduring than bronze ......which the innumerable series of years and the flight of time cannot destroy."

It is so also with great works in prose. The idea of Gibbon's great history was suddenly revealed to him as he sat on the steps of the church of Ara Coeli, on the site of the Capitol, and listened to the friars singing vespers. Then his life's work was set for him, and the mystic power of the genius of Rome seized his soul. The pursuit of letters, as well as that of the higher science, is its own reward. The literary sections have useful work to do in other directions than the criticism of current literature. The great mass of mankind will judge aright when local and ephemeral opinion clears away, and work will endure in so far as it touches the universal heart of humanity or rests upon the universal law of beauty.

Our Society has not specifically laid upon it the high mission laid upon the French Academy by its original charter "to work with all diligence to keep the language pure, eloquent, and capable of treating the arts and sciences." That was a good aim, worthy of the Cardinal Minister who made France so great. For a language is a living organism always in transition, like a pine tree putting forth new leaves and shedding old ones in accordance with its own laws. "*Oratio* next to *ratio*—speech next to reason," said Sir Phillip Sidney, "is the greatest gift bestowed upon mortality," and each language is at once the product and the manifestation of the genius of the race or nation speaking it. With characteristic insight the Greeks used one word *logos* for reason and speech. The ideas are inseparable. Shelley puts speech first. Prometheus,

Gave man speech and speech created thought.

The root words of a language are few, and, for the most part, are the same for many languages; the full vocabulary of a language being an extension into secondary, tertiary, or many more derived and metaphorical meanings, modified by suffixes and prefixes. This is not a chance process, but the genius of each people guides it, and the manner of making these changes reveals the intelligence of each people and its characteristic way of looking at the universe around it. Therein lies the spirit of the language, and the so-called silent and superfluous letters are clues to the logic of its evolution. The process goes on unconsciously and cannot be accelerated — even by a strenuous President or a confident multi-millionaire. The pine tree will not be hurried into dropping its leaves. The people are sovereign here, and will not drop a word, or a letter even, at the bidding of anyone. As Horace tells us, "Custom is the law and arbiter and rightful legislator of language."

Much complaint has arisen in recent years of the difficulty of English spelling. How can it be otherwise if spelling is not taught in the schools, and if the "letters Cadmus gave" are submerged in phonic systems or other recent experimentation. Words are not arbitrary signs, but are embodied thoughts. They have life-histories reaching back through innumerable years and teaching, often by these very despised silent letters, about affiliations of races in the dim past beyond the record of history. It is pleasing and instructive to trace these embodied thoughts through their changes, and it is helpful in acquiring a knowledge of other tongues as well as in understanding our own.

Whatever sympathy we may have for those who have no time to learn to spell, let us not permit them, Procrustes-like, to cut down the English language to the measure of their capacity. Rather let them turn to some of the abandoned etymological spelling books and learn words, not singly and separately, but in their groups and families; for English is not a jargon or a collection of Chinese ideographs, but an organ of thought naturally formed in the course of long centuries unconsciously by the English people. New words we must have for the new things under our skies, but we must jealously watch lest we gradually and unconsciously drift away into a Canadian dialect either in spelling or accent, and, even if we have as a Society no collective mandate for the task, it will be well to inquire whether our manner of speech is being kept as close as possible to the central standards and, to adopt the great Cardinal's phrase, whether we as Canadians are working with all diligence to keep the language pure and eloquent.

The spheres of Science and Literature, though they may seem at times to coalesce, are profoundly diverse. The former is fundamentally quantitative — the latter is radically qualitative. Science is based upon the principle laid down by one of the greatest of her votaries: *"All things exist in number, weight, and measure."* Yes! All things; save the will and the spirit of man. All things; save love, joy, honour, patriotism, and every other motive which stirs the human spirit to action or gives value and dignity to the life of man. For such things as these there is neither number, weight, nor measure; and yet in them is all that makes life worth living. They are the fields in which Literature is supreme; for it deals with the whole region of the spirit — the whole world of mind — and nothing in that world can be apprehended quantitatively. It is doubtless easier to appraise work done in science than work done in literature — the scientific student can measure his results by definite and readily accepted standards, while work in literature must abide the general judgment of mankind. For that reason, in an industrial age, the pursuit of literature is not favoured by practical men; but they forget that, while science deals with the material forms and forces of the universe, literature has for its sphere the whole of the moral and intellectual forces past, present, and future. "Who knoweth the things of a man, but the spirit of a man which is in him?" Now, the "things of a man" are just those things which men really care for and by which civil society advances or retrogrades.

These "things of a man," so profoundly interesting to humanity, lie within the domain of probable truth — a vast region extending from the merest probability to the highest moral conviction — while science with its mathematical methods and its weighings and measurings, lays claim to certainty, and in that is a great attraction for practical minds. But the sciences are no guide to life, and, in proportion as men obtain control of the forces of nature, do they need instruction from other sources of knowledge. In History, Political Economy, Sociology, and their kindred studies will be found the clues leading to the higher civilization and happier life of man. These are sometimes called "sciences" very incorrectly; for they all deal with probable truth. Their last word is never said, for they extend as civilization evolves and humanity advances. The *Dreadnought*, with its amazing adaptations of science, may be blown to atoms in an instant by a torpedo from below, or by dynamite from an air-ship from above. The hopes of the race are bound up rather in such things as the discussions of the Hague Conference — they are among the "things of a man."

We can now apprehend the full meaning of Matthew Arnold's definition of literature as the "Criticism of Life." Life! that is the life of man — human life — life which we fondly believe will endure in some more or less developed form when the spent sun has become as cold as the moon; but, in any case, life which is to each one of us far more than any scientific fact or theory ever discovered or propounded. For thousands of years our views of science have been grossly erroneous, while the principles of life have been in the main the same. The laws of conduct have been more stable than the theories of the constitution of matter. Man struggles and succeeds or fails now just as at the dawn of history, and we still sympathize with the idylls of Solomon and the Shulamite girl of the Bible, and smile at the gossip of the Syracusan women in Theocritus. Happiness is success, and happiness is dependent upon conduct. Now, conduct is the subject matter of literature, whether we read it in Homer, or Plutarch, or Thucydides, or Shakespeare, or Kipling, or even in our own Drummond's sympathetic portraiture of our quaint and very dear friend—the *Habitant* of Quebec.

Literature, then, being the study of human life, it is, of necessity, the most practical of all studies — practical because it deals with the varied experiences and capacities of the human soul. For that reason great statesmen have been trained in letters rather than in science — in classics rather than in mathematics. Their field is human life and in the mirror of what are happily called "the humanities" that life is reflected. The statesman seeks to move men, and he must study mankind — study them in the past in history — in the present in current literature, and from thence make his deductions for the future. With truth did Pope write:

The proper study of mankind is man.

That is the highest kind of knowledge; for all social institutions are stable in proportion as they are based upon it, and it is the most important to human happiness. "Know thyself" had the place of honour among the maxims of the seven sages inscribed upon the temple of Delphi, five hundred years before Christ. These sages were not theorists. They were statesmen, law-givers, men of affairs, and, like the writers of Ecclesiastes and Proverbs, were ignorant of all we know as exact science. Manners and circumstances change, but the master springs of conduct are unchanged, and, in the great works of former ages, we may see ourselves acting in a different stage setting and before a different audience.

"Visible and tangible products of the past," says Carlyle, "I reckon up to the extent of three. Cities with their cabinets and arsenals; then tilled fields with their roads and bridges; and thirdly — books. In which third truly lies a worth far surpassing that of the two others." Not only are they surpassing in worth, but in endurance. The great cities of the ancient world, once the centres of great empires — Babylon, Tyre, Carthage, Thebes — are mounds of ruins. The rich plains of Asia and the productive fields of Northern Africa, once the granary of the Roman world, have, for long centuries, remained untilled; but the literatures of Greece, Rome, and Judea, still sway the minds of men. The wealth and luxury of the merchant princes of old equalled anything existing in our day; but their civilization was material and their memory has passed into oblivion. The temple libraries recently exhumed contained deeds, contracts, leases, and such like practical documents, but nothing corresponding to the literature of the Jews or Greeks. The life was material, and therefore perished like the docks and palaces. The whole wealth and power of Asia was hurled back by a small band of idealists at Marathon and Thermopylæ, and, while the native annals of those great powers are a blank, the history of the little cantons of Greece and the deeds of their citizens have been a guide through all the ages. The names of many of the poorest citizens of Athens are familiar to us, but who knows the names of the merchant princes of Tyre and Sidon. Perished are their docks and palaces, perished are their names and deeds; but the work of the "blind old singer of Scio's rocky Isle" still lives.

Other creations may fade, to shapeless ruin decaying;
Over the world of thy song, youth's earliest dawn is still playing.

While the monuments of ancient literature are enduring and are still influencing the actions of mankind, it is not so in the case of those studies which deal with the world of matter. The science of Aristotle has been obsolete for centuries — his logic, rhetoric, and poetics are text-books in our great universities. The last shred of Greek physical speculation — the atomic theory — which was generally accepted at the close of the nineteenth century has been hopelessly shattered. We had, until the last few years, a working theory of the material universe, but we must now look round for another, and we are face to face with the fact that the triumphs of science have been chiefly in ministering to the comforts of the outer life. We are no nearer to the inner reality of the material world. It is now the duty of sociology to apply these rich conquests over the entire area of human life and elevate the whole race to a higher moral and intellectual plane by mitigating the struggle for life. In that task the study of mankind alone can guide us, and where can the spirit of man be studied if not in its interaction with the Time-spirit throughout the ages, as portrayed upon the scroll of history.

Great as have been the changes wrought by the advance of science during the last fifty years, the changes of the last decade in our fundamental conceptions of matter and of the ultimate constitution of the universe have been still more profound, and I am proud to add that some of the Fellows of our Society are among the leaders in this movement of scientific thought. The human mind will not rest without a rational theory of the inner reality of the world in which it finds itself. Such theories have been left to the philosophers until, in 1808, Dalton adopted the atomic theory, and it was frankly accepted by the leaders of science. "The atomic theory," said Clifford, "is no longer in the position of a theory, but these facts are definitely known and are no longer suppositions." These tiny atoms are, according to another leader of scientific thought, "the foundation stones of the material universe, which have existed since the creation unbroken and unworn." Existing, according to some, from eternity unchanged and unchangeable. They were, in old Roman days, the theme of the great poem of Lucretius; as in our day Emerson sang:

> The journeying atoms,
> Primordial wholes
> Firmly draw, firmly drive
> By their animate poles.

Never has a revolution in thought occurred with a rapidity so startling. The electrical theory of matter which now holds the field impresses the imagination of every thoughtful man and leads to far-reaching conclusions. The atom is no longer a minute mass of impenetrable ponderable matter. It is a system within which a thousand points or monads of electricity whirl and vibrate with inconceivable energy. These points, or monads, or electrons, as they are called, are not in any sense material, while the atom is simply the field within which they exercise their amazing force. We begin dimly to discern the primary evolution from force of what is known as matter and its continuous development into the various elements, while the latest researches of Ramsay and Rutherford are justifying the dreams of the alchemists of past ages.

I am making no attempt to discuss these questions — to do so is beyond my competence. They are present in the minds of all thoughtful men — they are being worked out in this Society, and their bearing upon the main theme of this paper is that this new theory is destroying materialism by eliminating the material. It presents to us a universe built up, not of matter, but of force. It opens up the vision of a grand unity as the foundation of reality. Matter is foreign to us, but force we know; for surely the human will is a force, and passion and intellect are forces, living and energizing in the world. Physics are being reconciled to metaphysics, and the material dissolves into the immaterial. Literature and Science are travelling hand in hand into the region of the imponderable forces where dwells the hidden reality of the universe.

This increasing approximation of scientific theory and speculative philosophy is modifying also the long conflict between science and religion. Our eminent fellow-countryman, George John Romanes, commented upon it in his last thoughts. He drew the broad distinction that, while science dealt with proximate causes, philosophy dealt with ultimate causes: in which latter category he placed the human will, and he argued that our fundamental ideas of causality and energy arise from our consciousness of human will as a self-originating force. Now, the chief value of literature is that it is the crystallized product of the conflict of the will of man with its environment — in history and archæology — in the forms of thought, as in language, grammar, and logic — in sociology and in law, as in morals and politics. As science interprets the interplay of invisible and imponderable forces, so also literature displays the myriad forces of the will and mind of man: and there is no reason to suppose that one kind of force perishes more than the other. So Browning writes in "Rabbi Ben Ezra":

All, that is at all,
Lasts ever, past recall,
Earth changes, but thy soul and God stand sure.

The pursuit of literature must then be of the first importance as an incentive to action, and as a means of enlarging the capacity and happiness of mankind: for it is in society that man finds his fruition.

Unless this world is a training school for the formation of character, in other words, for the moulding of the will, it is difficult to imagine its reason for existing. In history, and more especially in biography, we can trace the development of character acting and reacting in contact with other wills. History is a continuous moral judgment. For better for worse, the happiness of large masses of men — the fate of empires often — hangs on the will of one man: and again, when, from the fathomless depths of personality, a genius arises like Cæsar or Napoleon, the destinies of the world are changed. But even comparatively insignificant men may start a complete series of sequences. There are points on the water partings of our great rivers where a chance pebble may divert a tiny rill into the Gulf of Mexico or the Gulf of St. Lawrence. So it is at the fountain heads of history. The success of the American Revolution was primarily due to the omission of Lord George Germaine to notify Howe of Burgoyne's expedition from Canada. Burgoyne unsupported, surrendered at Saratoga, and decided the intervention of France. The American Revolution brought on the French Revolution, and these two events changed the face of the world. The fate of Canada, in 1775, hung upon Carleton, and trembled in the balance on the night of November 7th, when the little party in Bouchette's barge took him safely to Quebec, paddling with the palms of their hands as they passed through the narrow channel at the entrance of Lake St. Peter. Again, in 1812, the fate of Canada hung upon Brock when he boldly assumed the offensive, and the surrender of Detroit and Michilimackinac heartened the Canadians for the struggle.

Conduct is the fruit, or final result, of character, and the lives of great men are finger posts of guidance, or beacons of warning, as we pass through life. There lies the immense value of biography, and especially of such works as Plutarch's Lives. But we need not go as far as Plutarch. In a few weeks we shall be celebrating the memory of Champlain, the founder of our country — not a great man, as the word is commonly used, but a model of perfect conduct in every relation of life. Among the men who shine in the annals of the Western Hemisphere, he stands among the very first. Loyal to his King, constant to his country, faithful, brave, unselfish, and with full confidence in the future of Canada, his record is a source of pride to every Canadian, and to all time they will do honour to themselves in honouring his memory. Everyone trusted him from the wild savages of the lakes to the King on the throne of France, and he was true to all. His influence still exists, and his noble character is still a power for good. No nobler theme can inspire our studies. Let us continue to commemorate his life and deeds in the future, as the volumes of our Transactions show we have done in the past.

History, as a department of literature, must not, however, be confused with mere annals — dry records of occurrences like the compilations in almanacs and annuals. These are materials for history — the dry bones which must be clothed with flesh and blood and endowed with the breath of life by the co-ordinating and vivifying power of the intellect. The facts have not only to be ascertained, but fused and brought into relation with the sum of human experience, in which the universal principles which sway mankind are embodied. The high creative imagination of the poet is not called for; but the lower representative imagination is necessary — the faculty by which the historian transports himself into strange or remote circumstances, and throws his mind into sympathy with the actors of bygone ages. Only in that way can he discern the universal and so impart unity to his work.

To say that it is sometimes untrue is no more a reproach to history than to any other branch of knowledge. Contemporary history is seldom impartial. But the truth prevails in the end, as has been notably manifest in the case of the American Revolution. For a hundred years never was history so perverted, but, within the last fifteen years, our loyalist forefathers have been more than justified by a new school of historians grouped around the greater United States Universities who, writing from original sources, have risen above the special pleading of Bancroft and the rest, and admit (to borrow one of their own phrases) that "false and exaggerated conceptions of British despotism and tyranny had prevailed in American literature." So far has this gone that a professor of history in one of the State Universities has prepared for his own students a text-book on the history of the American Revolution, extracted from Lecky's "History of the 18th Century," which might be adopted with acceptance in any university in Canada.

Literature, at the highest level of its power, is expressed in poetry, which must be counted among the Fine Arts, since it is the product of the creative power of the imagination and is clothed with beauty of form, of proportion, and of cadence. Music expresses pure emotion, and in it the deep passion underlying universal humanity seeks expression; but its utterance is indefinite. Painting, while definite, is limited to the presentation of action at one moment of time, but poetry is not only the music of language, but it sustains its action over indefinitely long spaces of time. It appeals to the intellect as well as to the emotions, and touches all the chords of life. Poetry is more philosophical than history, and its subject matter is higher; for, while history relates what the spirit of man has done, the power of the imagination, working on an ideal plane, reveals what it is possible for the spirit of man to do.

And yet a reference to the volumes of our "Transactions" will show that no poetry has appeared in the English literary section, and very little in the French. There is no fixed standard by which it can be measured, and the judgment of posterity be anticipated. Poetry of the very highest order has not yet been written in Canada, nor probably anywhere upon this western continent. Much beautiful descriptive poetry we have, but the great creative Canadian poet has yet to appear. When he comes he will be a gift from the unknown; colleges, nor societies, nor culture will produce him. The origin of poetic genius is hidden in the impenetrable mystery of personality. Great poets arise from all classes and under all circumstances. Burns was a ploughman, Keats a surgeon's apprentice, Shakespeare had no regular education, all three sprang from the people; Byron was a nobleman; Shelley belonged to the gentry; Milton and Tennyson were the products of a complete university training. Genius rises superior to conditions of birth, and, being instinctively in harmony with the universal consciousness of mankind, transcends the local and particular and illuminates all it touches with

The light that never was on sea or land,

the inspiration "and the poet's dream."

Herein lies the difficulty of the immediate appreciation of the highest class of poetry. That in it which is universal appeals eventually to all sorts and conditions of men in all times and places; but, in the meantime, it is judged by the local and particular element — the time-spirit which environs us. Hence the gravest mistakes, both of appreciation and depreciation, have been made, and even the French Academy has not been infallible. Glover's "Leonidas" was received with a general chorus of praise; it is now practically unknown; Bailey's "Festus" was supposed to be a poem for all time, but is never mentioned now; as for Tupper's "Proverbial Philosophy," no book in recent times has had so great a sale, it is now most deservedly buried beyond hope. On the other hand, "Paradise Lost" fell flat on the public which restored the Stuarts, while Butler's "Hudibras" was received with acclaim. We all know how long Wordsworth, Browning, and Tennyson had to wait for general recognition. Such errors manifest the overpowering influence of transitory conditions on literary judgments. Some of Kipling's work will suffer from the same cause, and probably in proportion to its present popularity.

The principles of poetry were laid down by Aristotle in his "Poetics," and Horace in his "Art of Poetry." Art, including poetic art, Aristotle defined as an imitation of nature. He did not mean by that a simple repetition or representation of nature; but that the poet is in a true sense a maker, and, while he creates after the manner and on the lines of nature, he adds something from the ideal world of his imagination — something higher, which nature was aiming at but did not attain. In illustration, take our own national emblem, the maple leaf. There are no two mature leaves precisely alike — there is something particular in each, but the variations are within fixed limits. Yet nature had in view an ideal form which may be seen in a young leaf as it unfolds. So also Turner reproduces nature, but the landscape is glorified by his genius. In like manner a great portrait painter reproduces the face of his original truly; but at its highest expression. He shows the man as he might be — as God intended him to be. In art, then, the soul is exalted by the contemplation of the universal ideal, and in that way shares the creative rapture of the poet.

It follows from this that poetry has an entirely different canon of truth from history; for, while history deals with what has happened, poetry deals with what may happen. Aristotle somewhat paradoxically observes that it is better to follow the impossible which is probable than the improbable which is possible. There must be the truth of consistency. The poem must be congruous with the ideal or the universal basis of human nature, while that which is particular or accidental is of slight account. Therefore, in Shakespeare's "Winter's Tale" we are not troubled at reading of a shipwreck on the coast of Bohemia. In reading the "Idylls of the King" it is not in the least important whether King Arthur ever lived. The character drawn by Tennyson is grand and noble — ideally true to universal type. So also with Enoch Arden — how far the story is founded on fact is immaterial, the type of heroic self-sacrifice is felt to be true and possible to human nature and so rests on the universal.

While the literature of a people is the expression of the genius of that people it is, at the same time, a formative power which moulds and preserves national character. Especially is this true of poetry, for in its poetry the ideals of a people find utterance, and, just as the plays of Aeschylus were both the outcome and the stimulus of Greek national life at the critical period of the Persian wars, so the plays of Shakespeare were at once the epic of English history and the support of English freedom in its struggle with Spanish despotism. Nations live their lives — they rise, endure, and pass away. Knowledge has no bearing on their duration. Life is spiritual, and the soul of a people is not in what it has, or what it knows of the material world; but in the spiritual power of its aggregate personality. If material prosperity could have built up an empire Carthage would have crushed Rome, but Carthage is now nothing but a name, and its character and history are recorded only by its enemies. Yet what impartial observer in those far-off days would not have anticipated the success of Carthage. She had commercial eminence, a powerful navy, and wealth without end. While her antagonist was without money and had to learn the art of building ships, Carthage had commerce, manufactures, and capital; but not one writer or bard to kindle the flame of patriotism in her soul. As the nationalities of modern Europe crystallized out of the confusion of the middle ages, a distinctive national literature grew up in each and embodied its ideal. The Arabs overran Asia and Africa with a book, and the literary style of the Koran was an important factor in its initial reception in Arabia.

The great empires of the East, for all their wealth and power, passed away without leaving any records save in the Greek and Hebrew histories; but there is one small off-shoot of the Semitic race which has been preserved to the present day by the power of its literature. The Bible is, in fact, the literature of the ancient Jewish nation. Its selection and preservation form no part of my theme. My object is to point out the amazing power it has had in preserving the Hebrew people through 2,000 years of unparalleled persecution. It contains all forms of literature, but especially poetry of the very highest order. The triumph song of Moses, the lament for Jonathan, the philosophical drama of Job, the sweet idyll of Ruth, the grand prophetic outbursts of Isaiah, the treasury of the soul of all humanity in the Psalms, make the book a wonder of literature, and a heavy responsibility rests upon the Philistines who put it out of the schools. Without king, noble, or priest, without country, city, or temple, without any material holding ground, this book has kept alive the Jewish nation in all lands and supported it under the most dreadful oppression. Not only beside the rivers of Babylon, but beside all the rivers of the habitable world has this people wept the bitter tears of the alien; but the power of their literature kept the memory of Zion perennially fresh in their souls.

During the last twenty-five years the idea of a Canadian nationality has been rapidly growing, and the change is reflected in our literature, especially in our poetry. To weld all Canada into one nation is an arduous task, and the statesmen will need the aid of the writers of Canada. The double history and origin of our people stand in the way of that intimate fusion so important in the formation of national solidarity. The problem is not the absorption of a few thousands of scattered foreigners; but to unite in common aspirations the French and English elements of our society. That was done in England, but it took a long time; for our Edward the Third could not speak English, and, until the closing years of his long reign, French only was taught in the schools. It was the influence of Chaucer which decided the issue, and his poetry fixed the language we speak; but, like the victory at Quebec, the result was not a conquest; for, while the grammar is English and the common vocabulary is Saxon, the majority of words in our dictionaries are of French and Romance origin. This cannot be repeated; for both languages are now fully formed by great literatures, but much can be done by frankly facing the facts as they are, by having the outlines of French history taught in the English schools, and by promoting the teaching of the French language in every way short of rousing opposition by making it obligatory. It is ignorance which causes estrangement.

In this respect the work of our late colleague, Dr. Drummond, has been most important. With the insight of a true poet he discerned, through the outer husk, the true nature of the Habitant, and interpreted the soul of one-third of our people to the other two-thirds. For one hundred and fifty years the Habitant had lived his self-contained life. Happy, contented, and good natured, he was untroubled by envy of his richer neighbours. Those few of the English people who knew the Habitant liked him, but did not stop to study him until Drummond revealed the intrinsic worth of his character, his humour, his patient courage, his endurance, his simple faith in God.

The same tendency is manifest in the unification of our history by the increased devotion of English Canadians to the study, in the original authorities, of the period of the French Regime. The organization of the Champlain Society of Toronto is only one instance, though a notable one, of the movement in Ontario. It is now recognized that in the battles on the Plains of Abraham both sides won. The English troops overran the country, but the French continued to possess it. The French lost nothing, but gained free institutions; and, by dint of long companionship, the English have come to regard the history of Old Canada as theirs also. While the French Revolution severed the French Canadians from France, the sequence of the American Revolution severed the English Canadians from the English-speaking people of the South. The two elements of our people are nearer and more to each other than to either of the nations from which they sprang, and, in the study of the history of their common country the two races find a bond of common interest drawing them closer, year by year, as they know each other better.

The broad field of human interest thus included within the limits of literature has been, in some important sections, diligently cultivated by the Fellows of the Royal Society. The monographs and papers in the French and English literary sections are so numerous and valuable that it has become impossible for anyone to write upon the history of the northern part of this continent without reference to the series of our "Transactions." The two sections have vied with each other in elucidating the Cartier voyages. The Cabot voyages have been placed in their true historical setting, and the movement which resulted in the erection of the Cabot tower at Bristol, England, originated here. The tracks of the early explorers have been traced, and, in short, there is

And wrought with weeping and laughter,
  And fashioned with loathing and love,
With life before and after
  And death beneath and above,
For a day and a night and a morrow,
  That his strength might endure for a span
With travail and heavy sorrow,
  The holy spirit of man.

The holy spirit of man! ! Holy in its capacity, in its possibility; nay, more, in its ultimate destiny. The failures, the sorrows, the joys, the triumphs, of the "holy spirit of man"—*these are the subject matter of literature.*

—

decided upon at some point nearer the Atlantic waters, as suggested by Dr. Stafford.

About the end of September the season's work ended, as the staff had returned to their academic duties, and Dr. Stafford then returned to Montreal.

Biological Station, St. Andrews, N.B.

The special committee appointed to examine various places on the Atlantic shores of the Dominion with a view to the choice of a suitable site for a permanent station, decided that St. Andrews, where the old floating station began its work over ten years ago, presented overwhelming advantages. Fine fishing grounds are near at hand, while prolific lobster, clam and other fishery areas, and almost unique faunistic localities are close to St. Andrews. Besides, the facilities for investigations are such that work can be conducted for a longer season each year than in almost any other part of the coast, hence the Board decided with little difficulty on St. Andrews.

Professor D. P. Penhallow, McGill University, Hon. Secretary of the Biological Board, was most active and assiduous in carrying out the scheme approved by the Board. Many of the best sites, it was found, were possessed by the Canadian Pacific Railway Company, and the president, Sir Thomas Shaughnessy, most generously came to the aid of the board, and he consented to the acquisition of a location for the new station at Joe's Point, not far from the mouth of the St. Croix river. The site is an ideal one, and will afford most convenient access to the sea, a small landing stage and shed alone being necessary, while the buildings, laboratories, library, common room and boarding quarters, as well as the proposed aquarium, store-rooms, etc., are accessible by a specially made drive from the high road near the famous golf links. Much work has been done on the site under the supervision of Professor Penhallow, and the building is now in an advanced state and nearing completion, while a landing stage, suitable boats, water storage tank and other necessary adjuncts are in course of construction. A large staff of the best scientific workers in Canada will conduct active fishery investigations during the summer of 1908; but the work can never be fully carried out until an appropriate fishery cruiser, devoted to deep-sea dredging, etc., is provided. The small volume of marine biological papers issued by the Station, under the title "Further Contributions to Canadian Biology," has excited wide interest, and foreign governments and fishery authorities have applied for copies which have been circulated throughout the scientific world.

development of this important institution under the auspices of the Dominion Government.

The unparalleled herring schools of Nanaimo and the productive clam beds which afford great and remunerative industries, will be the immediate subjects of thorough study by workers at the station.

Georgian Bay Biological Station.

The study of fish-life and of aquatic biology has been diligently pursued by qualified investigators as in previous seasons. Dr. B. Arthur Bensley was called away and his work was taken up by Dr. E. M. Walker, University of Toronto, who acted as head of the station.

The following workers were in attendance during the season: Dr. E. M. Walker, lecturer in zoology; Dr. A. G. Huntsman, instructor; Mr. E. V. Cowdry, and Mr. W. J. Fraser, students, all of the University of Toronto.

Considerable progress was made in the collection and study of aquatic animals bearing on the natural history of fishes, particularly the study of the life histories of aquatic insects, of fish parasites in relation to their hosts, and the microscopic life of the water.

The experiments begun in the former season with a view to the relation of size of mesh in nets to the size of fish taken were continued, in-shore fishes being used for the purpose. Owing to the inclemency of the weather it was not possible to continue the work on the measurement of fishes taken by fishermen in nets of authorized mesh.

Further collections were made illustrating the food and growth of in-shore fishes.

Arrangements were made for tagging experiments, with the object of studying the movements of the black bass. The experiments will be begun on the opening of next season, and the co-operation of sportsmen and others will be invited in reporting the locality and the weight and sex of the fish taken.

The station has now in preparation a card catalogue which when completed will furnish an index to the fauna of the region.

The sub-committee appointed by the Biological Board, will make a visit early this season, to formally inspect the buildings, and to make practical suggestions as to fisheries researches during ensuing seasons. The Dominion Fishery Commission, which has reported on crucial matters relating to the commercial and sporting aspects of the Georgian Bay fisheries, has indicated to this sub-committee problems and lines of inquiry of vital importance to the fisheries of these famous waters, and valuable results will, it is hoped, be accomplished ere long in this way.

APPENDIX C

REPORT OF SCIENTIFIC WORK PERFORMED IN CONNECTION WITH THE DOMINION METEOROLOGICAL SERVICE.

By R. F. Stupart,

Director Dominion Meteorological Service.

REPORT OF SCIENTIFIC WORK PERFORMED IN CONNECTION WITH THE DOMINION METEOROLOGICAL SERVICE.

The ordinary climatic and forecast work of the Meteorological Service has been carried on systematically throughout the year, and investigation of the connection between meteorological conditions in Canada and those existing in other parts of the globe has been continued with energy.

With the double object in view of obtaining climatic data from Canada's north land and of obtaining continuous barometric observations from the northern portions of the Continent, six stations lying between Ft. McMurray on the Athabaska river and the Arctic Coast will within the next few months be supplied with full meteorological equipments. Investigation has so far led to a belief that the character of our Canadian winters depends in a large degree on the intensity and position of the highest mean pressure over the continent, and it does not seem improbable that it may be demonstrated that changes in these high pressures are related to atmospheric conditions over the equatorial regions.

It has been arranged that a meeting of meteorologists representing Great Britain and British Dominions shall be held in Quebec immediately after the close of the tercentenary celebration in July.

The importance of co-operation between different countries for the solution of the wider questions of meteorology has long been recognized on the Continent of Europe, and meetings of Directors of Meteorological Institutions and Observatories are held, from time to time, for the consideration of questions concerning joint action and uniformity of organization.

The meetings are also found to be useful on account of the opportunity which they afford for the personal exchange of views and the comparison of experience of methods employed under various conditions of climate and of social surroundings.

Such international meetings have not yet been held outside Europe and the number of Imperial or Colonial representatives who attend them is very small, although the British Empire includes the widest possible diversities of climate, and many of the most favourable positions for observations of international importance are on her soil.

The general object of the conference then will be to consider the best means of obtaining co-operation between the various meteorological organizations of the Empire with regard to the following matters:

1. Uniformity of practice as regards instrumental equipment, hours of observation, instructions and forms for observers, formulæ and tables

error over that at slit width 0.025 mm., but a slit 0.076 mm. gives a marked increase in both accidental and systematic errors. With a three prism spectrograph, dispersion 10 tenth-metres per millimetre at Hγ, neither accidental nor systematic errors are much increased by increase of slit width to 0.076 mm.

Considerable time has been occupied in investigating and perfecting the instrumental appliance used in this work, especially the spectrograph and the correcting lens. The former, which was constructed in the Observatory workshop from designs by Mr. Plaskett, has proved an efficient and accurate instrument, and only some minor improvements in the temperature case and method of applying the comparison spark were needed.

The correcting lens, whose purpose is to change the form of the colour curve of the objective, bringing Hγ instead of λ 5600 to a minimum focus, enabling a longer range of star spectrum to be photographed in one exposure, was found, after an exhaustive investigation, to give resultant negative aberration of about 2.5 mm. A new correcting lens of larger aperture, designed by Prof. Hastings, gave negative aberration of about 1.5 mm., and it was only after careful refiguring that the image became practically perfect resulting in a diminution of the required exposure time of about 30%, and in greater freedom from chance of systematic displacement of the lines.

An auxiliary investigation has been the determination of the wave lengths of the principal lines in the spark spectrum of an alloy of vanadium and iron, which is used as the comparison source in stellar spectroscopy. The spectra used in the measures were made by means of a 4-inch concave grating of 10 ft. focus. Owing to the combining of some close vanadium and iron lines, wave lengths obtained from the tables extant are uncertain, and a consistent determination was required to avoid this particular source of error in radial velocity work.

Micrometric observations of the position angle and distance of double stars as well as of the apparent positions of comets, whenever such are visible, have been carried on with the equatorial telescope, and the scope of the former is being widened.

The times of immersion and emersion of stars occulted by the moon at Ottawa, have been observed when the weather permitted.

Photometric observations of some short period variable stars are also being made with a modified form of the Zöllner photometre attached to the equatorial telescope.

The shelter for the cœlostat telescope is not yet completed, and work has co not been started on spectroscopic observation netic survey of the earth, undertaken by the Carnegie Institution of Washington.

Gravity.—The Observatory is provided with a half-seconds pendulum apparatus—type Mendenhall. There are three pendulums besides a "dummy" of the same mass as the others, which is used for the determination of the temperature of the swinging pendulum, by having a thermometer intimately attached to it. The pendulums are swung successively under constant pressure (60 mm.) in an air-tight chamber for nearly eight hours in each of the two positions on the agate knife-edge. For noting coincidences a sidereal chronometer with electrical attachment is used. Astronomical observations of a high degree of accuracy are necessary in order to determine the chronometer rate upon which depend the deduced periods of the pendulums. The periods are expressed to the seventh place of decimals, *i. e.,* to the ten-millionth of a second of time, as it is found that good observations with the same pendulum will agree within the units of the seventh place of decimals. One complete set of pendulum observations takes at least forty-eight hours, and at important stations two sets are taken. Observations with a half-seconds pendulum give relative gravity, as compared with similar observations at a base station. With the above apparatus observations were made at Washington and Ottawa, and as the former is connected with the principal European base stations, observations hereafter made, will be correlated to the International Gravity series. Stations occupied so far are:—Washington; Ottawa; Montreal; Toronto; Northwest River; Suva, Fiji; and Doubtless Bay, New Zealand.

It is intended to carry across Canada from the Atlantic to the Pacific, a chain of gravity stations, which will cover an arc of longitude of 64°.

Miscellaneous.

The photographic division has been kept busy during the past year, principally in the developing of the negatives taken, and the making of the prints used in connection with the various surveys. A two-fold enlargement is made from each of these negatives, and these are used in making accurate maps of the region under survey. Moreover, copies of maps and plans are frequently required, and also of the various drawings and curves used in the astrophysical division.

The workshop has proved a most useful and indeed indispensable adjunct to the Observatory. The mechanician has not been able to keep pace with the work required, and an assistant has lately been appointed. The work of the Observatory and the allied surveys has grown so rapidly, that the repairs and alterations required are sufficient to keep both men employed. Besides completing the spectrograph and the travelling wire micrometer mentioned in the last abstract, a polarizing photometer, for the determination of stellar magnitudes has been constructed. New cameras have been made for the spectrograph, and extensive alterations in the transits and chronographs used in longitude work have been completed, to say nothing of the numerous smaller pieces of work which cannot be detailed here. The workshop has been removed to a larger and better lighted room in the basement, in which the machine tools are arranged to much better advantage, and many facilities for the convenience and rapidity of working have been added.

Surveys.

Besides the above, extensive surveys are carried on in connection with the Observatory, and under the control of its Director. These comprise the International Boundary Surveys and the Geodetic Survey of Canada.

The nature of the work on four sections of the International Boundary Line, viz., the 141st meridian of west longitude, the Canada-Alaska Boundary under the Award of 1903, the 49th parallel, and the line from the Richelieu River to the St. Croix, was described in last year's statement.

The point of intersection of the 141st meridian with the Yukon River having been determined, a careful determination of the direction of the meridian at that point was made, and the line was then produced southward by a joint Canadian and United States surveying party for a distance of about 150 miles. The line is cut out where it passes through woods. Monuments will be placed at short intervals on high points, so that each will be visible from the next. The operations of the survey comprise a triangulation following the meridian, and a topographic survey of the immediate neighbourhood of the line on both sides of it.

Operations on the Award boundary line are being continued as described last year. An important part of the work consists of a topographic survey, in which the photographic method is used, of the region referred to in the agreement of 1905, supplementary to the Award, where definition of the line depends upon the selection, after survey of suitable mountain peaks. The crossing by the line of the Alsek River, presents a somewhat similar problem.

The re-monumenting of the 49th parallel from the Rocky Mountains to the Gulf of Georgia has been completed, and nothing remains to be done on this line, but the final inspection of the monuments and the completion of the triangulation across the Coast Range.

Operations have been begun on the 49th parallel east of the mountains, including a re-survey of the line, under triangulation control, the renewal of the original monuments and the placing of additional ones where needed.

On the Eastern Section, the survey and re-monumenting have been completed from the Richelieu River to Hall Stream, covering the whole of the northern boundary of the State of Vermont. The line has been aligned and measured, the old monuments, when in good condition, re-set, and new ones placed at many intermediate points. The line has been levelled over, and a plane table survey made of the adjacent country on each side of the line. Preparations are being made for a similar re-survey this season, of the line between Maine and New Brunswick.

The progress of the triangulation of the Geodetic Survey during the season of 1907, was very satisfactory. The various branches of the survey, including reconnaissance, signal building, angle-observing, and levelling are now thoroughly organized and in the hands of assistants trained for precise work.

Angle measurement has been completed over the territory lying between the Ottawa and St. Lawrence Rivers, from the easterly boundary of the Province of Ontario to a line some miles west of Ottawa City. In accuracy the observations conform to modern standards. A base line has been laid out near Coteau Junction, several miles in length, which, however, has not yet been measured.

The area so covered is nearly four thousand square miles. A similar area, on either side, in Quebec and Ontario, has been prepared for observation by the erection of observing towers. It is intended to proceed with the observations over this area, at once. Connection will be made at Montreal and the Richelieu River with the triangulation carried by Captain Anderson, of the Department of Militia and Defence, from Montreal south-eastward. The U. S. Lake Survey triangulation has been connected with the Niagara peninsula and a triangle thrown across the lake to the vicinity of Toronto.

Reconnaissance has been completed for a chain of quadrilaterals extending from Quebec to London, Ontario, and for a network covering the southern part of the Province of Quebec, between the St. Lawrence River and the 45th parallel. Reconnaissance has also been made in the Provinces of New Brunswick and Nova Scotia.

APPENDIX E

ASSOCIATED SOCIETIES

ASSOCIATED SOCIETIES

I.—From *The Ottawa Field Naturalists' Club,* through A. E. Attwood, M.A.

The Ottawa Field Naturalists' Club was organized in March, 1879, and it has, therefore, now entered upon the thirtieth year of its existence. It has had the honour of being affiliated with the Royal Society of Canada since the inauguration of the latter twenty-six years ago.

It is a matter worthy of note that all the members of the original council or executive committee are alive, and with one exception, still living in Ottawa; the first president, Lieut-Col. William White, though in his seventy-fourth year, is at present an energetic member of the Ottawa Public School Board.

By decision of the members of the club, the area of the Ottawa Field Naturalists' territory embraces a region within a radius of twenty-five miles of the city of Ottawa. Those who are acquainted with the Ottawa District are aware that it is one of very varied characteristics, and one exceedingly favourable for the naturalist. Favourable environment, however, does not entirely account for the success of the club, which three weeks ago was described in the Ottawa *Evening Journal* as the "greatest institution of the kind in the entire continent of North America."

Many of the prominent members of the club are persons whose special qualifications have led to their being appointed by the Federal Government to positions requiring men of the highest ability. Consequently, there is in the Capital City a large coterie of enthusiastic lovers of nature, who have used their energies and intelligence to promote the interests of the Ottawa Field Naturalists' Club. On its membership roll are to be found the following gentlemen who are Fellows of the Royal Society of Canada.

In Ottawa:—Dr. S. E. Dawson, President of the Royal Society of Canada.

Connected with the Geological Survey:—Dr. H. M. Ami, Dr. Robert Bell, Dr. R. W. Ells, Dr. J. F. Whiteaves, Prof. John Macoun, Dr. A. E. Barlow, and Mr. L. M. Lambe.

Connected with the Experimental Farm:—Dr. Wm. Saunders, Dr. James Fletcher, and Mr. F. T. Shutt.

Dr. J. C. Glashan, Public School Inspector; Sir Sandford Fleming, Sir James Grant, Prof. E. E. Prince, Mr. Thos. C. Keefer, C.M.G., Mr. A. McGill, and Mr. W. H. Harrington.

On Botany.

1.—"How the Seeds of Plants are Spread in Nature," by Norman Criddle.

2.—"Fungi from the Kawartha Lakes, including several new Species," by Cephas Guillet.

3.—"Notes on the Genus Vaccinium in British Columbia," by E. Wilson.

4.—"Some of the Influences Affecting Seed Production," by W. T. Macoun.

On Entomology.

1.—"The Great Leopard Moth," by Arthur Gibson.

2.—"List of Coleoptera collected by Mr. J. M. Macoun in British Columbia."

3.—"The Life History of the Honey Bee," by Percy H. Selwyn.

4.—"The Honey Bee and Other Bees," by Dr. Jas. Fletcher.

5.—"Mountain Sprites," by Dr. Jas. Fletcher.

On Conchology.

1.—"Marl Shells from Cobalt," by Bryant Walker.

On Ornithology.

1.—"Remarkably Early Arrival of the First Migrants of this Spring," by Rev. C. W. G. Eifrig.

2.—"New Brunswick Flycatchers," by Wm. H. Moore.

3.—"Spring Migration on the Bruce Peninsula," by A. B. Klugh.

4.—"Notes on Some Seal Island Birds," by H. F. Tufts.

5.—"The American Goshawk near Ottawa," by Rev. C. W. G. Eifrig.

6.—"How to Make a Bird Sanctuary Anywhere," by C. de Blois Green.

7.—"Dates of Arrivals of Birds at Camrose, Alta., in 1906 and 1907," by F. L. Farley.

8.—"Winter Birds in Montcalm County," by L. M. Terrill.

9.—"Dates of Departure in the Fall Migration of the More Common Birds of Ottawa," by Rev. C. W. G. Eifrig.

10.—"List of Sable Island Birds," by James Bouteiler.

11.—"Bird Notes from Southwestern Nova Scotia," by H. F. Tufts.

On Zoology.

1.—"A New Mouse for Canada," by W. E. Saunders.

2.—"A Viviparous Snake," by J. M. Macoun.

On Meteorology.

1.—"Climate in Relation to Health," by Dr. P. H. Bryce.
2.—"The Weather," by Dr. Otto Klotz.
3.—"Rain and Snow," by Prof. F. T. Shutt.

For the eighth year Mr. J. M. Macoun has been the Editor of *The Ottawa Naturalist*. The Associate Editors for Vol. XXI were:—

Dr. H. M. Ami, Geological Survey of Canada—Department of Geology.

Dr. J. F. Whiteaves, Geological Survey of Canada—Department of Palæontology.

Dr. A. E. Barlow, Geological Survey of Canada, Department of Petrography.

Dr. James Fletcher, Central Experimental Farm—Botany and Nature Study.

Hon. F. R. Latchford—Department of Conchology.

Mr. W. H. Harrington, Post Office Department—Department of Entomology.

Rev. G. Eifrig, 210 Wilbrod Street—Department of Ornithology.

Prof. E. E. Prince, Com. of Fisheries for Canada—Department of Zoology.

Dr. Otto Klotz—Department of Meteorology.

The Soirees Committee.

The present chairman of the Soirees Committee is Mr. Andrew Halkett, who is also 1st vice-president of the club. Regarding the soirees of the winter the report of the council reads:

No more successful series of lectures has ever been provided by the club than that of the past winter. Every subject was of popular interest, the addresses were all able efforts, the programme was carried out exactly as printed, and the attendance throughout the entire course was most gratifying. Reports of the work done by the various branches during the year were presented at the different meetings; and in this way, the aims of the club were kept before the public.

The lecture programme is herewith appended:

Lecture Programme.

Dec. 10.—General Exhibition of Specimens.
Address by Dr. J. F. White.
Personal Experiences in the Field during the past season: "Education and Forestry" (illustrated), by Dr. S. B. Sinclair.

"Mountain Sprites," by Dr. James Fletcher.

"A Talk on the Centenary of the Geological Society of London," by Dr. H. M. Ami.

"Rain and Snow," by Mr. F. T. Shutt.

"Observations in the Provinces of Alberta and Saskatchewan," by Mr. A. Halkett.

1908.

Jan. 7.—"Some Sanitary Considerations in the Construction, Heating, and Ventilation of Dwellings," by Dr. P. H. Bryce.
Report of the Zoological Branch.

" 21.—"The Honey Bee and other Bees," by Dr. James Fletcher.
"The Life and Work of the Honey Bee as observed from Spring to Fall," by Mr. Percy H. Selwyn.
Report of the Entomological Branch.

Feb. 4.—"The Height-of-Land Country between the St. Lawrence and Hudson Bay Waters" (illustrated), by The President, Mr. W. J. Wilson, Ph.B.
Report of the Geological Branch.

Feb. 18.—"Wheat, its Improvement and Uses" (illustrated), by Dr. Charles Saunders.
Report of the Ornithological Branch.

Mar. 3.—"The Time and Place for Nature Study in the Public Schools," by Dr. John Brittain, Macdonald College.
Report of the Botanical Branch.

Mar. 17.—"What is the Shamrock?" by Prof. John Macoun.
Annual Meeting.

All the lectures are free and open to the public.

The Excursions Committee.

The present chairman of the Excursions Committee is the Rev. G. Eifrig, who is also 2nd vice-president of the Club. As its name implies, the Ottawa Field Naturalists' Club is a sort of tramp association. Its home is essentially in the field, in the woods, along the streams, among the hills. Last year the first excursion was held in April and the last in October; altogether there were twelve outings. As most of the leaders are absent from the city during July and August, no outings are held during these months.

In connection with these excursions it might be of interest to say a few words as to their *modus operandi*. Two classes of excursions are recognized:—*Sub-Excursions* to points which may be reached by the Ottawa or the Hull Street Railway, and *General Excursions* to places reached by train or steamboat.

At the Sub-Excursions, the persons assemble at the point on the street railway nearest the place to be visited. Leaders of the different branches are in attendance and the party breaks up into groups each headed by a leader. The branch of natural history in which a person is most interested, decides the group which he will join or the leader which he will follow. About two hours later the groups re-assemble at some point previously agreed upon, and a pleasant and profitable hour is spent listening to addresses by the leaders and in comparing specimens collected.

The General Excursions are conducted in much the same manner, but the times of departure and return are, of course, determined by the time-table of the railway or steamboat company.

For this season the Excursions Committee has made arrangements to visit indoor places of interest when the weather conditions render out-door excursions inadvisable or impossible. In accordance with this arrangement, thirty-five friends and members of the club assembled at the Fisheries Exhibit on the wet afternoon of May 9th, when two hours were very profitably spent under the guidance of the 1st vice-president, Mr. Andrew Halkett, whose headquarters is in this building.

Branches of the Club.

Eight branches of natural history are recognized by the club; three of these, viz., the branches in Conchology, in Archæology, and in Meteorology, are still unorganized. The remaining five, Geology, Botany, Entomology, Ornithology, and Zoology, are organized and hold meetings with a degree of regularity throughout the year.

The nature of these meetings may be understood from a short description of those of the Botanical Branch, of which the writer is a member. About twenty persons owe allegiance to this branch. Unless circumstances prevent, they meet fortnightly from October to June, at the homes of the different members. The host of the evening is responsible for the programme, which is announced on the notes of invitation to the members prior to the meetings.

An hour or more is spent in lively discussion of the subject of the evening, after which the meeting becomes quite informal and specimens of a botanical nature are submitted and comments are made on topics in harmony with the general objects of the branch. A non-essential but very pleasant feature of each evening's programme is the partaking of refreshments provided by the wife of the host.

A special bulletin on "Farm Weeds of Canada" was issued during the year by the Seed Branch of the Department of Agriculture. This bulletin was exclusively the work of three members of the club, Mr.

G. H. Clark, seed commissioner, Dr. Jas. Fletcher, entomologist and botanist, Dominion Experimental Farms, and Mr. Norman Criddle, of Aweme, Man. This is undoubtedly one of the best government publications of its kind ever issued by any country.

The library of the club, which consists of a large number of bound volumes, has been placed on the shelves of the Carnegie Library. A label indicating that the book is the property of the club has been placed on each volume.

Appended is a list of the members of the council of the club elected at the annual meeting, March 17th, 1908:

Patron—The Right Honourable Earl Grey, Governor-General of Canada.

President—A. E. Attwood, M.A.

Vice-Presidents—A. Halkett, Rev. G. Eifrig.

Librarian—C. H. Young.

Secretary—T. E. Clarke, B.A., 470 O'Connor Street.

Treasurer—Arthur Gibson, Central Experimental Farm.

Committee—Mr. J. M. Macoun, Mr. H. H. Pitts, Mr. E. E. Lemieux, Mr. Alex. McNeil, Mr. L. H. Newman, Miss Q. Jackson, Miss E. E. Currie, Miss M. B. Williams.

II.—From *The Ontario Historical Society*, through BARLOW CUMBERLAND.

As no reports were for some years submitted to the Royal Society, it may not be inapt to summarize somewhat of the Ontario Society and its past work.

The Ontario Historical Society was incorporated in 1898, by a special act of the Legislature of Ontario to "unite the various Pioneer and Historical Societies of the Province in one central organization for the better promotion of intercourse and co-operation," to form new societies, collect, preserve and publish material and information respecting the early days of pioneer settlement, the archæology, ethnology, and land marks of Ontario, and generally to encourage the study of the history of the province, and of Canada.

The Minister of Education is the honorary president, and the president, and officers and an executive council of five, are elected at the annual meeting by the members and the representatives of the affiliated historical societies.

In 1898 there were nine societies in affiliation, these have now increased, in 1908, to 32. These are well spread throughout the province, almost all the counties of the early Province of Upper Canada being represented, and much earnest historical work is being done, some of

Members of the Ontario Society receive a copy each of the "Annual Report" and of the "Papers and Records."

The Society has accumulated a reference historical library, of some 3,000 volumes placed in its rooms, in the Educational Department, Toronto, and is receiving constant accessions. In 1899 an "Historical Exhibition" open for six weeks, was held in Victoria University, Toronto. The history of the province was well told by the many articles exhibited. The detailed catalogue, published by the Society is a valuable record of the existence of valuable memorials now widely distributed.

During the annual meetings of the Society, many places of interest have been visited, such as the Indian Reserve, and the old Mohawk Church, near Brantford. The Stony Creek Battlefield, the U. E. L. settlements, and Church of Adolphustown, the Southwold Mound and Port Talbot, Amherstburg, Bois Blanc Island and Huron Mission, the Battlefields at Chippewa, Lundy's Lane, Queenston Heights, Fort George, Navy Hall, and the historic churches, St. Mark's and St. Andrew's at Niagara-on-the-Lake; the Christian Islands and old Jesuit Fort Ste. Marie in Georgia Bay, Fort Frederick, Fort Henry, remains of Fort Frontenac and old Block Houses at Kingston.

The Society has been ever active in the promoting of the preservation of historic land marks.

At a meeting held at Toronto, in June, 1899, a resolution was passed advocating the preservation of the "Plains of Abraham" and the project has since been steadily urged. Resolutions were also passed protecting the forts on the Niagara Frontier. Fort George had been proposed to be entered for railway purposes, but was saved by the efforts of the Hon. J. G. Currie, and the Historical Societies at Niagara, Lundy's Lane, and Thorold and Beaver Dams. This Fort and Fort Erie have since been placed under the care of the "Niagara Falls Park Commission."

In 1904 the old Fort Malden and the Block Houses at Amherstburg and Bois Blanc Island, which were visited during the annual meeting in that year, were recommended for preservation, and it is trusted that their safety will yet be secured.

In 1905 the military "Commons" and Fort Missasaga at Niagara-on-the-Lake, were proposed to be subdivided into lots and sold. The Society, by committee and deputations entered into vigorous defence, and the property, together with additional land since purchased, has now been set apart by the Government as a permanent military training camp.

The restoration of old Fort York at Toronto has been kept constantly in view. It was advocated by the Society, and endorsed by a

By and the officers of the Royal Engineers, in 1826, to the level of the lake. The generous contribution by the Imperial Government, to the construction of these inner waterways of Canada, and for its defence at a time when our country was weak and sparsely populated, should never be forgotten.

The papers read at this meeting were of much interest and are published in Vol. VIII.

Mr. David Boyle, who had for so many years, filled the position of secretary, having resigned his office, an illuminated address testifying the thanks and obligations of the Society was presented to him.

The new officers for the year 1907 were elected, and an agitation initiated for the repair of Fort Henry, the larger portion of which is in fair condition, but some parts needing immediate care.

The Society would record the continued and admirable activities of the Hamilton Societies in the recovery of the historic landmarks at Stony Creek. The mortgage on the old Gage Homestead was paid off and the property deeded to the Women's Wentworth Historical Society, who have installed their museum in the homestead.

The Burial Field, in which a number of British Soldiers, who fell June 15th, 1813, were buried, was acquired by the County of Wentworth Veterans Association, and consecrated by Bishop DuMoulin, amid impressive ceremonies.

Thus is the heroism of our defenders kept alive for the emulation of our youth and the vitalizing of our patriotism.

The Ontario Historical Society, and its affiliated societies, have tendered to His Excellency Earl Grey, and the Royal Commission their heartiest good will and services in assisting in the Champlain Celebration and the preservation of the Battlefields of Quebec.

This they have been glad to do, not only as furthering a laudable project but also as tendering to their sister province of Quebec, the united interest we all have in the history of Canada, from its very earliest days as a national heritage in common.

The Society is endeavouring in every way to assist and promote the interest of the affiliated societies, and for further research, and study of the history of Canada. Two new societies, the Lennox and Addington Historical Society at Napanee, and the Tecumseth Historical Society at Thamesville, have been added this year, and others are in progress.

Additional grant has been made by the Ontario Government, and negotiations are being conducted with a view to a further expansion of the Society's work and creating increased possibilities for the spread of interest in historical work and the preservation of old memorials.

III.—From *The Entomological Society of Ontario,* through Mr. Arthur Gibson.

As delegate from the Entomological Society of Ontario, I have the honour of presenting the following report of the work of the Society during the past year.

The annual meeting of the Society was held on October 31st and November 1st last, at the Ontario Agricultural College, Guelph, the headquarters of the Society. This meeting was a most successful one, and a large number of prominent entomologists and others were in attendance during the two days' session. A feature of the annual meeting of this Society is the reception and discussion of the reports of the directors of the six districts in Ontario, into which the economic work of the Society is divided. In these reports mention is made of the insects which have been particularly destructive during the season. The annual report of the Society appeared in March last, and in this an account of the proceedings of the above meeting are given, as well as most of the papers which were presented at the sessions. Among these latter the following may be mentioned:—

"The Entomological Outlook" (Presidential Address), by Dr. J. Fletcher.

"The Gypsy and Brown-tail Moths in Massachusetts," by Mr. A. H. Kirkland.

"Voices of the Night," by Rev. Thos. Fyles.

"Collecting and Rearing Dragon-flies at the Georgian Bay Biological Station," by Dr. E. M. Walker.

"A Preliminary List of the Scale Insects of Ontario," by Mr. T. D. Jarvis.

"The Lime-Sulphur Wash," by Mr. L. Caesar.

"An Unusual Outbreak of Halisidota Caterpillars," by Mr. Arthur Gibson.

"Additional Insect Galls of Ontario," by Mr. T. D. Jarvis.

"Injurious Insects in Ontario in 1907," by Rev. Prof. Bethune.

"Entomological Record, 1907," by Dr. James Fletcher, and Mr. Arthur Gibson.

During the year the Society also held a summer meeting at the Ontario Agricultural College, on July 4 and 5, when interesting papers were presented by Mr. H. H. Lyman on "Thecla calanus and edwardsii"; Mr. C. W. Nash, on "Balance in Nature"; Dr. Henry Skinner on "Insects as Carriers of Diseases"; Dr. J. Fletcher, on "Nature Study as a means of Education"; Dr. W. Brodie, on "The life History of a Colony of the Tent Caterpillar" and Mr. C. W. Nash, on "Instinct *vs.* Education." An excursion was also held to Puslinch Lake, about 9 miles from the college, many specimens of interest being collected.

The branches of the Society at Quebec, Montreal, Toronto, Guelph, and Vancouver, have all been actively at work during 1907, and much useful work in entomology is being thus encouraged at all of these centres. Regular meetings during the winter have been held by all of these branches of the Society, and many interesting papers have been presented and discussed.

During the year, 22 bound volumes have been added to the Society's library at Guelph, besides a large number of periodicals, bulletins, and pamphlets. Many of these latter are being bound up into permanent volumes. This library, which is one of the most complete entomological libraries in America, is continually being used by members of the Society and by students specializing in entomology at the Ontario Agricultural College.

The collections of insects belonging to the Society have been materially added to, during the year, and considerable work has been done in going through the cabinets, and re-arranging the specimens.

The Canadian Entomologist, which is published by the Society, is now in its 40th volume. Volume XXXIX, which ended with the December, 1907, number comprised 432 pages, with 11 full page plates, and 23 figures in the text. No less than 73 different entomologists contributed to the volume, and 11 new genera, 216 new species, and 5 new varieties are described.

These papers are of a high character, and in a report like this, it is impossible to mention very many of them. Some of the more important however, are:—"New Micro-lepidoptera," by Mr. W. D. Kearfott; "New species of North American Lepidoptera," by Dr. W. Barnes; "Notes on Chalcolepidius and the Zopherini," by Major Thos. L. Casey; "On the Classification of the Mosquitoes," by Dr. Harrison G. Dyar and Mr. Frederick Knab; "A New Somatochlora, with a Note on the Species known from Ontario," by Dr. E. M. Walker; "Habits of some Manitoba 'Tiger Beetles' (Cicindela)", by Mr. Norman Criddle; "Studies in the Genus Incisalia," by Mr. John H. Cook; "The Eupitheciæ of Eastern North America," by Rev. G. W. Taylor; "List of Hemiptera taken at Como, Quebec," by Mr. G. A. Moore; "The Classification of the Culicidæ," by Miss Evelyn Groesbeeck Mitchell; "The Stridulation of the Snowy Tree-cricket (*Oecanthus niveus*), by Mr. A. Franklin Shull; "New Coleoptera from the Southwest," by Mr. H. C. Fall; "Tenthredinidæ of Colorado," by Mr. Geo. P. Weldon; "New Tropical American Hesperidæ," by Mr. George A. Ehrmann; "Perlidæ from British Columbia and Alberta," by Mr. Nathan Banks; "*Diplony-*

chus, Laporte (=*Hydrocyrius*, Spinola), and its Relation to the other Belostomatid Genera," by Mr. R. de la Torre Bueno; "New species of Colorado Aphididæ, with notes upon their life-habits," by Prof. C. P. Gillette; "Further Notes on the Occurrence of Hepialus thule, Strecker, at Montreal," by Mr. H. H. Lyman.

Besides the above technical papers, the following appeared under the heading "Practical and Popular Entomology":

How insects are distributed, by Mr. L. Cæsar.

A Homemade and Effective Insect Trap, by Mr. John D. Evans.

The Scolytidæ or Engraver-Beetles, by Mr. J. W. Swaine.

The Walking-Stick Insect (*Diapheromera femorata*), by Mr. J. B. Williams.

Fumigation with Hydrocyanic Acid Gas for Beginners, by Prof. Glenn W. Herrick.

The Society now has 185 Canadian members. The Canadian Entomologist is sent out to 486 subscribers each month as it is issued. Besides the subscribers there are on the Exchange List, the names of 112 Societies, etc., which receive the Canadian Entomologist regularly.

The present officers of the Society are:—

President—James Fletcher, LL.D., F.R.S.C., F.L.S., F.E.S.A., Entomologist and Botanist of the Experimental Farms, Ottawa.

Vice-President—Tennyson D. Jarvis, B.S.A., Lecturer in Entomology and Zoology, Ontario Agricultural College, Guelph.

Secretary—Lawson Cæsar, B.A., O. A. College, Guelph.

Treasurer—S. R. McCready, B.A., Professor of Botany and Nature Study, O. A. College, and Macdonald Institute, Guelph.

Librarian—Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Professor of Entomology and Zoology, O. A. College, Guelph.

Curator—J. Eaton Howitt, B.S.A., Lecturer in Botany, O. A. College, Guelph.

Directors—Division No. 1—C. H. Young Ottawa; Division No. 2—C. E. Grant, Orillia; Division No 3—J. B. Williams, Toronto; Division No. 4—C. W. Nash, Toronto; Division No. 5—George E. Fisher, Burlington; Division No. 6—J. A. Balkwill, London.

IV. From *The Ottawa Literary and Scientific Society*, through T. B. Flint, D.C.L.

The council of the Ottawa Literary and Scientific Society take pleasure in reporting another successful year in the operations of the society. Notwithstanding the establishment of a public library and the existence of many institutions of a more or less literary and educational nature, the society has increased its membership during the year. With its extensive library, composed so largely of books of historical and scientific interest, and its complete course of lectures during the winter season, the council feel justified in asserting that the society fills a place in the educational life of the Capital quite distinct from any other body.

The reading room, which is generously supplied with the leading newspapers and periodicals, and is open daily, was well patronized at all times.

There was an addition of 150 books to the library, and 3,634 books were issued to members, being an increase of about ten per cent over the previous year.

Another volume of Transactions, being the fourth since the inception of the society, was issued and copies sent to the various scientific institutions throughout the world with which publications are exchanged. The volume contains verbatim reports of all the lectures delivered during the season of 1906-07.

The treasurer's balance sheet shows a balance on hand at the close of the year of $77.79 against $333.52 at the commencement. The total receipts were $832.25, of which members' fees produced $417.00. The decrease in members' fees compared with the previous year was due to a considerable amount of arrears being collected in 1907. The total expenditure was $1,087.98. Of this sum $190.75 was paid out in connection with the issue of the volume of Transactions.

It is regretted that the grant from the Ontario Government has been reduced to $200 for the coming year and the council is of the opinion that, in view of the efforts put forth by the society for so many years to advance the literary and scientific interests of the city, it is entitled to more generous treatment. While it is earnestly hoped that the allowance will be restored to the original figure at the next meeting of the Legislature, special efforts must be made by the society in the meantime if its work is to be maintained at the same standard of efficiency as in the past.

The lecture course was interesting and instructive, and the attendance at the several meetings was gratifyingly large. The thanks of the society are due to the librarian of the Carnegie Library for the use of the hall of that institution.

The programme of the course was as follows:—

1907.

Nov. 27.—Inaugural Address "The Thory and Practice of the Constitution," by Thos. B. Flint, D.C.L., President.

10.—"The Passenger Pigeon," by Dr. C. J. S. Bethune,
11.—"A Year's Sojourn near the Lake of the Woods," by F. A. Clowes.
12.—"The Drosophilidæ," by B. Barlow.

One of the most important features of the work of the club is the compilation of the Ontario Natural Science Bulletin. Various aspects of natural history are considered in its pages, but prominence has been given to records, from reliable observers, of the less known plants and animals occurring within definite areas of the province. In this way much has been done to extend our knowledge of our flora and fauna. Amongst plants the filices, gramineæ, cyperaceæ and orchidaceæ have received special attention, and in future issues it is desired to give similar treatment to the ericaceæ, violaceæ, mosses and fleshy fungi.

Officers for the year 1907-08:—

President—J. W. Eastham.

Secretary-Treasurer—C. R. Klinck.

Editor of the Ontario Natural Science Bulletin—T. D. Jarvis.

VI.—From *The Elgin Historical and Scientific Institute*, through HERBERT S. WEGG.

The Elgin Historical and Scientific Institute begs to report as follows:—

Eight meetings were held during the year. Thirty-six new members were elected; the membership is now upwards of one hundred and seventy. Meetings were well attended, interesting papers and addresses were presented, and the institute is in a flourishing condition. During the summer of 1907 the members made their annual picnic excursion to the Southwold Earthwork and Port Talbot. A second picnic was held near New Sarum on the invitation of Mr. Chas. D. Oakes.

Captain John Price, of Port Stanley, presented to the institute original papers relating to the institution in 1817 of the Talbot Anniversary.

The following were among the papers and addresses presented during the year:—

"Address on the romantic history of Colonel Talbot, with some account of distinguished visitors to Port Talbot"; "Address on a recent trip to the Rockies and Edmonton"; "Readings from proof-sheets of the Talbot Papers"; "Hardships of the Talbot Settlers in 1816, as set forth by Singleton Gardiner in a letter to Henry Coyne"; "Original Minutes of the first Masonic Lodge (No. 30) at St. Thomas, 1818 to 1822"; "Bill Kissane, a noted criminal connected with St. Thomas in its early days," by the President.

"Three Talbot Letters recently discovered among the Askin Papers in the Dominion Archives," by Mrs. J. H. Wilson, vice-president.

"Address at the Southwold Earthwork on the Institute's first visit in 1891, and Mr. David Boyle's description of the Fort," by Mr. W. H. Murch.

"On the Pioneers of Southwold," by Mr. Frank Hutt.

"Address on his trip to Europe, with special reference to Belgrade, Dublin, and the Castle of Malahide," by Judge Ermatinger.

"History of Paul's or Turville's Hollow, St. Thomas," by Mrs. Dawson Kerr.

"On the early settlement of Dunwich and Aldborough," by Mr. C. St. Clair Leitch.

"Reminiscences of Manitoba, 1868-1870, including personal experiences of the writer as a prisoner of Louis Riel at Fort Garry, with extracts from diary," by Mr. A. W. Graham.

The expediency of endeavouring to obtain permanent quarters for the institute has been discussed, and it is hoped that something may be accomplished in the not distant future by a strenuous and sustained effort in this direction.

The institute has become a member of the Canadian Landmarks Association. It will cordially co-operate with other organizations in promoting the objects of the Quebec Battlefields Association, and thereby of the National Battlefields Commission.

The officers for 1908-1909 are as follows:—

President—James H. Coyne, M.A., F.R.S.C.

Vice-President—Mrs. J. H. Wilson.

Secretary—Herbert S. Wegg.

Treasurer—William H Murch.

Curator—Mrs. W. St. Thomas Smith.

Editor—Judge Ermatinger.

Council—Judge Colter, Samuel Price, F. Hunt, J. W. Stewart, K. W. McKay, Chas. D. Oakes, Mrs. J. S. Robertson, Mrs. C. O. Ermatinger, Mrs. Truman Duncombe, Mrs. C. St. Clair Leitch.

VII.—From *The Women's Historical Society of the County of Elgin*, through Mr. J. H. Coyne.

The Women's Historical Society of the County of Elgin presents its annual report for 1907-1908.

During the year nine regular meetings of the society and several meetings of the executive were held.

The papers read were as follows:—

"A trip to the Pacific Coast and report of the meeting of the National Council of Women at Vancouver," by Mrs. J. H. Wilson and Mrs. Louisa King.

"On the History of the County of Haldimand," by Mrs. C. W. Colter.

"On the History of Brantford," by Mrs. R. H. McConnell.

"The Story of Marguerite de Roberval," by Mrs. J. P. Finlay.

"'Glenbanner,' the Bannerman Farm," by Mrs. J. A. Kains.

"Early Recollections of St. Thomas," by Miss Ermatinger.

"History of the Island of Anticosti." Translated from the French by Lady Edgar, and loaned by the Women's Canadian Historical Society of Toronto.

"History of Alma College," by Mrs. R. I. Warner.

"History of St. Peter's Church and Cemetery, Tyrconnel," by Mrs. C. St. Clair Leitch.

"The Blackwood Family in the County of Elgin," by Miss Ella Sinclair.

A number of historical relics were received during the year.

The society is an auxiliary of the Elgin Historical and Scientific Institute, its members being also included in the membership of the institute.

Four social gatherings were enjoyed by the society during the year:—

The institute's picnics at Port Talbot and New Sarum.

A reception in honour of our president, Mrs. J. H. Wilson, on her return from the Pacific Slope, and

The annual social evening at Stevenson's Parlours on the 11th November.

The society has had a prosperous year, and has $135.18 to its credit in The Southern Loan and Savings Company after providing for all expenses.

Following is a list of the officers for 1907-1908:—

President—Mrs. J. H. Wilson.

1st Vice-President—Mrs. J. H. Coyne.

2nd Vice-President—Mrs. J. S. Robertson.

3rd Vice-President—Mrs. Mary Duncombe.

Secretary-Treasurer—Mrs. Graham Symington.

Assistant Secretary—Mrs. F. A. Fessant.

Assistant Treasurer—Miss Florence McLachlin.

Corresponding Secretary—Miss Lena Travers.

Curator—Mrs. R. H. McConnell.

Meetings of the Institute were held from November, 1907, till May, 1908. The following papers were communicated during the session:—

1.—"Presidential Address," by F. W. W. Doane, C.E.
2.—"On the Influence of Radium on the Decomposition of Hydriodic Acid," by H. Jermain M. Creighton, M.A.
3.—"The Source of the Limiting Factors controlling Deposition of Iron Ores," by Prof. J. Edmund Woodman, D.Sc.
4.—"The Myxomycetes of Pictou County, N.S.," by Clarence L. Moore, M.A.
5.—"The Action of Organic Sulphur in Coal during the Coking Process," by A. L. McCallum, B.Sc.
6.—"Fish-eating Habits of Medusæ," by Prof. E. E. Prince.
7.—"The Present and the Future of our Fisheries," by Prof. E. E. Prince.
8.—"A Few Chemical Changes influenced by Radium: a new method for the detection of Amygdalin," by H. Jermain M. Creighton, M.A.
9.—"The Behaviour of Solutions of Hydriodic Acid in Light in the Presence of Oxygen," by H. Jermain M. Creighton, M.A.
10.—"On the Occurrence of Tin in Nova Scotia," by Harry Piers.
11.—"Note on Eels in Water Pipes," by Watson L. Bishop.
12.—"Economic Geology of Arisaig, N.S.," by Prof J. Edmund Woodman, D.Sc.

IX.—From *The Numismatic and Antiquarian Society of Montreal,* through Mr. George Durnford, C.A., F.C.A., Can.

The Society during the session of 1907-1908 held the usual monthly meetings.

The Quebec Government granted to it the sum of $400, being 4% on the $10,000 held by the Government as the price of sale of the Chateau.

The following donations were made:—

To the Museum.—10 Canadian antiquities; 26 coins; 8 medals; 7 specimens of paper money; 17 stamps.

To the National Gallery.—2 portraits in oils; 1 engraving; 3 photographs.

In Canadian Scenes.—3 in oils; 1 engraving; 3 photographs.

To the Library.—49 books; 53 pamphlets. In Canadian Section—145 books; 35 pamphlets; and over 100 documents.

Gifts:—Among the gifts and donations are two valuable oil photographs of "Old Montreal," by J. Duncan, the gift of Mr. E. A. Adams;

The Society has pleasure in announcing that it has resumed the publication of the Antiquarian Journal; and will give its cordial support to the organization of the Historic Landmarks Association.

By purchase about 100 of the first volumes of the "Quebec Gazette" have been acquired.

In respect to the title of the Quebec Battlefields, this Society is strongly in favour of retaining their time-honoured names.

Officers.

President—Hon. L. W. Sicotte.

Vice-Presidents—W. D. Lighthall, L. J. A. Cressé, C. T. Hart, Ludger Gravel, James Reid, Judge Lafontaine.

Honorary Treasurer—George Durnford.

Honorary Recording Secretary—C. A. Harwood.

Honorary Corresponding Secretary—Pemberton Smith.

Honorary Librarians—J. A. U. Beaudry; R. W. McLachlan.

Members of the Council—P. O. Tremblay, S. M. Baylis, G. N. Moncel, J. C. A. Heriot, A. S. Hamelin, Robert Pinkerton, A. Chaussé, C. E. Bélanger, W. W. C. Wilson.

X.—From *The Royal Astronomical Society of Canada* (Ottawa Branch), through J. S. Plaskett.

I have the honour to submit to the Royal Society of Canada the following report of our proceedings for the past year.

The Society at Ottawa has had a very successful year, and the spring season is closing with excellent prospects for the future. The attendance at both afternoon and evening meetings, and the interest shown have been very encouraging to the officers, and show a growing interest in astronomy in Ottawa.

The meetings have been held every two weeks and, as was the case last year, alternately in the afternoons and evenings. At the evening meetings papers of a popular character, usually illustrated, have been presented, while at the afternoon meetings papers of a technical nature dealing with different branches of the work of the Observatory have been given. During the season 1907-1908, sixteen meetings including the annual general meeting have been held. The following is the programme:—

Oct. 17.—"The History of Astronomy," by W. F. King, LL.D.

Nov. 7.—"The Star Image in Spectrographic Work," (No. 2), by J. S. Plaskett, B.A.

Nov. 14.—"The Dawn of Astronomy," by Joseph Pope, C.M.G.

Nov. 28.—"The Orbits of Stellar Systems," by W. E. Harper, M.A.
Dec. 5.—"The Geometry of Orbits," by W. F. King, LL.D.
Dec. 19.—Annual General Meeting.
Jan. 16.—"The Calendar," by W. F. King, LL.D.
Jan. 30.—"Methods of Predicting Occultations," by R. M. Motherwell, B.A.
Feb. 13.—"Astronomical Cycles," by W. F. King, LL.D.
Feb. 27.—"Earthquakes and the Interior of the Earth," by Otto Klotz, LL. D.
Mar. 12.—"Time," by W. F. King, LL.D.
Mar. 26.—"The Determination of Azimuth," by F. A. McDiarmid, B.A.
Apr. 16.—"Latitude and Longitude," by Otto Klotz, LL.D
Apr. 30.—"Errors of Transit Observations," by R. M. Stewart, M.A.
May 14.—"Mars," by Joseph Pope, C.M.G.
May 28.—"The Spectrograph for Radial Velocity Work," by J. S. Plaskett, B.A.

At the evening meetings a valuable course on the elements of astronomy, each paper dealing with a different phase of the science was given by the President, Dr. W. F. King, Director of the Observatory. These lectures were each complete in themselves, and yet followed one another in logical order, giving in a readily understandable form much useful information about the branch of the subject they treated. They were all well attended and much interest was evinced in them. A new departure at the evening meetings has been the inauguration by the President of the "Question Box." Any question on astronomical subjects sent to the Secretary will be answered at the next evening meeting. Much interest has been aroused by this feature of the meetings, as most of the questions have been of a general character. The privilege extended to the members, at the conclusion of the meeting, of observing any interesting celestial objects with the telescope has been continued and is a very popular part of the proceedings.

The papers presented at the afternoon meetings have all been of a high class, several of them containing the results of original research forming distinct contributions to science. A brief abstract of each may be given.

1. "The Star Image in Spectrographic Work," by J. S. Plaskett, gave an account of the difficulties met with and the success finally attending the efforts to obtain a perfect auxiliary photographic correcting lens for the visual refractor. This is a continuation and conclusion of the paper under the same title given last season when the aberrations of

the original corrector were investigated. This paper was published in the Astrophysical Journal for March, 1908.

2 "The Orbits of Stellar Systems," by W. E. Harper, gave an account of some of the work done at the Observatory in obtaining the orbits of spectroscopic binaries. A short account of the different methods employed in treating the velocity observations to obtain the elements of the orbit was followed as an example by the velocity curve and orbit of α Draconis.

3. "The Geometry of Orbits," by W. F. King. An entirely new and wholly graphical method of obtaining the elements of a spectroscopic binary orbit was developed. Besides being entirely original, this method, especially for stars whose spectrum does not permit of very accurate measurement, effects a considerable saving of labour. This paper was published in the Astrophysical Journal for March, 1908.

4. "Methods of Predicting Occultations," by R. M. Motherwell. The principal methods employed for predicting occultations of stars by the moon at any given place, with special application to the Observatory at Ottawa, were treated. Graphical methods were fully discussed and explained on account of the labour saved.

5. "Earthquakes and the Interior of the Earth," by Otto Klotz, gave a concise summary of the state of our knowledge concerning the interior of the earth. The application of various indirect methods, especially the new one of seismology, led to the conclusion that the interior of the earth was not a fluid molten mass as originally supposed, but must be solid and rigid as steel. Published in the Journal of the Royal Astronomical Society of Canada, March—April, 1908.

6. "The Determination of Azimuth," by F. A. McDiarmid. The principles employed and the formulæ used in obtaining accurate determinations of Azimuth were developed. The errors to be guarded against and the precautions to be used were fully discussed, and examples from the Azimuth work in the Yukon showing the accuracy attainable were given.

7. "Errors of Transit Observations," by R. M. Stewart. This paper was a conclusion of the one given last year and gave the results of a valuable investigation into improved methods of observation and of arrangement of the stars in a time set in the determination of time and longitude with a portable transit instrument. This paper will shortly be published.

8. "The Spectrograph for Radial Velocity Work," by J. S. Plaskett, although not given at the time of writing, will contain a summary of the principles involved in designing the most efficient type of spectrograph.

It will embody the results of investigations recently undertaken as applied to the design of a new single prism spectrograph.

Each of the members receives free the bi-monthly Journal of the Royal Astronomical Society of Canada, containing, besides many of the papers presented to the Society, astronomical news of general interest and frequent contributions on different branches of astronomy. At the beginning of the year a handbook is also published and distributed free to the members. This contains the ephemerides of the sun, moon and planets, and much other valuable information.

At the annual general meeting held on December 19th, 1907, the following officers were elected for the ensuing year:—

President—W. F. King, B.A., LL.D., D.T.S.

Vice-President—Otto Klotz, LL.D., F.R.A.S.

Secretary—J. S. Plaskett, B.A.

Treasurer—R. M. Stewart, M.A.

Council—Joseph Pope, C.M.G., F.R.A.C.; A. H. McDougall, B.A.; F. A. McDiarmid, B.A.

XI.—From *The Royal Astronomical Society of Canada*, through R. Stewart Muir.

The increasing interest in the study of astronomy in Canada is manifested by the membership having increased to over 500 during the past year.

The officers elected for the ensuing year are as follows:—

Hon. President—Dr. W. F. King.

President—W. B. Mussen, Esq.

Vice-President—A. T. DeLury, Esq., M.A.

Second Vice-President—L. B. Stewart, Esq., D.L.S.

Secretary—J. R. Collins, Esq.

Recorder—Miss E. A. Dent.

Librarian—A. Sinclair, Esq., M.A.

Treasurer—George Ridout, Esq.

Curator—R. S. Duncan, Esq.

Council—Joseph Pope, C.M.G.; A. F. Miller, Rev. B. D. Marsh, L. H. Graham, Dr. A. D. Watson.

The retiring President, Dr. A. C. Chant, having occupied the position for the past four years, has devoted himself with singular zeal and energy to his duties. His final address was an exhaustive review of the progress of astronomy during the past year.

The publication of the Journal and Annual Handbook has been continued, and judging from the large number of requests for copies received from astronomers and scientific societies in foreign countries, the

Royal Astronomical Society may feel that these publications have attracted the favourable notice of astronomers, amateur and professional.

The following is a partial list of the papers read at the meetings of the Society since April, 1907. Some of the papers have been published in the Journal.

May 14.—"Recent Applications of Photography to Astronomy," by Mr. D. J. Howell.

May 28—"Variations in the Leading Features of the Tide in Different Regions," by W. Bell Dawson, D.Sc.

June 11.—"Critical Temperatures in Relation to Cosmic Theories," by Mr. R. S. Dewar.

Sept. 17.—"Some Notes on the Nebular Theory," by Mr. W. B. Musson.

Oct. 1.—"The Great Pyramid," (Second paper), by Mr. J. Frederick Sharpe.

Oct. 29.—"The Approaching Transit of Mercury," by A. R. Hassard, B.C.L.

Nov. 12.—"Variation of Latitude," by Prof. L. B. Stewart.

Nov. 26.—"Modern Theories of the Evolution of Matter," by Mr. J. R. Collins.

Dec. 10.—"A Review of Some Recent Views on the Canals of Mars," by W. E. Jackson, M.A.

Dec. 17.—"The Apex of the Sun's Way," by John A. Paterson, M.A., K.C.

Jan. 14.—"Annual At Home—Progress of Astronomy and Astrophysics," (Address of retiring President, Dr. A. C. Chant.)

Jan. 28.—"An Account of the Spiral Nebular Hypothesis," by Dr. A. C. Chant.

Feb. 11.—"Stellar Motions," by Mr. A. F. Millar.

Feb. 25.—"Corrections to Observations—Atmospheric Refractions," by Prof. A. T. DeLury.

Mar. 10.—"Popular Exposition of Darwin's Earth Moon Theory," by Mr. John Phillips.

Mar. 24.—"Corrections to Observations-parallax," by Prof A. T. DeLury.

Apr. 7.—"Ancient Ice Ages," by Prof. A. P. Coleman.

Apr. 21.—"Some Myths and Fancies of the Milky Way," by Mr. W. J. Wittemburg.

May 5.—"Star Magnitudes,"by Mr. J. E. Maybee.

May 19.—"Sir William Herschell," (Contributed by Rev. J. T. W. Claridge, M.A., F.R.A.S.)

It will embody the results of i
plied to the design of a new sin
Each of the members recei
Royal Astronomical Society of (
papers presented to the Society
and frequent contributions on d
beginning of the year a handbo
to the members. This contains
planets, and much other valuab
At the annual general meeti
lowing officers were elected for t
President—W. F. King, B.A
Vice-President—Otto Klotz
Secretary—J. S. Plaskett, I
Treasurer—R. M. Stewart, I
Council—Joseph Pope, C.M
F. A. McDiarmid, B.A.

XI.—From *The Royal Astro*
R. STE

The increasing interest in
manifested by the membership h
past year.
The officers elected for the e
Hon. President—Dr. W. F.
President—W. B. Mussen, E
Vice-President—A. T. DeLu
Second Vice-President—L. I
Secretary—J. R. Collins, Es
Recorder—Miss E. A. Dent.
Librarian—A. Sinclair, Esq.,
Treasurer—George Ridout, F
Curator—R. S. Duncan, Esq
Council—Joseph Pope, C.M.
L. H. Graham, Dr. A. D. Watson
The retiring President, Dr.
tion for the past four years, has
energy to his duties. His final
progress of astronomy during t
The publication of the
continued, and judging from
ceived from astronomers and

Sept. 23.—"A Trip from Bella Coola to the Interior," by Frank Kermode.
Oct. 7.—"The Sea Cucumber, 'The Holothuria,'" by Frank Sylvester
" 21.—"Indian Decorative Art," by Dr. Newcombe.
Nov. 4.—"Indian Decorative Art" (continued), by Dr. Newcombe.
" 18.—"Old Time Reminiscences of British Columbia," by Frank Sylvester.
Dec. 16.—"Old Time Reminiscences of British Columbia," by Frank Sylvester.
" 30.—"On Orchids and their Propagation," by E. A. Wallace.

1908.

Jan. 13.—"West Coast of Vancouver Island Narratives," by the Rev. Father Brabant.
" 27.—"Africa and the Africans," by Dr. Todd.
Feb. 10.—"The Infusorial Earths of British Columbia," by Oregon Hastings.
" 24.—"The Founding of Fort Yukon in 1848," by Mr. Murray. Paper given by J. Forman.
Mar. 23.—"The Explorations of A. C. Anderson for the Hudson Bay Co. in 1846," given by his son, J. R. Anderson.

Many of these papers were illustrated by lantern slides.

XIV.—From *The Natural History Society of Montreal,* through PROF. NEVIL NORTON EVANS, M.Sc., F.C.S.

In last year's report to the Royal Society of Canada, it was stated that the Natural History Society of Montreal, having sold its old building, had been obliged to store its library, collections and other effects, and get along as best it could in the two old dwelling houses on its new lot on Drummond Street, but that it was hoped that its new building would very soon be under course of construction. Owing to the recent financial depression, however, no work has yet been done on the new structure, and the society is still in the same uncomfortable situation with respect to an abiding place as it was a year ago. But the funds necessary for the construction of the basement and ground floor of its new home, with temporary roof and permanent heating system, etc., are now in hand, and the building committee has been instructed to start operations as soon as possible: and it is confidently hoped that the additional funds for the completion of the building will be forthcoming in time to prevent any pause in the work.

Meanwhile, the society has been by no means idle. The regular monthly meetings were held as usual during the winter at the temporary quarters of the society, the attendance and interest being very gratifying. The following papers were presented:—

Oct. 26.—"The New Permanent Biological Station at St. Andrews, N.B.," by Dr. Penhallow.

Nov. 25.—"The Collection and Rearing of Dragon-flies at the Marine Biological Station, Georgian Bay," by Dr. E. M. Walker.

Jan. 27.—"Some of the Latest Results in Plant Breeding," by Prof. Carrie M. Derick.

Feb. 24.—"Quebec and the Rock Slides from Cape Diamond," by J. S. Buchan, K.C.

Mar. 31.—"History of the Natural History Society of Montreal, with a Description of the Proposed New Building," by Dr. Penhallow.

April 27.—"The New North West of Canada," by Fred G. Lawrence, F.R.G.S.

In accordance with its usual custom, the society arranged for six Somerville Lectures and six Saturday Half-hour Talks to Children; and in addition a joint committee of the Natural History Society and the Local Council of Women planned thirty-four free illustrated lectures, delivered at various points in the city and suburbs, in the carrying out of which they were assisted by The Arts and Handicrafts Guild, The Cooking School of the Y.W.C.A., Ecole Ménagère, The Pure Milk League, The Tuberculosis League, The Victorian Order of Nurses. At all these lectures and demonstrations the attendance was very satisfactory and the interest elicited of such a nature as to thoroughly justify the society in continuing the work next year. The programme of these lectures is here appended.

Somerville Lectures, delivered in the Lecture Hall of the Y.M.C.A., Dominion Square:

"Coal Mining," by J. Bonsall Porter, Ph.D.

"Education for the Improvement of Rural Conditions," by J. W. Robertson, LL.D., C.M.G.

"A Botanist's Rambles in Spain," by Theo. L. Wardleworth, F.L.S.

"British Columbia and its Possibilities," by Harry Bragg, Esq.

"Forestry," by Dr. B. E. Fernow, LL.D. (Dean of the Forestry School, University of Toronto).

"The Fiords of British Columbia," by J. Austen Bancroft, M.A.

Saturday Half-hour Talks to Children, delivered in the Lecture Hall of St. Andrew's Church, Beaver Hall Hill:

"How Plants get their Food," by Prof. Carrie M. Derick, M.A.

"Just a Piece of Coal," by J. Austen Bancroft, M.A.

"Air," by J. S. Buchan, K.C.

Ecole Ménagère (in French). Montcalm School, DeMontigny Street. Two lectures.

"A Well Balanced Dinner," by Miss McLennan (Y.W.C.A.), in the Chalmers Church, cor. St. Lawrence and Prince Arthur Streets.

Tuberculosis.

"Tuberculosis," by Dr. C. N. Valin (in French), in Montcalm School, DeMontigny Street; Dr. J. G. Adami, in Victoria Hall, Westmount; Dr. J. G. Adami, in Old Brewery Mission, Craig Street; Dr. H. Campbell Howard, at St. Lambert; Dr. I. H. Laidley, in St. Mary's Church, cor. Prefontaine and Rouville Streets.

Sanitation.

"Importance of Medical Examination of Children in School," by Dr. J. E. Laberge (in French), in Montcalm School, DeMontigny Street. By Dr. T. A. Starkey, Old Brewery Mission, Craig Street; by Dr. J. E. Laberge, in St. George's School House, 15 Stanley Street; by Dr. T. A. Starkey, Victoria Hall, Westmount.

Victorian Order—Nursing.

Grace Church, Point St. Charles; Victoria Hall, Westmount; "Care of Sick at Home (in French), by Dr. Eug. St. Jacques, in Montcalm School, DeMontigny Street; Taylor Church, Papineau Avenue; Chalmers Church, cor. St. Lawrence and Prince Arthur Streets; St. George's School House, 15 Stanley Street.

The annual field day was held on Saturday, 8th June, at Isle aux Noix, in the Richelieu River, near St. Johns, and was a pronounced uccess.

The officers of the society are:

Patron—His Excellency the Governor-General of Canada.

Hon. President—Lord Strathcona and Mount Royal.

esident—D. P. Penhallow, D.Sc., F.R.S.C.

. Vice-President—Hon. J. K. Ward.

Presidents—Frank D. Adams, Ph.D., F.R.S.C.; J. S. Buchan,

.; Rev. R. Campbell, M.A., D.D.; Carrie M. Derick, M.A.;

ide, M.A., Sc.D.; Wesley Mills, M.A., M.D.; C. S. J.

r J. W. Stephens, M.L.A.; Miss Van Horne.

ling Secretary—Prof. N. N. Evans.

nding Secretary—F. W. Richards.

—Jas. W. Pyke.

. E. Norris.

Members of Council—John Harper, chairman; J. A. U. Beaudry, C.E.; Prof. J. Bemrose, F.I.C., F.C.S.; Henry Birks, Joseph Fortier, A. Holden, E. P. Lachapelle, M.D.; James Morgan, Alex. Robertson, B.A.

Superintendent—Alfred Griffin.

XV.—From *The Niagara Historical Society*, through Miss Janet Carnochan.

Since the formation of our society in December, 1895, this has been, perhaps, the most eventful year of its existence, since this year the object of our ambition and for which we worked so continuously was obtained, namely, the obtaining of a handsome, commodious and safe building to contain our valuable collection, which building was formally opened 4th June, 1907.

In many other respects our progress has been marked, as twenty-five members have been added to our numbers, making nearly one hundred and fifty, but as only one-fourth of these reside in the town, the work falls on a few. Two pamphlets have been printed, besides the annual report; over eight hundred of our publications have been distributed to the members, contributors to the building fund, historical societies and others, besides this a larger number sold than in any previous year, reaching the amount of over thirty dollars.

The opening of the building was the occasion of a large number of articles being presented, the collection now numbering about four thousand. Regular monthly meetings were held from October to April, besides several special meetings. The papers read were:

"Old Pensioners of Niagara," by Miss Kate Creed.

"Boat-building in Niagara, 1837-1840," by Miss Augusta G. Gilkison.

"Reminiscences of Queenston Heights," by Miss Joanna G. Wood.

"Resemblances and Contrasts, Kingston and Niagara," by Miss Carnochan.

"Origin of some Words," by Rev. P. J. Bench.

"Reminiscences of European Travel," by Miss Joanna G. Wood.

The first publication of the year was "Sir Isaac Brock," first read before the York Pioneers, and "Count de Puisaye," reprinted by permission of the Ontario Historical Society, both by Miss Carnochan; the second was the report of the opening of Memorial Hall, 4th June, with the addresses given, full particulars of expenditure and contributions to the building fund, description of the building and contents, an account of the steps taken during three years, what, in short, might be called the evolution of our historical building.

The edition of several of our publications is exhausted, and these we shall try to republish, there having been many requests for them. We exchange with thirty-five societies and are thus, besides other books presented, obtaining a valuable historical library. We have had the usual grant for printing purposes from the Provincial Government and the County of Lincoln. We also have on hand several manuscripts for publication.

The year has brought to us, we are thankful to acknowledge, the fulfilment of our desires as regards a building, an event that was looked upon as chimerical but is now an accomplished fact. A few of the steps taken may be enumerated. On 17th September, 1903, a public meeting was held, at which it was determined to procure a building to be called Memorial Hall, and we first contributed ourselves, wrote to distant Niagarians, then asked help from the Provincial and Dominion Governments, county and town councils. Plans and specifications were decided on, the building to be of red brick with buff trimmings, 70 feet by 30, with gallery; the cost, $4,000, but with extra expenses, cases, furnishing, the amount has reached $5,000. Besides the $4,650 contributed, the site given by the President, and other contributions in kind, the outlay has reached $5,200. The only debt is $275, and this, it is hoped, will soon be wiped out. The first sod was turned in April, 1906, and the building was finished all but the portico in October, 1906, and in February, 1907, when cases had been made we moved in, much assistance being given by Mrs. Thompson, the acting secretary of the Ontario Historical Society, who has had much experience in Loan Exhibits. Many new cases had been procured and the articles could thus be arranged in groups which had not before been possible in the crowded condition of our room. The divisions now are: Flags, military accoutrements, portraits and pictures, Niagara printing, woman's work and wear, household articles, China, Indian relics, furniture, newspapers and pamphlets, rare books, coins, scrap books containing letters, documents, autographs, etc.

Five hundred invitations were sent out and many kind letters of congratulation received. We were honoured by the presence of the Lieutenant-Governor, Sir Mortimer Clark, who formally declared the building open, after making a congratulatory speech. Addresses were given by C. C. James, F.R.S.C., Dr. Colquhoun, Dr. Bain, Col. Cruikshank, F.R.S.C., and others. Although rain somewhat marred the day there was a large attendance. A committee of ladies provided bounteous refreshments and the opening day proved a great success.

A handsome visitors' book was presented to us, and in this new register over 1,300 names have been entered since 4th June. Among these were many groups, High School pupils from Buffalo, Literary Club from St. Catharines, [illegible] Society, [illegible] Yacht party from Chicago, Military from the Camp, Lads from Students' Volunteer Movement, school children, summer visitors, etc. We feel that the collection will prove of instructive educative value, especially to the young, and if such is the case we shall feel amply rewarded by the thought that thus patriotic feelings are aroused and intensified, and the hope that others may take for their's our motto, "The love of country guides."

President—Miss Carnochan.

Vice-President—Rev. J. C. Garrett.

Secretary—Alfred Ball.

Treasurer—Mrs. S. D. Manning.

Curator and Editor—Miss Carnochan.

Committee—Mrs. T. F. Best, W. R. McClelland, W. J. Wright, M.A., F. J. Rowland, Rev. P. J. Bench.

Hon. Vice-Presidents—Mrs. Roe, Mrs. H. Clement, C. A. F. Ball, H. Paffard.

Life Members—T. Kennard Thomson, Mrs. J. G. Wilson.

Honorary Members—Rev. Canon Bull, Lt.-Col. Cruikshank, F.R.S.C Sir Jas. LeMoine, John Ross Robertson, Hon. Wm. Gibson, Jas. Wilson C.E., David Boyle, Major Hiscott, E. A. Lancaster, M.P., Dr. Jessup M.P.P., C. C. James, F.R.S.C., Newton J. Ker, C.E.

XVI.—From *The Nova Scotia Historical Society*, through the HONOURABLE L. G. POWER.

The Nova Scotia Historical Society begs to present the following report of its proceedings during the past year.

Meetings were held from November, 1907, to April, 1908.

At the annual meeting, held on 11th February, 1908, officers for the year were elected as follows:—

President—Professor Archibald MacMechan, Ph.D.

Vice-Presidents—Hon. Mr. Justice Longley, Hon. L. G. Power, and Ven. Archdeacon Armitage.

Corresponding Secretary—Harry Piers.

Recording Secretary—R. J. Wilson, M.A.

Other Members of Council—James S. Macdonald, Archibald Frame, A. H. Buckley, and G. W. T. Irving.

Auditors—W. L. Brown and M. A. B. Smith, M.D.

Library Commissioners—Professor MacMechan, Rev. John Forrest, D.D., A. H. MacKay, LL.D., F.R.S.C., and James S. Macdonald.

During the session the following papers were read:—

1907.

Nov. 12.—"The Existing Historic Relics of the Town of Lunenburg, N.S.," by Miss Agnes Creighton.

Dec. 10.—"Sir George Prevost, Lieut.-Governor of Nova Scotia, 1808-1811," by James S. Macdonald.

1908.

Jan. 14.—"The Militia of Nova Scotia, 1749 to 1830," by Major J. Plimsoll Edwards.

Feb. 25.—"The Junius of Nova Scotia (John Young)," by John E. Irwin.

Mar. 24.—"Some Letters written to the Hon. S. G. W. Archibald, with comments thereon," by Mr. Justice Patterson.

April 24.—"Customs of the Micmac Indians," by H. W. Hewitt.

During the year the very valuable library of works on British North American history, bequeathed to the society by the late Thomas Beamish Akins, D.C.L., Record Commissioner of Nova Scotia, was transferred to the society by the trustees, and it has been arranged on shelves and is now in process of being catalogued.

An exhaustive index to volume viii of the Collections of the Society (Dr. Akins' "History of Halifax") has been published during the year, and volume xiii of the collections will appear immediately.

Efforts are being made by the society to have set apart, as public property, the site of the old town and fortress of Louisbourg, Cape Breton, perhaps the most interesting historic site in Nova Scotia.

XVII.—From *The New Brunswick Natural History Society*, through W. J. Wilson.

During the year the membership has been increased by the addition of eleven life, one corresponding, eighty-five ordinary, one hundred and forty-five associate, and forty-three junior members, a total increase for the year of two hundred and eighty.

The following shows the numbers, classes and total enrolled membership:

Honorary 8, Life 20, Corresponding 25, Ordinary 151, Associate 284, Junior 47; total 535.

The treasurer reports the total receipts at $3,008.79, of which $350 was contributed by the ladies association. The balance on hand is $955.00.

une conférence et un concert. M. Auguste Lemieux, le conférencier, avait pris pour sujet: Les Batailles des plaines d'Abraham et de Sainte-Foye. Cette soirée était sous le haut patronage et la présidence immédiate de son Excellence le Gouverneur-Général. Toute la maison du Gouverneur assistait, ainsi que Sir Wilfrid et Lady Laurier, et nombre de personnalités des plus en vue à Ottawa. L'Institut Canadien a profité de cette soirée pour offrir, dans une adresse au représentant de Sa Majesté Edouard VII, l'hommage de son plus respecteux dévouement et de sa fidélité la plus parfaite.

La clôture de nos conférences a été marquée par la représentation d'une comédie de votre humble serviteur, intitulée: "Le Conscrit Impérial." Il ne m'appartient pas naturellement de parler de cette comédie, mais si j'en crois le succès obtenu, je ferai observer qu'on devrait jouer plus souvent des pièces de théâtre canadiennes à Ottawa afin de propager chez nos compatriotes le goût de ce genre de littérature si propre à instruire le peuple tout en le divertissant.

L'institut a enrichi sa bibliothèque de nombreux volumes et sa salle de plusieurs revues et journaux tant anglais que français. Nous avons sous presse la conférence donnée par M. le Sénateur Poirier, membre de la Société Royale du Canada, sur l'histoire de l'Institut Canadien. Nous serons heureux d'offrir des exemplaires de cette conférence à toutes les sociétés sœurs et à tous les intellectuels qui s'intéressent à l'essor des lettres canadiennes.

Les officiers actuels de l'Institut Canadien-Français d'Ottawa sont:—

Président—M. Rodolphe Girard.

Vice-président—M. Thomas Richard.

Secrétaire Archiviste—M. Moïse Lalonde.

Secrétaire-correspondant—M. G. Boivin.

Trésorier—M. J.-E. Marion.

Bibliothécaire—M. F. Audet.

Directeur des Cours—M. H. Beaulieu.

Directeur Musical—M. A. Lafontaine.

Directeur du Musée—M. F.-R.-E. Campeau.

Membres du Conseil Exécutif—MM. A. Cantin, Jos. Motard, U. Vézina.

En terminant, messieurs de la Société Royale du Canada, permettez-moi au nom de l'Institut Canadien dont je suis l'humble président, de vous présenter avec l'hommage de ma plus vive admiration pour tout le bien que vous accomplissez dans le champ des lettres, des sciences et des arts, mes remerciements les plus sincères pour l'honneur que vous nous faites en nous demandant ce rapport, et pour l'encouragement que vous voulez bien nous accorder.

XIX.—From *The New Brunswick Historical Society*, through MR. S. D. SCOTT.

This society has during the past year continued its studies of local history, and contributions have been read at the monthly meetings, throughout the winter.

The last number of publications issued includes the third paper of the series of historical geographical documents edited by William F. Ganong, Ph.D.; a paper by Rev. W. C. Gaynor "In the Days of the Pioneers"; an account of St. John's first club by Lieut.-Col. Armstrong, and a sketch of the trials and tribulations of Benjamin Marston, loyalist, by Rev. Dr. W. O. Raymond, a fellow of your society.

The president of the society is Mr. C. Ward, who has served as secretary almost from the beginning of its history.

The New Brunswick Historical Society finds some satisfaction in the reflection that it was the pioneer of the series of Tercentenary celebrations which culminate in this year's festival at Quebec.

The Champlain statue, for which the Dominion Government made a grant in response to our society's application, and to which the people of New Brunswick subscribed the remainder of the cost, will very shortly be erected.

It is expected that the beginning of Anglo-Saxon occupation of the territory on the River St. John, by the erection of Fort Frederick in 1758, will be recognized by some form of celebration in September of this year. A committee of the society is now making the necessary arrangements.

A copy of the last issue of the society's collections is submitted.

XX.—From *The New Brunswick Loyalists' Society*, through MR. S. D. SCOTT.

This society was organized in 1889, and the constitution adopted at a meeting held on the 13th of May in that year.

The objects of the society are to perpetuate the memory and principles of the loyalists of the American Revolution and to bring their descendants into closer association with one another.

During the past year, meetings of the society have been held as usual.

On the Sunday nearest to the 18th of May, the anniversary fixed by the loyalists themselves on which to celebrate their landing at St. John, the usual anniversary service was held at Trinity Church, St. John, the church of the loyalists, the occasion being rendered more than usually interesting and impressive by the presence of Rev. Samuel N. Watson, a great grandson of Rev. Samuel Cook, D.D., a loyalist, and

XXII.—*Report of the Botanical Club of Canada for 1906-7 and 1907-8.*

By the General Secretary, A. H. MacKay, LL.D.

During the summer of 1907 I was in Europe at the time the report for 1906 should have been presented. I am therefore now presenting the reports of the last two years together.

Through the kindness of the Director of the Meteorological Service of the Dominion at Toronto, a large number of observations made on the smaller group of phenomena described in my previous report had been sent to me for the report of 1906, and are marked by an asterisk in the list which follows.

The corresponding list for 1907 had not been received at the date of compilation, due probably to the non-publication of the observations of the previous year, and my inability to ask in time for any such aid.[1] My report under the circumstances shall be as brief as possible, the simple presentation of phenological observations which I find at hand.

Nova Scotia Phenochrons, 1906.

The first table contains the summary of about three hundred schedules of observations made in as many of the public schools of the province by the pupils attending school, from a radius of about two miles around each school, the observation being proven and recorded by the teacher, who transmits the schedule with the regular school return to the inspector. The superintendent sends the schedules from specified regions of the province to the following staff of phenologists, who are themselves also in the educational service. Their reports can be found *in extenso* in the April Journal of Education for Nova Scotia, 1907, from pages 79 to 91. They also compile schedules showing the average dates (phenochrons) of the various phenomena for the coast belt, the low inland belt and the high inland belt of each special region of the province. These schedules were compiled in their turn into the ten regions of the province shown on the said first table by Miss Jean Lindsay, B.A. The said Nova Scotian staff is as follows:

Region I. (Yarmouth and Digby Counties), A. W. Horner Principal of Seminary School, Yarmouth.

Region II. (Shelburne County), C. Stanley Bruce, Shelburn Academy.

Region III. (Queens County), Minnie C. Hewitt, Scien Teacher, Lunenburg Academy.

[1] [illegible] been received and will be found appended to the Rep

Region II. (Lunenburg County), Burgess McKittrick, B.A., Principal, Lunenburg Academy.

Region III. (Kings and Annapolis Counties), Ernest Robinson, County Academy, Amherst.

Region IV. (Hants and South Colchester), W. J. Shields, Principal, Hantsport High School.

Region V. (Halifax County), G. R. Marshall, B.A., Principal, Compton Avenue School, Halifax.

Region V. (Guysboro County), J. B. McCarthy, B.A., B.Sc., Science Master, Halifax Academy.

Region VI. A and B. (Cobequid Slope), J. E. Barteaux, M.A., Science Master, Truro Academy.

Region VII. (Cumberland and North Colchester), E. J. Lay, Principal, Amherst Academy.

Region VII. (Pictou and Antigonish Counties), C. L. Moore, M.A., Science Master, Pictou Academy.

Regions VIII, IX and X. (Cape Breton Island), L. A. De Wolfe, M.Sc., Truro Academy.

Nova Scotia Phenochrons, 1907.

The detailed reports of the staff of phenologists can be found in the April Journal of Education for Nova Scotia, 1908, from pages 98 to 119. This staff differed from that of the previous year, as shown above, in the following particulars:

Region IV. (Hants and South Colchester), O. Von B. Cossitt, Principal of High School, Maitland, who succeeded the late lamented W. J. Shields, Principal of Hantsport High School.

Region V. (Halifax and Guysboro Counties), G. R. Bancroft, B.A., Science Master, Halifax County Academy.

Region VII. (Pictou and Antigonish Counties), W. P. Fraser, B.A., Science Master, Pictou Academy.

The compilation of the table for 1907 is the work of Mr. James McG. Stewart.

General Canadian Phenochrons, 1906.

The following table gives the dates of the first observance only of each phenomenon, except in the case of Nova Scotia, where the average dates of the averages of each of the ten regions is given. The of the ten regions will be averaged to find the provincial phenochron for each phenomenon on the list. This will be done by the compiler-in-chief.

There is a convenience in averaging the dates of ten stations, which accounts for the ten columns for stations in the form within. When a few dates are not given, it may be fair to enter in the blanks the dates from a similar and neighbouring station which is not otherwise utilized for the sheet. Great care should be taken that such observations taken from a schedule not summarized, should be what might have been observed at the station indicated in the heading, and to indicate such a transference the date should be surrounded by a circle with the pen, which would always mean that the observation was not made in the station heading the column, but in a neighbouring one, and was taken from a supernumerary schedule.

Thunder-Storms.

These dates will be entered in their respective columns and opposite the month indicated. They will not be averaged, of course. The number of observation schedules represented in any "region" or general sheet under this head should be noted somewhere on the top margin of the page.

Accuracy.

Care must be exercised in selecting schedules, the observations of which appear to have been carefully made, neglecting any which give reason for doubt, when selecting for summation on the form within. Great care must also be exercised in copying the figures and entering them, so that no slip may occur. Every entry should be checked. One slip may spoil the effect of all the accurate numbers entering into the summation. In like manner great care has to be taken in adding and averaging the figures, and for this purpose every sum should be done twice (once in reverse order), so as to give absolute confidence in the accuracy of the work.

Remarks.

The compiler filling one of these blanks should keep one copy for himself while sending the other to the compiler-in-chief.

The set of stations on the right, under "when becoming common," must be *exactly* the same as on the left, under "when first seen." The compiler can enter explanatory remarks in the blank below, and should sign each sheet as a guarantee of its correctness. These sheets will be bound into a volume for each year.

OBJECT AND CONSTITUTION OF THE CLUB.

The Botanical Club of Canada was organized by a committee of section four of the Royal Society of Canada, at its meeting in Montreal, May 29th, 1891.

The object is to promote, by concerted local efforts and otherwise, the exploration of the flora of every portion of British America, to publish complete lists of the same in local papers as the work goes on, to have these lists collected and carefully examined in order to arrive at a correct knowledge of the precise character of our flora and its geographieal distribution, and to carry on systematically seasonal observations on botanical phenomena.

The intention is to stimulate, with the least possible paraphernalia of constitution or rules, increased activity among botanists in each locality, to create a corps of collecting botanists wherever there may be few or none at present, to encourage the formation of field clubs, to publish lists of local flora in the local press, to conduct from year to year exact phenological observations, etc.; for which purposes the secretaries for the provinces may appoint secretaries for counties or districts, who will be expected, in like manner, to transmit the same impetus to as many as possible in their more local spheres of action.

Members and secretaries, while carrying out plans of operation which they may find to be promising of success in their particular districts, will report as frequently as convenient to the officer under whom they may be immediately acting.

Before the end of January, at the latest, reports of the work done within the various provinces during the year ended December the 31st previous, should be made by the secretaries for the provinces to the general secretary, from which the annual report to the Royal Society shall be principally compiled. By the first of January, therefore, the annual reports of county secretaries and members should be sent in to the secretaries of the province.

To cover the expenses of official printing and postage, a nominal fee of twenty-five cents per annum is expected for membership (or one dollar for five years in advance, or five dollars for life membership). Secretaries for the provinces, when remitting the amount of fees from members to the general treasurer, are authorized to deduct the necessary expenses for provincial office work, transmitting vouchers for the same with the balance.

The names of those reporting any kind of valuable botanical work during the year will be published in the list of active members, even should the payment of fees be forgotten. All payments are

[illegible]

[illegible]

[illegible]

FLOWERING AND OTHER PHENOCHRONS FOR EACH REGION OF THE PROVINCE OF NOVA SCOTIA, COMPILED FROM 300 PUBLIC SCHOOL OBSERVATION SCHEDULES.

Year ended July, 1906.

Day of the year corresponding to the last day of each month.

Jan. 31, Feb. 59, March 90, April 120, May 151, June 181, July 212, Aug. 243, Sept. 273, Oct. 304, Nov. 334, Dec. 365

For Leap Year add one to each except January.

When First Seen. (Regions.)

Year ended July, 1906.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.
1 Alnus incana, Wild	110.2	106.8	109.7	108.8	119.5	118.3	112.9	119.3	112.5	118.	113.6
2 Populus tremuloides	.....	114.9	100.	119.5	122.2	121.2	118.5	128.3	119.	126.	118.8
3 Epigea repens, L.	100.1	101.4	104.8	107.6	106.9	114.3	116.	116.8	118.	120.	110.6
4 Equisetum arvense	119.6	128.1	129.5	126.6	136.	132.1	126.6	129.9	123.	133.5	128.5
5 Sanguinaria Canadensis	.....	.....	.....	121.9	128.5	137.2	127.7	136.	.....	130.	130.2
6 Viola Blanda	120.3	120.5	124.1	123.5	124.5	125.	126.2	134.3	129.5	126.7	125.5
7 Viola palmata, *cucullata*	123.5	124.8	126.6	125.4	128.2	128.4	128.9	138.5	130.	132.5	128.7
8 Hepatica triloba, etc.	.....	.....	112.	122.	.....	129.5	119.5	143.5	.....	.....	120.7
9 Acer rubrum	122.8	126.7	125.6	124.8	131.2	130.5	128.9	136.8	133.5	134.5	129.5
10 Fragaria Virginiana	122.5	123.8	125.1	124.3	129.2	127.8	129.3	139.	133.	129.7	128.4
11 " " fruit ripe	159.6	160.3	162.6	164.4	170.1	167.6	170.5	175.7	177.	176.7	168.4
12 Taraxacum officinale	123.4	125.	128.7	126.4	131.9	132.5	132.2	139.7	135.	137.3	131.2

When Becoming Common. (Regions.)

Year ended July, 1906.	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
1 Alnus incana, Wild	120.9	119.9	114.1	118.5	119.8	126.2	125.5	118.3	124.3	117.	125.
2 Populus tremuloides	124.3	.....	121.	110.	121.6	128.1	128.2	123.8	130.4	126.	130.
3 Epigea repens, L.	120.2	111.2	113.3	116.2	116.8	119.	124.6	123.9	125.5	123.7	128.
4 Equisetum arvense	133.8	124.9	132.5	134.5	130.6	145.5	137.5	131.6	134.6	127.	139.7
5 Sanguinaria Canadensis	134.	.....	.....	.....	127.9	131.5	140.	132.4	139.	.....	133.
6 Viola Blanda	131.7	126.9	126.9	131.7	130.4	132.2	131.4	132.8	140.	132.3	132.5
7 Viola palmata, *cucullata*	134.9	130.2	130.5	132.9	131.7	136.7	134.1	135.5	144.5	135.7	137.5
8 Hepatica triloba, etc.	132.5	.....	.....	119.	129.	.....	137.	129.	148.5	.....	.....
9 Acer rubrum	135.7	132.6	131.7	132.	130.	137.9	137.	135.	142.3	138.5	140.5
10 Fragaria Virginiana	137.1	132.	131.9	133.6	133.4	138.7	136.6	139.2	145.3	138.3	142.5
11 " " fruit ripe	177.2	169.	171.4	173.7	175.1	178.5	177.1	178.1	181.7	187.	180.
12 Taraxacum officinale	138.	131.4	132.2	133.7	134.9	140.1	138.2	139.2	147.4	140.	142.7

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

When First Seen. Regions.											Year ended July, 1906.	When Becoming Common. Regions.										
1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.	Day of the year corresponding to the last day of each month. Jan. 31, Feb. 59, March 90, April 120, May 151, June 181, July 212, Aug. 243, Sept. 273, Oct. 304, Nov. 334, Dec. 365 For Leap Year add one to each except January.	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
144.3	145.2	144.9	148.1	152.4	149.6	153.1	159.2	159.7	154.3	151.1	27 Cornus Canadensis	157.6	150.6	151.7	152.9	155.6	160.2	157.	160.8	164.5	161.7	160.7
.....	214.	.....	.....	206.	202.5	191.5	228.	207.	.....	208.1	28 " " fruit ripe	216.1	.....	.....	.....	.....	212.	211.	225.	220.5	212.	.....
144.6	147.5	140.5	148.7	151.5	154.9	152.6	160.7	161.7	152.	151.5	29 Trientalis Americana	158.3	153.8	153.1	152.1	156.	160.2	163.	159.5	165.2	166.	154.
148.5	152.7	154.1	155.4	159.2	160.7	159.3	156.6	157.	143.	154.6	30 Clintonia borealis	160.4	154.	157.5	159.3	162.	166.1	167.5	165.3	162.1	163.	147.
154.	157.2	157.	158.	159.6	159.6	162.8	168.	165.	.....	160.1	31 Calla palustris	167.1	160.	162.9	.....	163.7	167.2	169.2	166.2	172.5	175.	.....
154.4	154.5	155.4	160.6	164.5	165.8	160.8	171.1	162.	177.	162.6	32 Cypripedium acaule	166.5	159.6	160.5	162.	166.7	170.7	169.1	167.5	175.6	167.	.....
157.6	156.3	156.1	158.5	164.6	161.2	164.7	171.9	167.7	170.3	162.9	33 Sisyrinchium angustifolium	168.6	164.1	161.2	162.6	165.9	171.3	168.	170.	176.8	171.2	174.7
161.5	159.	161.4	166.4	170.	171.	170.9	175.8	176.3	175.	168.7	34 Linnæa borealis	173.5	167.7	165.7	167.9	173.8	175.9	176.6	174.1	177.7	177.	179.
151.7	151.8	150.2	156.1	159.8	151.8	159.7	168.	162.	164.7	157.6	35 Kalmia glauca	163.7	160.	157.9	155.5	162.3	167.9	155.4	167.8	174.1	168.3	168.3
168.9	167.2	163.	170.1	161.9	163.8	168.5	179.3	179.	176.	169.8	36 Kalmia angustifolia	175.3	177.5	172.9	170.	173.9	168.3	170.3	173.1	184.	184.	179.
165.7	160.9	160.6	164.5	169.2	150.	162.7	172.9	.....	169.	163.9	37 Cratægus oxyacantha	169.8	172.8	166.6	169.3	168.7	175.6	156.	168.7	176.5	.....	174.
165.9	158.7	156.1	158.9	167.	162.5	162.7	174.2	167.	161.5	163.4	38 Cratægus coccinea, etc.	168.7	170.6	166.5	162.3	164.6	173.2	168.5	168.3	175.5	171.	166.5
163.5	159.7	164.2	166.1	170.3	169.7	170.7	177.9	180.7	175.	169.8	39 Iris versicolor	174.7	169.1	165.5	171.3	171.	175.2	173.7	174.6	180.8	187.	179.
162.1	161.6	162.	163.9	169.6	166.8	168.2	178.8	174.7	168.	167.6	40 Chrysanthemum Leucanthemum	173.6	168.	167.8	167.3	171.2	176.5	173.4	174.1	180.8	181.	175.5

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

YEAR ENDED JULY, 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	334
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen. Regions.

	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.
41 Nuphar advena	164.5	164.3	165.5	166.5	165.9	170.3	165.3	172.4	178.	171.	168.4
42 Rubus strigosus	159.	160.6	157.1	156.3	161.7	161.8	164.5	169.7	177.	179.	164.7
43 " " fruit ripe	206.	199.5	202.	.....	208.	204.	197.5	223.3	218.	.....	207.3
44 Rhinanthus Crista-galli	170.6	167.2	172.	173.2	177.2	176.	175.4	180.7	183.	.....	175.
45 Rubus villosus	165.8	164.2	167.4	165.9	166.4	171.4	175.8	173.	180.	171.	170.1
46 " " fruit ripe	221.5	230.6	225.	237.	234.7	244.	234.7	241.3	238.	.....	234.1
47 Sarracenia purpurea	164.	166.9	.....	.....	174.2	172.	163.7	172.7	177.	175.	170.7
48 Brunella vulgaris	173.8	168.7	170.7	178.	182.	174.	174.8	185.5	198.	.....	178.4
49 Rosa lucida	172.5	174.3	174.1	174.6	176.5	173.5	174.9	201.	197.	.....	179.8
50 Leontodon autumnale	165.9	163.3	165.4	167.9	171.7	169.2	172.1	175.7	179.	170.	170.
51 Linaria vulgaris	.....	174.3	.....	182.	172.8	171.2	147.5	.....	.....	172.	170.
52 Trees appear green	134.8	131.1	131.2	133.4	137.	134.8	137.4	148.3	146.3	150.	138.4
53 Ribes rubrum (cultivated)	137.	137.6	139.9	139.4	146.9	148.8	147.4	154.4	152.	151.	145.4
54 " " (fruit ripe)	176.5	.....	198.	182.	.....	196.	188.	199.	206.	.....	192.2

When Becoming Common. Regions.

	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and. Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria.)	10. Inverness Slope to Gulf.
41 Nuphar advena	172.9	165.6	170.3	170.5	171.	174.4	171.6	169.9	175.5	184.	176.
42 Rubus strigosus	169.8	168.4	167.	165.8	163.4	169.8	172.5	164.7	173.5	183.	.....
43 " " fruit ripe	218.1	212.	213.5	212.	.....	222.7	219.	221.	222.7	222.	.....
44 Rhinanthus Crista-galli	180.1	174.7	172.7	177.	176.9	185.8	179.	181.	185.5	188.	.....
45 Rubus villosus	176.8	174.2	171.8	173.4	172.9	174.	176.8	179.4	182.5	186.	177.
46 " " fruit ripe	243.2	241.	235.	234.5	245.	243.5	249.5	242.7	252.8	245.	.....
47 Sarracenia purpurea	177.	171.5	172.4	182.	.....	177.5	179.	170.	179.3	183.	178.
48 Brunella vulgaris	182.4	176.1	174.3	170.	181.	.....	180.	182.2	196.	200.	.....
49 Rosa lucida	187.2	186.5	180.9	177.5	179.5	190.2	177.3	184.3	206.	202.	.....
50 Leontodon autumnale	175.2	168.8	168.2	173.5	174.3	178.2	175.8	175.9	181.7	183.	173.
51 Linaria vulgaris	181.2	223.	175.	.....	187.	176.2	175.9	154.5	.....	.....	177.
52 Trees appear green	148.2	142.1	143.5	141.5	145.7	152.3	148.1	148.6	154.6	154.3	151.
53 Ribes rubrum (cultivated)	151.5	147.5	143.1	146.3	146.1	154.1	154.2	153.3	160.1	155.	155.5
54 " " (fruit ripe)	202.5	194.	207.	204.	.....	.....	201.5	189.	210.	212.	.....

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

Year ended July, 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen. Regions.

Year ended July, 1906.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.
55 R. nigrum (cultivated)	138.2	141.6	145.4	141.9	149.8	150.6	149.1	157.4	157.	153.5	148.4
56 " fruit ripe	.....	227.	.....	.....	.....	.....	204.	211.	212.	.....	213.5
57 Prunus Cerasus	140.6	140.3	143.4	144.1	153.4	152.6	155.1	161.1	.....	.....	148.8
58 " " fruit ripe	.....	.....	201.	210.	.....	206.5	211.	200.	.....	.....	205.7
59 Prunus domestica	142.9	143.7	145.2	148.9	153.4	150.5	153.9	165.6	160.5	163.	152.8
60 Pyrus Malus	144.4	146.5	147.	150.4	157.7	154.1	156.4	165.9	162.7	162.3	154.7
61 Syringa vulgaris	157.7	157.1	156.5	159.8	167.5	164.1	164.5	175.5	169.	174.	164.6
62 Trifolium repens	157.	156.6	159.	159.3	165.6	163.5	163.4	172.8	174.5	174.5	164.6
63 Trifolium pratense	148.3	152.9	154.9	159.7	166.	165.4	165.9	174.2	175.	176.5	163.9
64 Phleum pratense	178.	162.3	173.	174.3	168.4	173.1	169.	199.	198.	.....	177.2
65 Solanum tuberosum	169.6	182.7	175.	193.	198.	191.	185.	198.5	204.	.....	188.5
66 Ploughing (first of season)	108.2	109.9	114.8	128.3	122.	128.3	126.9	122.9	130.	127.2	121.8
67 Sowing " "	124.4	118.6	127.4	134.5	130.9	134.7	134.1	135.9	135.	134.	130.9
68 Potato-planting "	121.	117.3	131.	138.	126.7	137.7	133.4	126.1	133.	128.3	129.2

When Becoming Common. Regions.

Year ended July, 1906.	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
55 R. nigrum (cultivated)	154.4	147.2	146.8	151.7	146.9	156.7	155.4	156.4	163.	161.	158.5
56 " fruit ripe	222.2	.....	236.	.....	.....	.....	235.	208.	217.	215.	.....
57 Prunus Cerasus	155.4	145.7	146.7	148.7	151.4	168.4	156.3	159.9	165.8	.....	.....
58 " " fruit ripe	211.2	.....	.....	.....	214.	.....	211.	206.	214.	.....	.....
59 Prunus domestica	157.8	147.8	150.5	146.3	154.9	160.5	158.7	159.3	168.1	165.	166.7
60 Pyrus Malus	161.4	154.6	153.4	153.7	157.8	163.4	161.	162.7	171.8	169.	166.7
61 Syringa vulgaris	170.	164.6	162.9	158.9	166.1	173.4	169.2	169.8	179.8	176.5	178.5
62 Trifolium repens	171.4	168.9	163.2	164.8	168.5	171.4	171.2	169.2	178.1	179.5	179.5
63 Trifolium pratense	171.3	160.7	161.6	164.8	170.	172.7	172.3	172.9	179.	181.5	178.
64 Phleum pratense	181.4	174.2	171.3	169.5	183.	170.	179.5	178.5	204.	203.	.....
65 Solanum tuberosum	200.5	185.	192.8	.....	.....	208.	202.	.....	207.5	208.	.....
66 Ploughing (first of season)	128.6	118.	119.8	124.8	139.3	131.3	121.	133.5	130.5	136.	132.
67 Sowing " "	139.1	132.8	127.7	139.8	144.6	140.1	.....	140.8	142.2	142.3	141.7
68 Potato-planting "	138.8	128.	127.1	148.1	154.	139.4	.....	141.8	134.	140.3	136.5

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

YEAR ENDED JULY, 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen. Regions.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria.)	10. Inverness Slope to Gulf.	Average Dates.	Phenochron
122.7	120.5	116.3	136.3	140.2	130.4	139.5	131.6	127.7	123.7	130.7	69 Sheep-shearing season
178.6	184.8	190.5	198.6	197.6	202.4	201.5	211	205.	208.	197.8	70 Hay-cutting "
240.3	241.8	235.9	239.1	240	239.2	238.8	260.4	240.	256.5	243.2	71 Grain-cutting "
265.5	260.4	267.8	267.9	266.5	269.1	274.6	279.7	275.	287.3	270.4	72 Potato-digging "
93.2	97.3	94.5	98.8	91.	94.	84.6	94.	108.	...	95.	73a Opening of rivers
96.7	96.3	99	104.5	110.4	106.7	110.7	105.	115.	...	104.8	73b Opening of lakes
102.1	100.3	101.4	101.9	108.3	105.9	019.7	110.4	109.	113.	106.	74a Last snow to whiten ground
112.6	106.0	114.2	109.	124.2	121	124.5	120.8	150.	150.	123.2	74b " to fly in air
131.6	114.2	138.5	141.3	140.7	124.6	142.1	145.9	137.	143.	130.8	75a Last spring frost—hard
159.5	127.2	161.2	167.8	167.1	166.2	165.4	165.8	163.5	168.	161.2	75b " " hoar
116.5	101.	98.5	113.8	110.3	104.1	110.	105.4	87.	114.	106.1	76a Water in streams—high
.	229.5	.	265.5	241	227.	242.6	199.8	231.	....	230.6	76b " " low
266.5	258.5	251.9	248.9	263.2	247.3	260.3	280.6	246.	289.	261.4	77a First autumn frost hoar
277.7	289.4	270.2	291.	282.7	286.2	292.1	301.8	300.	301.	290.1	77b " " hard

When Becoming Common. Regions.

Phenochron	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria.)	10. Inverness Slope to Gulf.
69 Sheep-shearing season	140.6	134.8	138.9	130.7	148.6	147.3	.....	147.5	146.5	136.7	134.7
70 Hay-cutting "	209.4	189.5	193.6	205.	225.	214.2	.....	206.6	222.3	213.	215.
71 Grain-cutting "	249.3	247.2	249.4	243.4	250.7	246.	.....	246.8	266.2	247.	247.
72 Potato-digging "	279.2	272.4	270.8	266.3	278.8	272.2	.....	285.	289.9	279.	298.5
73a Opening of rivers	....	....	....	....	....	....	....	....	....	....	....
73b Opening of lakes	....	....	....	....	....	....	....	....	....	....	....
74a Last snow to whiten ground	....	....	....	....	....	....	....	....	....	....	....
74b " to fly in air	....	....	....	....	....	....	....	....	....	....	....
75a Last spring frost—hard	....	....	....	....	....	....	....	....	....	....	....
75b " " hoar	....	....	....	....	....	....	....	....	....	....	....
76a Water in streams—high	....	....	....	....	....	....	....	....	....	....	....
76b " " low	....	....	....	....	....	....	....	....	....	....	....
77a First autumn frost hoar	....	....	....	....	....	....	....	....	....	....	....
77b " " hard	....	....	....	....	....	....	....	....	....	....	....

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

When First Seen. Regions.											Year ended July, 1906.	When Becoming Common. Regions.										
1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.	Day of the year corresponding to the last day of each month. Jan. 31, Feb. 59, March 90, April 120, May 151, June 181, July 212, Aug. 243, Sept. 273, Oct. 304, Nov. 334, Dec. 365 For Leap Year add one to each except January.	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria.)	10. Inverness Slope to Gulf.
311.6	312.4	311.	302.1	304.7	303.2	308.5	303.7	305.	.....	306.9	78a First snow to fly in air	....	....	....	....	....	....	....	....	....	....	....
319.3	327.4	310.9	315.3	307.	312.7	313.3	313.6	329.5	314.	316.3	78b " whiten ground	....	....	....	....	....	....	....	....	....	....	....
315.	337.6	.....	347.	338.	323.	340.6	336.1	324.	.....	332.7	79a Closing of lakes	....	....	....	....	....	....	....	....	....	....	....
359.	339.	.....	.....	341.8	331.5	360.	345.3	330.	.....	343.8	79b " rivers	....	....	....	....	....	....	....	....	....	....	....
95.6	90.7	87.3	93.8	118.1	108.8	96.	95.3	97.	.....	98.1	81a Wild ducks migrating, N.	....	....	....	....	....	....	....	....	....	....	....
343.	306.6	.....	297.	284.5	.....	297.6	301.	323.	.....	307.5	81b " " S.	....	....	....	....	....	....	....	....	....	....	....
97.9	90.3	93.6	90.7	85.	87.8	89.5	93.3	87.	100.5	91.5	82a " geese " N.	....	....	....	....	....	....	....	....	....	....	....
.....	333.8	332.	.....	303.	346.	300.1	302.7	271.	.....	312.7	82b " " S.	....	....	....	....	....	....	....	....	....	....	....
91.6	88.6	91.2	94.4	97.4	93.7	96.8	98.8	90.	91.	93.3	83 Melospiza fasciata, North	....	....	....	....	....	....	....	....	....	....	....
91.4	87.2	86.4	87.5	83.4	90.3	90.9	93.6	94.	107.	91.2	84 Turdus migratorius "	....	....	....	....	....	....	....	....	....	....	....
87.2	90.9	87.5	101.3	98.3	91.6	91.7	101.5	90.	90.5	93.0	85 Junco hiemalis "	....	....	....	....	....	....	....	....	....	....	....
139.	124.5	129.7	124.3	128.2	132.7	128.7	129.	131.	.....	129.7	86 Actitis macularia "	....	....	....	....	....	....	....	....	....	....	....
.....	106.6	111.	127.	115.	114.	134.1	.....	.....	.....	117.9	87 Sturnella magna "	....	....	....	....	....	....	....	....	....	....	....
126.6	126.3	123.6	121.7	119.	125.6	123.5	125.9	127.	121.	124.0	88 Ceryle Alcyon "	....	....	....	....	....	....	....	....	....	....	....

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

Year ended July, 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen. — Regions.

Plant	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.
27 Cornus Canadensis	144.3	145.2	144.9	148.1	152.4	149.6	153.1	159.2	159.7	154.3	151.1
28 " " fruit ripe	.....	214.	.....	.....	206.	202.5	191.5	228.	207.	.....	208.1
29 Trientalis Americana	144.6	147.5	140.5	148.7	151.5	154.9	152.6	160.7	161.7	152.	151.5
30 Clintonia borealis	148.5	152.7	154.1	155.4	159.2	160.7	159.3	156.6	157.	143.	154.6
31 Calla palustris	154.	157.2	157.	158.	159.6	159.6	162.8	168.	165.	.....	160.1
32 Cypripedium acaule	154.4	154.5	155.4	160.6	164.5	165.8	160.8	171.1	162.	177.	162.6
33 Sisyrinchium angustifolium	157.6	156.3	156.1	158.5	164.6	161.2	164.7	171.9	167.7	170.3	162.9
34 Linnæa borealis	161.5	159.	161.4	166.4	170.	171.	170.9	175.8	176.3	175.	168.7
35 Kalmia glauca	151.7	151.8	150.2	156.1	159.8	151.8	159.7	168.	162.	164.7	157.6
36 Kalmia angustifolia	168.9	167.2	163.	170.1	161.9	163.8	168.5	179.3	179.	176.	169.8
37 Cratægus oxyacantha	165.7	160.9	160.6	164.5	169.2	150.	162.7	172.9	.....	169.	163.9
38 Cratægus coccinea, etc.	165.9	158.7	156.1	158.9	167.	162.5	162.7	174.2	167.	161.5	163.4
39 Iris versicolor	163.5	159.7	164.2	166.1	170.3	169.7	170.7	177.9	180.7	175.	169.8
40 Chrysanthemum Leucanthemum	162.1	161.6	162.	163.9	169.6	166.8	168.2	178.8	174.7	168.	167.6

When Becoming Common. — Regions.

Plant	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
27 Cornus Canadensis	157.6	150.6	151.7	152.9	155.6	160.2	157.	160.8	164.5	161.7	160.7
28 " " fruit ripe	216.1	.....	.....	.....	.....	212.	211.	225.	220.5	212.	.....
29 Trientalis Americana	158.3	153.8	153.1	152.1	156.	160.2	163.	159.5	165.2	166.	154.
30 Clintonia borealis	160.4	154.	157.5	159.3	162.	166.1	167.5	165.3	162.1	163.	147.
31 Calla palustris	167.1	160.	162.9	.....	163.7	167.2	169.2	166.2	172.5	175.	.....
32 Cypripedium acaule	166.5	159.6	160.5	162.	166.7	170.7	169.1	167.5	175.6	167.	.....
33 Sisyrinchium angustifolium	168.6	164.1	161.2	162.6	165.9	171.3	168.	170.	176.8	171.2	174.7
34 Linnæa borealis	173.5	167.7	165.7	167.9	173.8	175.9	176.6	174.1	177.7	177.	179.
35 Kalmia glauca	163.7	160.	157.9	155.5	162.3	167.9	155.4	167.8	174.1	168.3	168.3
36 Kalmia angustifolia	175.3	177.5	172.9	170.	173.9	168.3	170.3	173.1	184.	184.	179.
37 Cratægus oxyacantha	169.8	172.8	166.6	169.3	168.7	175.6	156.	168.7	176.5	...	174.
38 Cratægus coccinea, etc.	168.7	170.6	166.5	162.3	164.6	173.2	168.5	168.3	175.5	171.	166.5
39 Iris versicolor	174.7	169.1	165.5	171.3	171.	175.2	173.7	174.6	180.8	187.	179.
40 Chrysanthemum Leucanthemum	173.6	168.	167.8	167.3	171.2	176.5	173.4	174.1	180.8	181.	175.5

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

WHEN FIRST SEEN. — REGIONS.

Year ended July, 1906.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.
55 R. nigrum (cultivated)	138.2	141.6	145.4	141.9	149.8	150.6	149.1	157.4	157.	153.5	148.4
56 " fruit ripe	.....	227.	.....	.....	.....	.....	204.	211.	212.	.....	213.5
57 Prunus Cerasus	140.6	140.3	143.4	144.1	153.4	152.6	155.1	161.1	.....	.....	148.8
58 " " fruit ripe	.....	.....	201.	210.	.....	206.5	211.	200.	.....	.....	205.7
59 Prunus domestica	142.9	143.7	145.2	148.9	153.4	150.5	153.9	165.6	160.5	163.	152.8
60 Pyrus Malus	144.4	146.5	147.	150.4	157.7	154.1	156.4	165.9	162.7	162.3	154.7
61 Syringa vulgaris	157.7	157.1	156.5	159.8	167.5	164.1	164.5	175.5	169.	174.	164.6
62 Trifolium repens	157.	156.6	159.	159.3	165.6	163.5	163.4	172.8	174.5	174.5	164.6
63 Trifolium pratense	148.3	152.9	154.9	159.7	166.	165.4	165.9	174.2	175.	176.5	163.9
64 Phleum pratense	178.	162.3	173.	174.3	168.4	173.1	169.	199.	198.	.....	177.2
65 Solanum tuberosum	169.6	182.7	175.	193.	198.	191.	185.	198.5	204.	.....	188.5
66 Ploughing (first of season)	108.2	109.9	114.8	128.3	122.	128.3	126.9	122.9	130.	127.2	121.8
67 Sowing " "	124.4	118.6	127.4	134.5	130.9	134.7	134.1	135.9	135.	134.	130.9
68 Potato-planting "	121.	117.3	131.	138.	126.7	137.7	133.4	126.1	133.	128.3	129.2

WHEN BECOMING COMMON. — REGIONS.

Year ended July, 1906.	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
55 R. nigrum (cultivated)	154.4	147.2	146.8	151.7	146.9	156.7	155.4	156.4	163.	161.	158.5
56 " fruit ripe	222.2	.....	236.	.....	.....	.....	235.	208.	217.	215.	.....
57 Prunus Cerasus	155.4	145.7	146.7	148.7	151.4	168.4	156.3	159.9	165.8	.....	.....
58 " " fruit ripe	211.2	.....	.....	.....	214.	.....	211.	206.	214.	.....	.....
59 Prunus domestica	157.8	147.8	150.5	146.3	154.9	160.5	158.7	159.3	168.1	165.	166.7
60 Pyrus Malus	161.4	154.6	153.4	153.7	157.8	163.4	161.	162.7	171.8	169.	166.7
61 Syringa vulgaris	170.	164.6	162.9	158.9	166.1	173.4	169.2	169.8	179.8	176.5	178.5
62 Trifolium repens	171.4	168.9	163.2	164.8	168.5	171.4	171.2	169.2	178.1	179.5	179.5
63 Trifolium pratense	171.3	160.7	161.6	164.8	170.	172.7	172.3	172.9	179.	181.5	178.
64 Phleum pratense	181.4	174.2	171.3	169.5	183.	170.	179.5	178.5	204.	203.	.....
65 Solanum tuberosum	200.5	185!	192.8	.....	.....	208.	202.	.....	207.5	208.	.....
66 Ploughing (first of season)	128.6	118.	119.8	124.8	139.3	131.3	121.	133.5	130.5	136.	132.
67 Sowing " "	139.1	132.8	127.7	139.8	144.6	140.1	.....	140.8	142.2	142.3	141.7
68 Potato-planting "	138.8	128.	127.1	148.1	154.	139.4	.....	141.8	134.	140.3	136.5

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

When First Seen. Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.	Year ended July, 1906. Day of the year corresponding to the last day of each month. Jan. 31, Feb. 59, March 90, April 120, May 151, June 181, July 212, Aug. 243, Sept. 273, Oct. 304, Nov. 334, Dec. 365. For Leap Year add one to each except January.	When Becoming Common. Average Dates.	Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria.)	10. Inverness Slope to Gulf.
311.6	312.4	311.	302.1	304.7	303.2	308.5	303.7	305.	.....	306.9	78a First snow to fly in air	....	....	....	....	....	....	....	....	....	....	....
319.3	327.4	310.9	315.3	307.	312.7	313.3	313.6	329.5	314.	316.3	78b " whiten ground	....	....	....	....	....	....	....	....	....	....	....
315.	337.6	.....	347.	338.	323.	340.6	336.1	324.	.....	332.7	79a Closing of lakes	....	....	....	....	....	....	....	....	....	....	....
359.	339.	.....	.....	341.8	331.5	360.	345.3	330.	.....	343.8	79b " rivers	....	....	....	....	....	....	....	....	....	....	....
95.6	90.7	87.3	93.8	118.1	108.8	96.	95.3	97.	.....	98.1	81a Wild ducks migrating, N.	....	....	....	....	....	....	....	....	....	....	....
343.	306.6	.....	297.	284.5	.....	297.6	301.	323.	.....	307.5	81b " " S	....	....	....	....	....	....	....	....	....	....	....
97.9	90.3	93.6	90.7	85.	87.8	89.5	93.3	87.	100.5	91.5	82a " geese " N.	....	....	....	....	....	....	....	....	....	....	....
.....	333.8	332.	.....	303.	346.	300.1	302.7	271.	.....	312.7	82b " " S.	....	....	....	....	....	....	....	....	....	....	....
91.6	88.6	91.2	94.4	97.4	93.7	96.8	98.8	90.	91.	93.3	83 Melospiza fasciata, North	....	....	....	....	....	....	....	....	....	....	....
91.4	87.2	86.4	87.5	83.4	90.3	90.9	93.6	94.	107.	91.2	84 Turdus migratorius "	....	....	....	....	....	....	....	....	....	....	....
87.2	90.9	87.5	101.3	98.3	91.6	91.7	101.5	90.	90.5	93.0	85 Junco hiemalis "	....	....	....	....	....	....	....	....	....	....	....
139.	124.5	129.7	124.3	128.2	132.7	128.7	129.	131.	.....	129.7	86 Actitis macularia "	....	....	....	....	....	....	....	....	....	....	....
.....	106.6	111.	127.	115.	114.	134.1	.....	.....	.....	117.9	87 Sturnella magna "	....	....	....	....	....	....	....	....	....	....	....
126.6	126.3	123.6	121.7	119.	125.6	123.5	125.9	127.	121.	124.0	88 Ceryle Alcyon "	....	....	....	....	....	....	....	....	....	....	....

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued*

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen. Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average Dates.	Year ended July, 1906.	When Becoming Common. Average Dates.	Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb and Col.).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
150.5	135.4	125.6	123.5	129.7	127.5	124.3	126.7	128.	130.	130.1	89 Dendrœca coronata, North											
131.5	134.9	131.1	130.	137.2	136.4	132.5	132.5	135.	140.	134.1	90 D. æstiva "											
117.	123.4	123.3	113.8	115.	133.8	117.8	121.	124.	.....	121.	91 Zonotrichia alba "											
141.7	145.	143.6	143.5	150.9	146.5	150.1	160.8	151.	138.	147.1	92 Trochilus colubris "											
138.	127.8	131.4	136.7	137.5	144.4	137.4	150.	142.	143.	138.8	93 Tyrannus Carolinensis "											
141.5	127.	132.8	136.7	124.8	143.7	139.6	.....	.....	135.	135.1	94 Dolychonyx oryzivorus "											
137.8	133.6	134.2	136.	120.1	141.1	139.1	149.5	139.	.....	136.7	95 Spinis tristis. "											
150.5	148.2	123.	145.1	134.2	138.	132.6	139.	135.	134.	137.9	96 Setophaga ruticilla "											
152.	157.5	154.5	151.	159.	99.	136.3	.....	.....	.....	151.7	97 Ampelis cedrorum "											
144.	134.	110.8	118.7	124.9	140.2	138.3	123.1	141.	128.	130.3	98 Chordeiles Virginianus "											
101.6	103.3	103.9	107.6	111.9	110.4	112.2	114.6	119.	120.	110.4	99 First piping of frogs											
104.5	103.8	107.9	115.1	114.5	118.6	119.7	120.7	123.3	121.2	114.9	100 First appearance, snakes											

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1905-1906.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col.)	7. North Cum., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Total for Province. Year 1905.
						186				186
			187							187
						194				194
				195						195
	196^{2}			196		196	196			196^{5}
	200^{2}					200	200	200		200^{5}
			203							203
						206				206
						207^{2}		207		207^{3}
				208		208	208	208		208^{5}
				209^{2}		209	209	209		209^{5}
						210				210
								211		211
				212						212
				213			213^{2}	213		213^{4}
				214			214			214^{2}
								220		220
	225									225
			226							226
	228									228
232				232		232				232^{3}
234^{4}	234^{11}									234^{15}
235	235^{12}	235^{6}	235^{2}	235^{5}		235^{15}	235^{2}	235		235^{44}
				236		236				236^{2}
						237				237
						238				238
						239				239
		240				240				240^{2}
241										241
	242	242			242^{3}	242^{11}		242		242^{18}
		247				247				247
	249^{3}	249^{6}	249^{2}		249^{8}	249^{18}				249^{37}
		250		250	250^{7}	250	250	250		250^{12}
				251						251
						253				253
						256				256
						239				259
						261				261
						262				262
					264	264^{2}				264^{3}

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1905-1906.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col.)	7. North Cum.,* Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Total for Province. YEAR 1905.
						267				267
					268^{3}	268$_{7}$				268^{10}
				281		281^{14}	281	281		281^{17}
286^{5}	286^{3}						286			286^{9}
287	287			287			287			287^{4}
				293						293
						294				294
						298				298
				312						312
	313^{2}									313
				334						334
								363		363

YEAR 1906.

				4				3		3, 4.
						36	36			36^{2}
						37^{2}				37^{2}
										38
	40^{3}		40	40^{6}		40^{2}	40^{5}	40		40^{18}
46^{2}										46^{2}
							50			50
				58						58
				59^{3}		59		59$_{2}$		59^{6}
				61		61				61^{2}
			62			62				62^{2}
						76				76
						82				82
	86		86							86^{2}
						87				87
							91			91
				96				96^{2}		96^{3}
		100								100
			102			102				102^{2}
	104									104
						105				105
						108				108
109										109
	110^{2}									110^{2}

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1906.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col.)	7. North Cum., Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Total for Province YEAR 1906.
111^{3}	111^{22}					111				111^{25}
	112^{6}		112	112^{4}		112				112^{12}
113	113		113^{11}	113^{12}	113	113^{43}				113^{69}
						114				114
			115		115	115	115			115^{4}
116^{3}			116	116	116	116^{3}				116^{9}
117^{15}	117^{32}	117^{15}	117^{8}	117^{5}	117^{15}	117^{31}				117^{121}
	118^{7}		118	118^{3}		118^{9}	118			118^{21}
119										119
120^{11}			120							120^{12}
	121			121						121^{2}
							122			122
123^{2}	123^{24}			123		123^{2}				123^{29}
		124^{2}								124^{2}
	125^{2}					125^{2}				125^{4}
					126	126^{2}				126^{3}
						127^{4}	127			127^{5}
			128^{11}	128^{15}	128^{22}	128^{46}				128^{94}
			129			129^{2}				129^{3}
			130	130		130^{2}				130^{4}
						131^{2}				131^{2}
132	132									132^{2}
	133									133
								136		136
						137				137
138		138				138^{2}	138^{2}			138^{6}
139^{11}	139^{18}	139^{3}		139^{3}	139	139^{5}	139^{15}	139^{2}	139^{2}	139^{60}
	140					140				140^{2}
							143			143
145	145^{3}	145^{3}	145		145^{2}	145	145			145^{12}
	146^{17}		146	146^{5}		146^{9}	146^{2}	146^{2}	146^{2}	146^{44}
								147		147
148	148					148				148^{3}
						149^{2}				149^{2}
	151		151							151^{2}
152^{8}			152		152^{5}	152^{17}				152^{28}
153^{3}			153		153	153^{4}		153		153^{10}
154^{14}	154^{49}	154^{18}	154^{13}	154	154^{16}	154^{17}				154^{128}
155						155_{5}				155^{6}
						156^{11}	156			156^{12}
						157				157
						158				158

PHENOLOGICAL OBSERVATIONS, CANADA, 1906.

" WHEN FIRST SEEN."—OBSERVATION STATIONS.

YEAR 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except **January**.

	*Nova Scotia. (Average dates)	St. John, N.B.	Charlottetown, P.E.I.	Urss, O.	Paris, O.	Arden, O.	Birman, O.	Beatrice, O.	Toronto, O.	Lakefield, O.	Estevan, Man.	Norquay, Man.	Morden, Man.	Oakbank, Man.	Aweme, Man.	Pheasant Forks, Sask.	Quesnel, B.C.	Princeton, B.C.	Stuart's Lake, B.C.	Vancouver, B.C.
17 Amelanchier Canadensis	142.	140										134		125		140		113	144	
18 " " (fruit ripe)	201.																			
19 Prunus Pennsylvanica	147.	152		141		145	133	140	133			134		143	128	142	151			104
20 " " fruit ripe	220.																242			
21 Vaccinium Can. and Penn.	146.	155			143				138								160			65
22 " " fruit ripe	204.																215			150
23 Ranunculus acris	153.		160	163	132		132		148	155						111	110	64		
24 R. repens	158.																80			110
25 Trill. erythrocarpum	145.	140		134			132		124	123		148								
26 Rhododendron Rhodora	149.	152																		
27 Cornus Canadensis	151.	155																		
28 " " fruit ripe	208.																			
29 Trientalis Americana	151.																175			119
30 Clintonia borealis	154.																			
31 Calla palustris	160.																			
32 Cypripedium acaule	162.	162															170			

PHENOLOGICAL OBSERVATIONS, CANADA, 1906

"WHEN FIRST SEEN." OBSERVATION STATIONS.

YEAR 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

	*Nova Scotia (Average dates)	St. John, N.B.	Charlottetown, P.E.I.	Ursa, O.	Paris, O.	Arden, O.	Burman, O.	Beatrice, O.	Toronto, O.	Lakefield, O.	Emerson, Man.	Norquay, Man.	Morden, Man.	Oakbank, Man.	Aweme, Man.	Pleasant Forks, Sask.	[illegible] B.C.	[illegible] B.C.	[illegible] B.C.	Vancouver, B.C.
49 Rosa lucida	179.	..	..	..	157	..	158	..	164	39	..	..	161	157	..	..	181	149		139
50 Leontodon autumnale	170.	..	..	..	..	..	..	..	..							..	248			
51 Linaria vulgaris	170.	..	..	..	..	..	..		..								118			
52 Trees appear green	138.	..	..	..	..	..	..		..								90			
53 Ribes rubrum (cultivated)	145.	..	167	138	137	139	142	40	135	39		131	12	..	48	44	80	90		
54 " " (fruit ripe)	192.	..	..	..	..	..	..		..								216			
55 R. nigrum (cultivated)	148.	..	..	..	..	..	..		..							40	180			
56 " fruit ripe	213.	..	..	..	..	..	..										220			
57 Prunus Cerasus	148.	..	160	..	136	..	135	..	134	136		139					[illegible]	98		91
58 " fruit ripe	205.	..	..	..	..	..	..	..	..								246			
59 Prunus domestica	152.	..		138	136	..	136	.	133							.		188		.
60 Pyrus Malus	154.	162	160	146	136	142	140	135	138				150			150	50	[illegible]		90
61 Syringa vulgaris	164.	162	17	150	140	141	137	150	144	43		156	150		.		55			113
62 Trifolium repens	164.	..		..	164	..	179	..	157			157	..	169	..	..	160	89	...	117
63 Trifolium pratense	163.	..		165	..	..	168	..	161			..	..	185	..	..	105	53	...	126

PHENOLOGICAL OBSERVATIONS, CANADA, 1906.

"When Last Seen."—Observation Stations.

Year 1906.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

	*Nova Scotia. (Average dates)	St. John, N.B.	Charlottetown, P.E.I.	Ursa, O.	Paris, O.	Arden, O.	Birman, O.	Beatrice, O	Toronto, O.	Lakefield, O.	Estevan, Man.	Norquay, Man.	Morden, Man.	Oakbank, Man.	Aweme, Man.	Pheasant Forks, Sask.	Quesnel, B.C.	Princeton, B.C.	Stuart's Lake, B.C.	Vancouver, B.C.
76a Water in streams—high	106.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	160	....	....	....
76b " " low	236.	295	....	....	....	....	....	....	....	....	....	....	....	....	....	....	340	....	....	....
77a First autumn frost—hoar	261.	259	291	....	....	....	....	....	....	....	....	....	....	....	....	236	127	....	....	....
77b " " hard	290.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	254	127	....	....	....
78a First snow to fly in air	306.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	308	....	....	....
78b " whiten ground	316.	....	319	....	....	....	....	....	....	....	....	....	....	....	....	....	323	....	....	....
79a Closing of lakes	332.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	324	....	....	....
79b " rivers	343.	....	337	....	....	....	....	....	....	....	....	....	....	....	....	....	350	....	....	....
81a Wild ducks migrating, N.	98.	....	....	....	....	95	89	....	....	....	91	93	95	105	....	94	82	....	87	....
81b " " " S.	307.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	246	....	....	....
82a " geese " N.	91.	....	84	109	....	118	90	....	....	108	88	90	105	117	....	88	97	....	97	....
82b " " " S.	312.	....	257	....	....	....	....	....	....	....	....	....	....	....	....	305	249	....	....	....
83 Melospiza fasciata, North	93.	....	96	....	....	106	75	104	93	93	....	....	....	....	....	....	79	....	....	....
84 Turdus migratorius "	91.	....	96	....	136	96	54	93	92	67	....	95	99	109	....	104	85	85	87	....
85 Junco hiemalis "	93.	....	97	....	....	....	....	....	91	99	....	93	....	....	....	85	....	....	....	....

PHENOLOGICAL OBSERVATIONS, CANADA, 1906.

"When Last Seen."—Observation Stations.

Year 1906. Day of the year corresponding to the last day of each month. Jan. 31, July 212 Feb. 59, Aug. 243 March 90, Sept. 273 April 120, Oct. 304 May 151, Nov. 334 June 181, Dec. 365 For Leap Year add one to each except January.	*Nova Scotia (Average dates)	St. John, N.B.	Charlottetown, P.E.I.	Ursa, O.	Paris, O.	Arden, O.	Birman, O.	Beatrice, O.	Toronto, O.	Lakefield, O.	Estevan, Man.	Norquay, Man.	Morden, Man.	Oakbank, Man.	Aweme, Man.	Pheasant Forks, Sask.	Quesnel, B.C.	Princeton, B.C.	Stuart's Lake, B.C.	Vancouver, B.C.
86 Actitis macularia North	129.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
87 Sturnella magna "	117.	.....	.....	.....	.....	.....	85	.....	103	94	.....	96	95	.....	.....	98	90	102	.....	.....
88 Ceryle Alcyon "	124.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
89 Dendrœca coronata, "	130.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
90 D. æstiva... "	134.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
91 Zonotrichia alba "	121.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
92 Trochilus colubris "	147.	.....	.....	.....	144	164	142	.....	135	137	.....	141	136	171	.....	212	119	123	147	.....
93 Tyrannus Carolinensis "	138.	.....	.....	.....	.....	.....	130	.....	130	133	102	130	.....	.....	.....	.....	.....	.....	.....	.....
94 Dolychonyx oryzivorus	135.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
95 Spinis tristis "	136.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
96 Setophaga ruticilla "	137.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
97 Ampelis cedrorum "	151.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
98 Chordeiles Virginianus "	130.	.....	156	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	151	150	.....	.....	.....
99 First piping of frogs	110.	.....	114	107	122	107	92	106	91	93	101	104	98	97	.....	94	90	91	.....	.....
100 First appearance, snakes	114.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	105	180	.....	.....	.....

FLOWERING AND OTHER PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

Year ended July, 1907.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

When First Seen — Regions.

Year ended July, 1907	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10. Victoria and Inverness.	Average Dates.
41 Nuphar advena	171.8	168.1	.....	166.4	168.7	178.	171.5	167.	.....	.....	170.2
42 Rubus strigosus	168.6	165.9	168.7	159.7	160.6	166.5	164.	172.5	170.4	.....	166.3
43 " " fruit ripe	199.	.....	.....	197.5	209.	.....	208.9	219.3	210.	.....	207.3
44 Rhinanthus Crista-galli	172.2	172.5	.....	.....	.....	143.	173.2	187.	187.	.....	172.5
45 Rubus villosus	172.1	169.9	169.	154.1	170.4	163.4	168.5	175.5	179.	.....	169.1
46 " " fruit ripe	238.5	221.5	223.	227.5	234.	236.	235.5	252.	239.	.....	234.1
47 Sarracenia purpurea	170.5	170.5	.....	170.	174.	168.6	176.	178.	185.	.....	174.1
48 Brunella vulgaris	176.	169.4	171.	179.7	.....	177.5	179.5	172.	187.	.....	176.5
49 Rosa lucida	174.5	175.8	175.	174.7	176.	175.5	177.9	194.6	197.	.....	180.1
50 Leontodon autumnale	170.4	172.7	171.9	171.7	172.3	172.2	174.2	172.8	179.	.....	173.0
51 Linaria vulgaris	169.3	179.5	170.	159.	.....	170.6	174.5	176.	.....	.....	171.3
52 Trees appear green	132.	141.	135.3	140.6	142.5	139.5	139.1	148.8	150.4	.....	141.0
53 Ribes rubrum (cultivated)	143.6	144.5	147.1	150.2	152.2	153.2	149.9	160.3	161.7	.....	151.4
54 " " (fruit ripe)	201.	193.	.....	195.	208.	.....	190.1	201.	205.	.....	199.0

When Becoming Common — Regions.

Year ended July, 1907	Average Dates.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10. Victoria and Inverness.
41 Nuphar advena	174.7	171.3	172.8	173.	171.8	174.8	.....	176.5	183.	.....	.....
42 Rubus strigosus	172.1	170.3	171.5	175.5	167.2	169.9	171.5	170.	177.8	175.6	.....
43 " " fruit ripe	214.9	213.	.....	.....	204.	214.	.....	216.7	226.6	215.	.....
44 Rhinanthus Crista-galli	178.2	175.4	177.1	.....	.....	.....	156.	177.	192.	192.	.....
45 Rubus villosus	175.2	175.8	176.1	172.1	169.7	176.3	171.	173.5	179.3	183.5	.....
46 " " fruit ripe	241.9	245.5	231.	234.	236.6	240.	.....	243.8	258.	247.	.....
47 Sarracenia purpurea	178.5	176.2	174.3	.....	176.	178.5	170.	.....	185.	190.	.....
48 Brunella vulgaris	180.1	178.5	174.5	175.	179.	.....	183.	187.	170.	194.	.....
49 Rosa lucida	186.6	179.	183.2	179.	188.	.....	176.2	180.8	202.	205.	.....
50 Leontodon autumnale	177.7	174.5	179.1	177.2	175.7	176.	178.2	177.9	176.6	184.	.....
51 Linaria vulgaris	174.0	174.3	182.5	.....	164.6	179.	167.	176.8	.....	.....	.....
52 Trees appear green	153.6	157.9	152.3	147.2	150.3	153.6	152.5	151.7	159.5	157.5	.....
53 Ribes rubrum (cultivated)	157.2	149.8	151.6	154.8	155.4	158.1	158.9	155.3	164.1	167.	.....
54 " " (fruit ripe)	206.9	210.	203.	.....	204.	212.	.....	199.	209.	211.	.....

FLOWERING AND OTHERS PHENOCHRONS FOR THE PROVINCE OF NOVA SCOTIA.—*Continued.*

When First Seen. Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10. Victoria and Inverness.	Average Dates.	Year ended July, 1907. Day of the year corresponding to the last day of each month. Jan. 31, Feb. 59, March 90, April 120, May 151, June 181, July 212, Aug. 243, Sept. 273, Oct. 304, Nov. 334, Dec. 365 For Leap Year add one to each except January.	When Becoming Common. Average Dates.	Regions. 1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10. Victoria and Inverness.
308.4	309.9	307.8	312.7	307.7	307.	309.5	311.9	311.	....	309.5	78a First snow to fly in air	....	....	....	....	....	....	....	....	....	....	....
322.3	327.4	313.9	304.9	326.1	310.7	314.8	320.9	319.3	....	317.8	78b " " to whiten ground	....	....	....	....	....	....	....	....	....	....	....
335.7	333.1	337.	331.	333.7	324.	340.3	355.3	337.	....	336.3	79a Closing of lakes	....	....	....	....	....	....	....	....	....	....	....
337.8	338.3	341.5	347.7	350.	335.5	346.7	339.5	343.	....	342.2	79b " of rivers	....	....	....	....	....	....	....	....	....	....	....
92.	89.9	89.6	100.	90.	89.4	88.9	86.	93.5	....	91.0	81a Wild ducks migrating, N.	....	....	....	....	....	....	....	....	....	....	....
333.	324.5	287.5	272.	297.8	295.	291.7	....	320.	....	302.7	81b " " " S.	....	....	....	....	....	....	....	....	....	....	....
85.6	88.8	289.	86.9	84.2	85.7	84.5	87.5	94.	....	87.3	82a " geese " N.	....	....	....	....	....	....	....	....	....	....	....
332.	327.	293.	296.4	299.2	321.2	300.	....	....	....	309.8	82b " " " S.	....	....	....	....	....	....	....	....	....	....	....
87.6	86.6	88.6	94.7	90.7	90.5	87.5	94.	94.	....	90.5	83 Melospiza fasciata, North	....	....	....	....	....	....	....	....	....	....	....
83.2	82.3	81.9	86.4	82.9	84.4	86.8	94.	95.7	....	86.4	84 Turdus migratorius "	....	....	....	....	....	....	....	....	....	....	....
89.5	89.8	85.2	101.6	89.1	89.2	97.2	92.	92.	....	91.7	85 Junco hiemalis.. "	....	....	....	....	....	....	....	....	....	....	....
119.3	126.3	....	134.6	128.4	131.9	129.1	139.2	128.5	....	129.6	86 Actitis macularia "	....	....	....	....	....	....	....	....	....	....	....
....	121.9	120.	129.7	....	137.6	134.5	....	....	....	128.7	87 Sturnella magna, "	....	....	....	....	....	....	....	....	....	....	....

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1906-1907.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10.	Year 1906.
	185						185_2			185^{3}
		186				186				186^{2}
						190				190
					193	193^{2}				193^{3}
					194	194^{3}	194			194^{5}
						195				195
						200				200
						205				205
215	215									215^{2}
	217									217
			218			218		218		218^{2}
			219							219
						223				223
						224^{2}	224	224^{2}		224^{5}
						227				227
			229							229
	231									231
						233^{3}		233^{2}		233^{5}
						234^{9}		234		234^{10}
235		235				235^{3}	235			235^{6}
							236	236		236^{9}
			238^{2}							238^{2}
	239									239
	240									240
					241	241				241^{2}
			242							242
243^{7}	243	243	243^{2}	243^{2}			243^{2}	243		243^{26}
			244^{3}			244^{9}	244^{2}	244		244^{15}
						245				245
246^{4}		246				246				246^{6}
			249^{3}		249^{2}	249^{4}		249		249^{10}
						250				250
							251			251
							256			256
		257^{2}	257^{2}		257^{6}	257^{44}	257	257		257^{26}
						259^{2}				259^{2}
					260	260				260
263										263
			264^{2}							264^{2}
						267		267		267^{2}
276										276
						278				278
	279									279

PHENOLOGICAL OBSERVATIONS, CANADA, 1907.

"WHEN FIRST SEEN."

OBSERVATION STATIONS.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

No.		*Average Dates for Nova Scotia.	St. John, N.B.	Charlottetown, P.E.I.	Aweme, Man.	Mistawasis, Sask.	Princeton, B.C.	Vancouver, B.C.
33	Sisyrinchium angustifolium	167.	163		160			
34	Linnæa borealis	170.					172	142
35	Kalmia glauca	162.						
36	Kalmia angustifolia	170.						
37	Cratægus oxyacantha	167.						
38	Cratægus coccinea, etc	167.						
39	Iris versicolor	173.						
40	Chrysanthemum Leucanthemum	171.						
41	Nuphar advena	170.						118
42	Rubus strigosus	166.			174		171	75
43	" " fruit ripe	207.					209	149
44	Rhinanthus Crista-galli	172.						
45	Rubus villosus	169.						
46	" " fruit ripe	234.						
47	Sarracenia purpurea	174.						
48	Brunella vulgaris	176.						
49	Rosa lucida	180.					152	
50	Leontodon autumnale	173.						
51	Linaria vulgaris	171.						
52	Trees appear green	141.			151	157	122	
53	Ribes rubrum (cultivated)	151.			155		131	
54	" " (fruit ripe)	199.						
55	R. nigrum (cultivated)	154.					135	
56	" fruit ripe	209.						
57	Prunus Cerasus	157.					138	110
58	" " fruit ripe	209.						
59	Prunus domestica	159.					141	
60	Pyrus Malus	160.	163				144	119
61	Syringa vulgaris	168.	171					124
62	Trifolium repens	168.					143	132
63	Trifolium pratense	167.	163				159	139
64	Phleum pratense	179.						

PHENOLOGICAL OBSERVATIONS, CANADA, 1907.

"When First Seen."

Observation Stations.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

No.		*Average Dates for Nova Scotia.	St. John, N.B.	Charlottetown, P.E.I.	Aweme, Man.	Mistawasis, Sask.	Princeton, B.C.	Vancouver, B.C.
65	Solanum tuberosum	193.	....	....	....	....	174	....
66	Ploughing (first of season)	122.	....	....	....	....	160	....
67	Sowing (first of season)	131.	....	....	....	....	161	....
68	Potato-planting "	130.	....	....	....	....	112	....
69	Sheep-shearing "	135.	....	....	....	....	....	....
70	Hay-cutting "	199.	220	....	....	....	186	....
71	Grain-cutting "	240.	....	....	....	....	235	....
72	Potato-digging "	267.	....	....	....	....	306	....
73a	Opening of rivers	95.	....	....	....	....	72	....
73b	Opening of lakes	112.	....	....	....	....	....	....
74a	Last snow to whiten ground	125.	....	....	....	130	80	....
74b	" to fly in air	135.	....	....	....	140	94	....
75a	Last spring frost—hard	139.	....	....	....	....	133	....
75b	" " hoar	161.	....	....	....	....	160	....
76a	Water in streams—high	....	....	....	....	....	....	....
76b	" " low	237.	....	....	....	....	....	....
77a	First autumn frost—hoar	259.	255	....	....	....	228	....
77b	" " hard	291.	261	....	....	259	....	....
78a	First snow to fly in air	309.	....	....	....	254	310	....
78b	" to whiten ground	317.	....	....	....	256	312	....
79a	Closing of lakes	336.	....	....	....	299	....	....
79b	" rivers	342.	....	....	....	....	....	....
81a	Wild ducks migrating N.	91.	....	....	....	109	73	....
81b	" " " S.	302.	....	....	....	....	....	....
82a	" geese " N.	87.	....	....	....	110	96	....
82b	" " " S.	309.	....	....	....	....	....	....
83	Melospiza fasciata, North	90.	....	....	....	....	90	....
84	Turdus migratorius "	86.	....	....	....	....	69	56
85	Junco hiemalis "	91.	....	....	....	....	....	....
86	Actitis macularia "	129.	....	....	....	....	....	....
87	Sturnella magna "	128.	....	....	....	....	61	....
88	Ceryle Alcyon "	127.	....	....	....	....	....	....

PHENOLOGICAL OBSERVATIONS, CANADA, 1907.

"When First Seen."

Observation Stations.

	Day of the year corresponding to the last day of each month. Jan. 31, July 212, Feb. 59, Aug 243, March 90, Sept 273, April 120, Oct 304, May 151, Nov 334, June 181, Dec 365 For Leap Year add one to each except January.	*Average Dates for Nova Scotia.	St. John, N.B.	Charlottetown, P.E.I.	Aweme, Man.	Mistawasis, Sask.	Princeton, B.C.	Vancouver, B.C.
89	Dendrœca coronata, North	133.	....	....	....	....	....	....
90	D. æstiva "	140.	....	....	....	....	....	....
91	Zonotrichia alba "	127.	....	....	....	....	152	....
92	Trochilus colubris "	154.	....	....	....	....	122	96
93	Tyrannus Carolinensis "	140.	....	....	....	....	....	....
94	Dolychonyx oryzivorus "	137.	....	....	....	....	....	....
95	Spinis tristis "	148.	....	....	....	....	....	....
96	Setophaga ruticilla "	142.	....	....	....	....	....	....
97	Ampelis cedrorum "	143.	....	....	....	....	....	....
98	Chordeiles Virginianus "	134.	....	....	....	....	133	....
99	First piping of frogs	113.	....	....	....	139	104	70
100	First appearance, snakes	119.	....	....	....	135	115	....

PHENOLOGICAL PHENOMENA.—DATES WHEN FIRST SEEN.

Observations for 1907 reported to the Director of the Meteorological Service, Toronto; and kindly sent to the Secretary of the Club. (Not received in time for incorporation with the observations in the preceding table.)

PLANTS, BIRDS, &c.		Red Willow, Alta.	Sion, Alta	Alix, Alta.	Ranfurly, Alta.	Gray Hill (near Red Deer) Alta.	St. Albans, Man.	Norquay, Man.	Oakbank, Man.	Morden, Man.	Cottam, Ont.
1. Blood Root (Sanguinaria Canadensis)	Flowering	....	....	....	....	....	....	....	....	....	....
2. Hepatica (Hepatica triloba)	"	....	....	....	....	....	....	....	....	....	....
3. Trailing Arbutus (Epigæa repens).....	"	....	....	....	....	....	....	....	....	....	....
4. Dandelion (Taraxacum officinale)......	"	158	158	....	169	160	145	152	158	148	116
5. Violet, White (Viola blanda)..........	"	....	167	....	153	150	152	....	....	....	....
6. Violet, Blue (Viola cucullata).........	"	151	151	....	....	139	....	151	....	....	....
7. Columbine (Aquilegia formosa)	"	170	....	....	....	181	....	167	....	....	....
8. Blueberry (Vaccinium)...............	"	....	....	....	....	....	....	....	....	....	....
9. Red Clover (Trifolium pratense).......	"	....	....	....	....	....	....	....	....	....	....
10. White Clover (Trifolium repens)......	"	....	....	....	....	169	....	161	185	....	....
11. Wild Raspberry (Rubus).............	"	....	....	....	....	176	174	179	....	....	....
12. Cultivated Currant (Ribes rubrum)....	"	....	121	....	156	161	155	158	....	....	....
13. Wild Rose (Rosa lucida).............	"	193	176	....	177	178	190	173	174	....	....
14. Trillium (Trillium)...................	"	....	....	....	....	....	171	160	....	....	....
15. Anemone (Anemone patens)...........	"	125	184	....	127	....	115	....	125	....	122
16. Maple (Acer).......................	"	....	....	....	155	....	147	150	153	144	117
17. Strawberry, Wild (Fragaria Virginiana)	"	163	155	....	157	146	147	154	157	....	....
18. Strawberry, Cutivated (Fragaria)......	"	....	....	....	....	....	....	....	....	....	134
19. Crocus, Cultivated (Iris)............	"	....	....	....	....	....	....	....	....	....	....
20. Lilac (Syringa vulgaris)..............	"	....	....	....	....	....	....	168	....	166	....
21. Apple (Pyrus Malus).................	"	....	....	....	....	....	....	....	....	164	144
22. Plum, Cultivated (Prunus domestica)..	"	....	....	....	....	....	....	162	....	....	135
23. Cherry, Wild (Prunus)...............	"	....	....	....	164	164	158	162	167	....	....
24. Cherry, Cultivated (Prunus Cerasus)..	"	....	....	....	....	....	....	....	....	....	....
25. Buttercup (Ranunculus acris).........	"	146	144	....	....	144	....	....	....	....	....
26. Yellow Pond Lilly (Nuphar advena)...	"	....	149	....	....	....	....	188	....	....	....
27. Pitcher Plant (Sarracenia purpurea)...	"	....	....	....	....	....	179	....	....	....	....
28. Saskatoon (Amelanchier Canadensis)...	"	....	167	....	164	158	160	160	159	....	....
29. Golden Rod (Solidago)...............	"	....	....	....	177	214	....	....	....	....	....
30. Geese..............................	Migrating.	98	100	86	99	81	82	109	....	83	78
31. Ducks..............................	"	121	100	93	119	94	91	111	128	84	70
32. Robins.............................	"	144	136	....	130	101	82	92	....	88	71
33. Meadow Larks......................	"	113	....	....	....	97	91	106	....	80	72
34. Blue Birds..........................	"	....	....	....	....	114	....	147	....	....	67
35. Flicker or Golden Woodpecker.........	"	....	....	....	141	134	93	114	....	93	....
36. Song Sparrow.......................	"	150	165	....	140	94	115	....	....	....	....
37. Swallows...........................	"	....	157	....	137	139	141	131	....	144	141
38. Juncoes............................	"	....	....	....	103	....	82	83	....	....	....
39. Orioles............................	"	....	....	....	....	....	141	148	....	135	....
40. King Birds..........................	"	....	....	....	148	135	141	142	....	140	....
41. Humming Birds......................	"	....	....	....	176	....	....	153	....	....	178
42. Frogs Piping........................	"	127	122	....	133	110	127	134	126	126	78
43. Earth Worm Casts (Frost out of ground)..........		....	....	117	133	....	....	....	....	121	73
44. Lakes Open....................................		122	....	....	146	105	....	....	....	....	....
45. Rivers Open...................................		....	121	107	....	113	....	....	....	111	....
46. Ploughing		124	121	....	133	102	....	....	....	126	105
47. Sowing.......................................		134	140	....	135	119	....	137	....	119	95
48. Hay Cutting...................................		203	212	213	219	199	....	220	....	201	187
49. Grain Cutting.................................		252	....	246	255	240	....	245	....	217	220
50. Potato Planting...............................		157	148	....	143	131	....	142	142	127	114

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1906-1907.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and	10. Inverness.	Year 1906.
......	185	......	......	......	......	......	185_{2}	......	......	185^{3}
......	......	186	......	......	......	186	......	......	......	186^{2}
......	......	......	......	......	......	190	......	......	......	190
......	......	......	......	......	193	193^{2}	......	......	......	193^{3}
......	......	......	......	......	194	194^{3}	194	......	......	194^{5}
......	......	......	......	......	......	195	......	......	......	195
......	......	......	......	......	......	200	......	......	......	200
......	......	......	......	......	......	205	......	......	......	205
215	215	......	......	......	......	......	......	......	......	215^{2}
......	217	......	......	......	......	......	......	......	......	217
......	......	......	218	......	......	218	......	218	......	218^{2}
......	......	......	219	......	......	......	......	......	......	219
......	......	......	......	......	......	223	......	......	......	223
......	......	......	......	......	......	224^{2}	224	224^{2}	......	224^{5}
......	......	......	......	......	......	227	......	......	......	227
......	......	......	229	......	......	......	......	......	......	229
......	231	......	......	......	......	......	......	......	......	231
......	......	......	......	......	......	233^{3}	......	233^{2}	......	233^{5}
......	......	......	......	......	......	234^{9}	......	234	......	234^{10}
235	......	235	......	......	......	235^{3}	235	......	......	235^{6}
......	......	......	......	......	......	......	236	236	......	236^{9}
......	......	......	238^{2}	......	......	......	......	......	......	238^{2}
......	239	......	......	......	......	......	......	......	......	239
......	240	......	......	......	......	......	......	......	......	240
......	......	......	......	......	241	241	......	......	......	241^{2}
......	......	......	242	......	......	......	......	......	......	242
243^{7}	243	243	243^{2}	243^{2}	......	......	243^{2}	243	......	243^{26}
......	......	......	244^{3}	......	......	244^{9}	244^{2}	244	......	244^{15}
......	......	......	......	......	......	245	......	......	......	245
246^{4}	......	246	......	......	......	246	......	......	......	246^{6}
......	......	......	249^{3}	......	249^{2}	249^{4}	......	249	......	249^{10}
......	......	......	......	......	......	250	......	......	......	250
......	......	......	......	......	......	......	251	......	......	251
......	......	......	......	......	......	......	256	......	......	256
......	......	257^{2}	257^{2}	......	257^{6}	257^{44}	257	257	......	257^{26}
......	......	......	......	......	......	259^{2}	......	......	......	259^{2}
......	......	......	......	......	260	260	......	......	......	260
263	......	......	......	......	......	......	......	......	......	263
......	......	......	264^{2}	......	......	......	......	......	......	264^{2}
......	......	......	......	......	......	267	......	267	......	267^{2}
276	......	......	......	......	......	......	......	......	......	276
......	......	......	......	......	......	278	......	......	......	278
......	279	......	......	......	......	......	......	......	......	279

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1906-1907.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8 Richmond and Cape Breton.	Victoria and Inverness. 9.	10.	Year 1906.
280										280
			284							284
						294				294
						298				298
301	301^{8}		301^{15}	301		301^{18}		301		301^{45}
	302		302							302^{2}
304										304
305										305
			307							307
		316								316
331										331
					332					332
							359	359		359^{2}
							360			360

YEAR 1907.

	73^{2}									73^{2}
							74	74		74^{2}
	76^{8}	76		76^{4}		76	76			76^{15}
	77^{2}									77^{2}
	78		78							78^{7}
79^{3}										79^{2}
81^{4}				81		81	81^{6}	81		81^{13}
						82	82^{3}	82		82^{5}
	83									83
							85			85
						86				86
	87		87^{5}			87^{2}		87		87^{9}
			88							88
							94			94
99	99^{19}	99								99^{21}
	100^{6}	100^{3}	100							100^{10}
			101							101
				102						102
						104				104
							106			106
						108				108
114^{5}	114^{2}									114^{7}
	116		116							116^{2}
							117			117
			118							118
			121				121^{3}			121^{4}

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA. 1907

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Victoria and Inverness.	10. Victoria and Inverness.	Year 1907.
	123									123
	124									124
						125				125
		129								129
	130							130		130^{2}
131^{5}	131^{42}	131		131^{6}	131	131^{15}	131^{15}	131^{5}		131^{88}
						132	132	132		132^{20}
		134	134^{6}							134^{7}
						136^{2}				136^{2}
								137		137
						138				138
140	140		140^{2}		140^{2}	140				140^{7}
						141^{3}				141^{3}
								142		142
			143							143
			144^{5}			144^{2}	144	144		144^{9}
						145				145
			146							146
			148		148					148^{2}
			149							149
			150							150
					151					151
		152								152
					155					155
	157									157
	158^{9}	158^{11}			158^{10}	158^{3}				158^{38}
	159^{5}	159^{6}			159	159				159^{13}
160	160		160^{4}			160				160^{7}
					163					163
	165					165				165^{2}
166^{5}	166^{2}		166^{2}		166	166	166			166^{12}
167^{7}	167^{29}	167^{4}	167	167^{4}	167^{2}					167^{47}
	168^{5}		168^{2}			168				168^{8}
169^{2}	169^{8}	169	169		169^{3}	169^{3}				169^{18}
170^{19}	170^{34}	170^{6}	170^{25}	170^{9}	170^{7}	170^{26}	170^{7}	170^{2}		170^{129}
				171		171				171^{2}
		172		172_{2}		172		172		172^{5}
	173^{3}					173				173^{4}
					174	174				174^{2}
175^{3}	175^{17}	175^{2}	175	175^{3}	175^{2}	175^{21}	175^{3}	175^{5}		175^{56}
	176^{24}	176^{10}	176^{5}	176^{8}		176^{7}	176^{3}	176^{3}		176^{60}
	177^{10}	177^{11}	177^{11}	177^{2}	177^{9}	177^{2}	177^{6}	177^{2}		177^{53}
	178^{3}	178	178^{5}	178^{3}	178^{8}	178	178^{3}			178^{24}
		179					179			179^{2}

PHENOLOGICAL OBSERVATIONS, CANADA, 1907.

"When First Seen."

Observation Stations.

Day of the year corresponding to the last day of each month.

Jan.	31	July	212
Feb.	59	Aug.	243
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For Leap Year add one to each except January.

		*Average Dates for Nova Scotia.	St. John, N.B.	Charlottetown, P.E.I.	Aweme, Man.	Mistawasis, Sask.	Princeton, B.C.	Vancouver, B.C.
1	Alnus incana, Wild	113.	....	....	....	....	105	78
2	Populus tremuloides	121.	....	....	134	....	....	....
3	Epigæa repens, L	115.	....	....	....	....	....	....
4	Equisetum arvense	130.	....	....	....	....	....	....
5	Sanguinaria Canadensis	130.	....	....	....	....	....	....
6	Viola Blanda	129.	139	....	....	....	....	....
7	Viola palmata, *cucullata*	134.	144	....	....	....	120	....
8	Hepatica triloba, etc.	131	....	....	....	....	....	....
9	Acer rubrum	133.	....	....	....	....	....	100
10	Fragaria Virginiana	134.	144	....	147	....	129	91
11	" " fruit ripe	172.	183	....	....	....	155	144
12	Taraxacum officinale	137.	144	....	145	....	128	103
13	Erythronium Americanum	139.	139	....	....	....	121	86
14	Coptis trifolia	139.	....	....	....	....	....	....
15	Claytonia Caroliniana	132.	....	....	....	....	104	103
16	Nepeta Glechoma	144.	....	....	....	....	....	106
17	Amelanchier Canadensis	146.	....	....	160	....	....	....
18	" " (fruit ripe)	206.	....	....	....	....	....	....
19	Prunus Pennsylvanica	152.	159	....	158	....	....	117
20	" " fruit ripe	217.	....	....	....	....	....	....
21	Vaccinium Can. and Penn.	150.	167	....	....	....	....	69
22	" " " fruit ripe	206.	....	....	....	....	....	....
23	Ranunculus acris	159.	163	....	....	....	....	....
24	R. repens	164.	....	....	....	....	67	....
25	Trillium erythrocarpum	151.	147	....	....	....	....	129
26	Rhododendron Rhodora	155.	163	....	....	....	....	....
27	Cornus Canadensis	157.	167	....	....	....	....	132
28	" " fruit ripe	203.	....	....	....	....	....	....
29	Trientalis Americana	157.	....	....	....	....	113	125
30	Clintonia borealis	161.	....	....	....	....	....	....
31	Calla palustris	164.	....	....	....	....	....	....
32	Cypripedium acaule	165.	167	....	....	....	144	....

Prenons un de ces exemplaires à l'aspect si imposant, et voyons ce qu'il contient.

Bien qu'il n'y ait à proprement parler que cinq volumes, on peut en réalité en compter sept, comme nous avons fait plus haut, car le cinquième volume, qui contient déjà, à lui seul, plus de pages que tout le reste de l'ouvrage, se divise en deux parties bien distinctes, ayant chacune leur pagination spéciale, ce qui en fait réellement deux volumes séparés. De plus, ce cinquième volume se termine par un *Traité de la Marine,* œuvre aussi de Champlain, qui a une pagination spéciale, et forme par conséquent comme un septième volume.

Le premier volume renferme, outre la préface générale de Laverdière et sa notice biographique de Champlain, la première édition d'un manuscrit dont on connut pour la première fois l'existence, au Canada, par une lettre de M. de Puibusque au commandeur Viger, en date du 15 décembre 1855. Ce manuscrit précieux, œuvre de Champlain, est le journal d'un voyage qu'il fit aux Antilles et au Mexique, de 1599 à 1601, en qualité de commandant d'un vaisseau qui appartenait à son oncle, le capitaine Provençal, et faisait partie d'une expédition envoyée par le roi d'Espagne [1] à ses possessions des Indes Occidentales.

M. de Puibusque avait vu ce manuscrit chez M. Féret, un savant archéologue de Dieppe, et avait songé à en faire l'acquisition pour le donner à la ville de Québec comme "un souvenir et une relique de son fondateur". Mais il n'avait pu réussir à se le procurer. Il s'était contenté d'en faire un résumé et quelques extraits, qu'il avait envoyés à M. Viger.

Plus hardi et plus heureux que lui—*audaces fortuna juvat*—l'abbé Casgrain,[2] dans un voyage qu'il fit en France en 1868, obtint de M. Féret la permission de copier tout le manuscrit. Il le fit de sa propre main: sa copie est la reproduction parfaite du manuscrit de Dieppe. A cette copie est jointe la reproduction des soixante-deux gravures ou planches, vraiment magnifiques, quelques-unes coloriées, que Champlain avait dessinées lui-même pour illustrer son journal de voyage.

C'est cette copie de l'abbé Casgrain, avec ses gravures, conservée avec soin dans les archives du séminaire de Québec, où nous avons eu le plaisir de la voir nous-même, que suivit Laverdière pour faire la première édition du *Voyage de Champlain aux Indes Occidentales.* Pour ce voyage, en effet, ce n'est pas seulement la première édition canadienne, c'est tout à fait la première édition.

Comment ce manuscrit de Champlain, demeuré jusque-là inédit, se

---

[1] Philippe III, petit-fils de Charles-Quint, et fils de Philippe II que son *Invincible Armada* a rendu célèbre.

[2] Le huitième président de la Société Royale (1889-90).

mière, qui renferme trois cent vingt-huit pages, n'est à peu près que la répétition des voyages de Champlain de 1603 à 1618; la deuxième partie a trois cent quarante-trois pages, et continue le récit de ses voyages jusqu'en 1632; enfin la troisième partie est le traité de Champlain sur la Marine. Tout cela forme le tome cinquième des Œuvres de Champlain, qui fut publié à Paris, "chez Louis Sevestre", en 1632. Ce volume est dédié au cardinal de Richelieu, en des termes qui ne semblent pas du tout la manière ordinaire de Champlain. Pour nous servir d'une expression piquante de M. de Puibusque, "il y parle une autre langue que la sienne." [1]

"Il est évident, dit Laverdière, en parlant de l'édition de 1632, qu'une main étrangère s'est chargée de la révision de l'ouvrage de Champlain."

Laverdière va plus loin et précise davantage:

"Non seulement, dit-il, quelqu'un a revu, ou même retouché le récit de Champlain, mais on peut affirmer que ce travail a été fait soit par un jésuite, soit par un ami des religieux de cet ordre.

"Il faut remarquer, ajoute-t-il, que cette édition s'imprimait au moment où les Récollets faisaient d'inutiles efforts pour rentrer dans une mission dont ils étaient les fondateurs, tandis que les Pères Jésuites revenaient seuls, évidemment protégés par la toute-puissance de Richelieu...

"Que le lecteur examine attentivement l'édition de 1632, et il remarquera que l'on retranche à dessein, des éditions précédentes, tout ce qui était en faveur des Récollets, et que l'on y introduit au contraire tout ce qui pouvait servir la cause des Jésuites... Le caractère brave et loyal de Champlain ne permet pas de supposer qu'il ait eu recours à de pareils procédés..." [2]

Quoi qu'il en soit, cette édition de 1632 est extrêmement intéressante; et quant à la seconde moitié du volume, elle est certainement, comme le dit Laverdière, "unique et indispensable" pour l'histoire de la Nouvelle-France. C'est là que l'on trouve, en effet, le récit du premier séjour un peu prolongé de Champlain à Québec, de 1620 à 1624, et celui de l'érection du premier fort Saint-Louis; celui de l'arrivée des premiers jésuites en Canada, en 1625, sous les auspices du duc de Ventadour;[3] puis le récit de la prise de Québec par les Anglais en 1629, et celui de la reddition du pays à la France en 1632.

* * *

[1] *Œuvres de Champlain*, p. 637.

[2] *Ibid.*, p. 638.

[3] Henri de Lévy, duc de Ventadour, 4e vice-roi de la Nouvelle-France (1625-1627).

tention, dans sa vie et sa conduite, étant le plus modeste, le plus vrai et le plus sincère des hommes, son style est l'expression simple et naturelle de sa pensée et de ses sentiments.

Pour apprécier, du reste, avec justice le style de Champlain, il faut évidemment se reporter au temps où il écrivait, au commencement du dix-septième siècle, alors que la langue française n'avait pas encore atteint son dernier degré de perfection; et nous mettant bien dans le milieu où vivait le fondateur de Québec, nous n'hésiterons pas à dire: " Quel bon et beau style que le sien, quelle limpidité et quelle clarté ! "

Pour moi, l'avouerai-je en toute simplicité, quand je me sens fatigué de la lecture du *Correspondant* ou de la *Revue des Deux-Mondes,* des grands écrivains, nos maîtres d'aujourd'hui—on se fatigue des meilleures choses—il m'arrive souvent de prendre mon Champlain, de l'ouvrir à tout hasard, et d'en parcourir quelques pages. Cette lecture me rafraîchit et me réconforte. Je fais mes délices de ce style sans prétention, et j'y reviens toujours avec plaisir.

Que de fois je me suis demandé où Champlain avait puisé ce savoir, ces connaissances qui nous étonnent, et acquis ce degré de culture intellectuelle dont témoignent ses écrits ! Il appartenait à une humble famille de pêcheurs de la Saintonge; on ne voit pas qu'il ait fréquenté les grands collèges, les universités de l'époque; quand il a été en rapport avec les grands personnages de son temps, et présenté même à la Cour, il était déjà remarqué comme un homme de bonne éducation. Il s'est fait lui-même; il a su profiter de toutes les occasions de s'instruire; il était, comme l'a si bien dit Laverdière, un " observateur intelligent." Mais il faut supposer, avant tout, qu'il avait reçu une forte éducation de famille; et son exemple m'a toujours laissé une haute idée de l'instruction primaire qui se donnait, à son époque, sinon dans toute la France, du moins à Brouage, son pays natal.

* * *

Que savions-nous donc de Champlain, avant la publication de ses Œuvres par Laverdière? Qu'il avait fondé Québec en 1608, et que de 1608 à 1635 il avait réussi à faire un tout petit commencement de colonie au Canada. Bien maigre renseignement, avouons-le, et qui était loin de rendre justice à la mémoire de ce grand homme.

De son caractère noble et élevé, de son savoir, de ses connaissances, de ses nombreux et intéressants voyages, de son talent de narrateur, nous ne pouvions avoir qu'une idée confuse et imparfaite. Comme l'a si bien dit Laverdière, " toute la vie de Champlain est dans ses Œuvres." Et nous ne les connaissions pas... Nous ne pouvions nous faire une juste idée de la largeur de ses vues, de l'étendue de ses projets, parce qu'il n'avait pu mettre à exécution qu'une petite partie du plan qu'il avait conçu. On juge d'un arbre par ses fruits, et d'un homme par ses actions: l'œuvre que Champlain avait pu réaliser sur les bords du Saint-Laurent, toute méritoire qu'elle était, était cependant peu de chose.

Mais voilà qu'en 1870 on exhume de la poussière où ils dorment depuis plus de deux siècles les quelques rares—très rares—exemplaires de ses récits de voyages, les précieux volumes de ses Œuvres; ils sont édités de nouveau, mis à la portée du public; et nous y découvrons l'ensemble de ses vues, qui sont à la fois superbes, raisonnables, faciles à réaliser. C'est tout un nouveau Champlain qui nous apparaît. Ce n'est plus le simple fondateur d'une bourgade sur les rives du Saint-Laurent, c'est un grand esprit colonisateur, c'est un créateur d'empire, c'est une intelligence qui est d'au moins cent ans en avant de celle de ses contemporains.

Ce que veut Champlain, c'est la création d'une nouvelle France en Amérique; et il ne propose pour la réalisation de son plan que les moyens les plus simples et les plus pratiques: ce qui est le caractère du génie. Mais il lui faut lutter contre les fausses idées de son temps; il a les mains liées; il ne peut mettre à exécution qu'une toute petite partie de ses vastes et magnifiques projets. Qu'importe; il en a tout le mérite. Sa figure grandit, à nos yeux, en proportion des obstacles qu'il rencontre; et nous l'apprécions non plus seulement pour ce qu'il a fait, mais en proportion de ce qu'il voulait faire, et que la maladresse et souvent le mauvais vouloir de ses contemporains l'ont empêché de réaliser.

Ah, si l'on avait compris la politique de Champlain! Que de guerres désastreuses pour la France dans les trois derniers quarts du dix-septième siècle eussent été évitées! Et quel magnifique et solide empire colonial elle eût pu établir en Amérique!

Champlain, étudié et considéré dans ses Œuvres, sera désormais pour nous non plus seulement le fondateur de Québec, mais l'un des meilleurs et des plus pratiques esprits colonisateurs que la France ait produits.

II.

Après avoir rendu à Champlain un hommage que je crois juste et mérité, ne convient-il pas d'apprécier aussi le travail du savant, doublé d'un artiste, qui lui a érigé un si beau monument par la publication de ses Œuvres?

Il ne s'agit plus de l'œuvre matérielle et typographique; nous en avons déjà parlé. Mais que dire du travail intellectuel dont Laverdière

On conçoit qu'avec de pareils moyens il est facile de tirer des conclusions comme celle-ci: "Cette campagne avait été entreprise pour des motifs d'intérêt particulier, et elle tourna au grand désavantage de la religion et de celui de la France."

Ailleurs, il se moque agréablement des suppositions du même auteur au sujet du prénom de Champlain, Samuel:

"De ce que le nom de Samuel, donné à Champlain, était, paraît-il, inusité alors chez les catholiques, et en honneur chez les protestants, l'auteur de l'*Histoire de la colonie française en Canada* insinue que Champlain avait bien pu naître calviniste. Il y avait, ce semble, une insinuation plus naturelle à faire: c'est que, dans cette hypothèse, le père et la mère de Champlain avaient dû apostasier; car son père s'appelait Antoine, et sa mère Marguerite, deux noms tout à fait catholiques."

C'est par de nombreuses notes de ce genre relatives à Champlain, et une foule d'autres destinées à éclaircir des points obscurs de notre histoire, que Laverdière a enrichi son édition; c'est aussi par les préfaces si intéressantes qu'il a ajoutées à celles de l'auteur. Laverdière a mis d'abord une préface générale en tête de son ouvrage; il a aussi une préface spéciale pour chaque volume. Ce sont de véritables petits chefs-d'œuvre d'exposition historique; et il faut dire la même chose de sa notice biographique de Champlain: elle est écrite sans apprêts, avec simplicité, mais d'une manière si exacte, qu'elle sera toujours citée comme un modèle de biographie.

On le voit, s'il faut louer sans réserve l'œuvre matérielle et typographique de l'artiste qui dressa un si beau monument à la mémoire de Champlain, le travail intellectuel dont il enrichit ce monument ne mérite pas moins nos éloges.

* * *

Artiste, Laverdière l'était vraiment dans toute l'acception du mot: il était musicien, chantait admirablement, et pouvait lire n'importe quelle partition;[1] il était un dessinateur émérite; il était très entendu en architecture: ou plutôt que n'était-il pas, et que ne savait-il pas?

Nous avons rendu hommage à l'artiste, à l'éditeur distingué des *Œuvres de Champlain.* Disons maintenant un mot de l'homme, que nous avons si bien connu et appris à estimer. Il est resté dans notre mémoire comme le type de l'homme aimable, franc et sans dol, incapable d'aucune bassesse, bon et serviable, à la fois doux et ferme, persévérant dans ses résolutions.

---

[1] C'est à Laverdière que l'on doit la belle édition du Graduel et du Vespéral romain, imprimée à Québec chez Desbarats en 1864; celles des Chants lithurgiques, du Paroissien noté, de la Semaine Sainte, etc.

C'était une nature riche et facile, extrêmement bien douée, pleine de talents et de ressources, et qui pouvait rendre des services inappréciables à une institution comme le séminaire et l'université. M. Casault, qui s'entendait en hommes, n'avait pas manqué de se l'attacher comme un précieux auxiliaire.

Son extérieur n'avait cependant rien de brillant; il paraissait même un peu gauche et lourd dans ses allures. Tout en étant d'une conversation facile, dans l'intimité, il n'était nullement doué du don de l'éloquence; il n'avait rien non plus de bien remarquable comme professeur. Sa véritable fonction, c'est celle qu'on lui avait confiée, en le nommant bibliothécaire de l'université. Il était là vraiment à sa place: homme d'ordre et de classification, d'un savoir universel, d'un goût sûr, capable d'apprécier toutes choses à leur juste valeur.

C'était un heureux caractère, toujours de bonne humeur, toujours prêt à rendre service, et n'avait rien de cet égoïsme qui dépare souvent les plus belles qualités des savants et des érudits. Plein de connaissances, il était d'un accès facile à tous ceux qui venaient le consulter, il les éclairait, les soutenait, les encourageait dans leurs travaux. Il était d'une tranquillité d'âme admirable; et lorsque je pense à Laverdière, je ne puis m'empêcher de me rappeler l'*impavidum ferient ruinæ* d'Horace [1].

Ses amusements, c'était son violon, quand le mauvais temps le retenait à sa chambre; c'était surtout sa chaloupe, dans la belle saison. Les mariniers du port étaient sûrs de le voir arriver à certaines heures de la journée. Il tendait ses voiles, détachait son embarcation, et filait une course du côté de Maizerets, ou bien vers le Château-Richer, son pays natal, où tout le monde est un peu navigateur. Sa chaloupe, dit-on, lui joua plusieurs fois de mauvais tours, mais il ne s'en vantait pas.

Sa grande passion, c'était celle de l'histoire, de l'histoire de notre pays, surtout, qui l'occupait sans cesse, qu'il étudiait et cherchait à approfondir dans les plus petits détails; et lorsque quelque problème se présentait à son esprit, il ne se donnait de repos qu'il n'en eût trouvé la solution.

Il nous semble encore le voir arriver, un matin, au presbytère de Notre-Dame de Québec,[2] armé d'un pic et d'une pelle, affublé d'une vieille soutane aux manches retroussées. Il venait demander au curé Auclair la permission de travailler un peu dans le petit jardin de la cure: " J'ai l'espoir, dit-il, d'y trouver Notre-Dame-de-Recouvrance.—Bonne chance, lui répond l'excellent curé." La question de déterminer l'en-

[1] Ode 3e du livre III.

[2] Nous étions alors vicaire à la Basilique.

Certes, en voilà assez, il nous semble, pour rendre la mémoire de Laverdière infiniment chère à tous ceux qui s'occupent d'histoire canadienne, et qui savent apprécier les sources dont il leur a rendu l'accès si facile. N'était-il pas juste de lui rendre quelque hommage? et ne convient-il pas de lui garder un souvenir reconnaisant?

II.—*Deux familles rurales de la rive sud du Saint-Laurent: Les débuts de la complication sociale dans un milieu canadien-français.*

Par M. LÉON GÉRIN.

(Lu le 26 mai 1908.)

Dès 1886, l'auteur recueillait sur place les premiers matériaux de la monographie de l'Habitant de Saint-Justin, rive nord du Saint-Laurent. Publiés d'abord dans la revue *la Science Sociale,* de Paris, ces renseignements furent, en 1898, reproduits dans la collection des Mémoires de la Société Royale du Canada, en plus grand détail, et augmentés de notes sur deux paroisses attenantes à Saint-Justin.

Sous sa forme nouvelle, cette étude avait un triple intérêt: elle présentait la description méthodique d'un type traditionnel de cultivateur canadien-français observé sur la terrasse, c'est-à-dire à l'arrière plan de la plaine étroite qui borde la rive nord du fleuve; elle contenait les ébauches de deux variétés du même type, celle de l'Habitant de Maskinongé, ou du bord même du Saint-Laurent, et celle de l'Habitant de Saint-Didace, ou de la montagne; enfin, elle faisait connaître la méthode d'observation sociale de Frédéric Le Play et d'Henri de Tourville, qui avait guidé l'auteur dans ses observations et ses déductions, et dont, même, la nomenclature se trouvait en partie reproduite dans les cadres de l'exposition.

L'auteur présente aujourd'hui deux autres types, observés cette fois dans la plaine qui forme la rive sud du Saint-Laurent: le cultivateur de Saint-Dominique (comté de Bagot), le colon-émigrant de l'Ange-Gardien (comté de Rouville). Cette étude, comme la précédente, lui paraît avoir un intérêt scientifique multiple. Elle forme une nouvelle contribution à la connaissance de l'Habitant et de la géographie sociale du Canada français. Elle signale par rapport au type primitif de notables variations, principalement de deux sortes: il y a le type que le nouveau régime industriel et commercial a eu l'effet d'élever dans l'échelle sociale, et d'autre part, le type que ce même régime a eu l'effet d'instabiliser. Pour plus de rapidité et de clarté, on n'indiquera ici que les caractères les plus saillants de chacun de ces types, par comparaison avec celui ou ceux précédemment décrits. Enfin, les divisions mêmes de l'étude accusent un changement, un progrès, peut-être, dans la méthode d'observation et d'exposition, en ce qu'il rend plus facile, plus exact et plus rapide le travail d'analyse, de comparaison et de classification des types sociaux.

particuliers payés; et à l'extinction de cette jouissance, les biens iront exclusivement aux enfants issus du mariage, lesquels "en feront le partage par parts égales". On ne voit plus ici chez le père de famille la préoccupation absorbante de maintenir le domaine intact entre les mains de quelqu'un de ses descendants et de favoriser la création de nouveaux domaines agricoles, non plus que le même parti pris d'avantager dans ce but un fils au détriment des autres, ou d'une manière générale, les garçons au détriment des filles.

Les rapports établis entre les divers membres de la famille de Saint-Dominique, et qui assurent, en même temps que sa subsistance matérielle, son bien-être moral, c'est-à-dire la paix au foyer, ne diffèrent pas très sensiblement de ceux observés entre les membres de la famille de Saint-Justin. Mais toutes les différences qui ont été relevées sont dans le sens d'une plus grande distension de ces rapports, d'une plus grande indépendance des membres du groupe les uns vis-à-vis des autres. Dans les deux cas nous voyons que la mère jouit dans la famille d'une autorité presque égale à celle du père, et que, d'autre part, les enfants jouissent vis-à-vis de leurs parents d'un certain laisser-aller, double particularité assez remarquable quand on la rapproche du tableau que nous font les écrivains de la famille paysanne dans les provinces de la France d'où sont venus nos ancêtres. Nous avons vu que ces différences d'organisation entre la famille du paysan français et celle de l'Habitant canadien s'expliquent assez bien par les conditions d'existence mêmes dans lesquelles ce dernier s'est trouvé placé depuis son installation en Amérique: abondance du sol disponible, proximité d'immenses étendues inoccupées, qui ont fourni à l'origine la matière première de deux grandes industries de simple récolte, la traite des fourrures, puis l'abatage et le flottage du bois; industries primitives, exercées à de grandes distances des établissements agricoles, qui ont tenu les chefs de famille, durant de longues périodes, éloignés de leurs foyers, laissant la mère de famille chargée de la direction, non seulement du ménage, mais aussi de la ferme. La mère a vu dès lors son influence grandir. De même ces industries, et plus tard le développement des centres de commerce et de fabrication, la construction de chemins de fer, ont ouvert à la jeunesse de nouveaux débouchés et occasionné dans les campagnes une rareté de main-d'œuvre favorable à l'indépendance des enfants.

Mais cette émancipation de la femme et des enfants est encore plus en évidence dans la famille de Saint-Dominique que dans celle de Saint-Justin. Par exemple, à Saint-Justin, la femme coopérait bien avec son mari à la confection du testament; dans le cas de survivance lors de la dissolution de la communauté par la mort de son conjoint, elle entrait en possession de la moitié des biens accumulés pendant le mariage par le travail des époux, et obtenait la jouissance viagère (ou durant viduité) de la part laissée par son mari. A Saint-Dominique, le chef de famille fait seul son testament, mais il institue sa veuve sa légataire universelle, exécutrice testamentaire et administratrice. " Je nomme madite épouse mon exécutrice testamentaire et l'administratrice des biens de ma succession, et comme telle elle exercera cette charge la durée de sa jouissance; sans être tenue de faire inventaire, elle pourra vendre, échanger, transporter ou autrement disposer de mes capitaux et biens meubles et immeubles pour le prix et suivant les conditions qu'elle jugera avantageuses, de gré à gré, sans aucune formalité de justice, et sans le consentement ni l'intervention de mes héritiers et légataires, et elle pourra faire ces dispositions chaque fois qu'elle le jugera avantageux à ma succession."

Il semble bien que la personnalité de la mère de famille s'affirme davantage sous ce régime. A Saint-Justin, la femme, à titre d'associée, coopérait avec son mari à la confection du testament, et dans le cas de prédécès de celui-ci, devenait l'associée de son fils héritier. A Saint-Dominique, la mère de famille, à titre de légataire universelle, d'exécutrice et d'administratrice absolue, à la mort du père de famille remplace celui-ci et exerce tous ses droits. De même il m'a paru que dans la famille de Saint-Dominique, les enfants, les garçons surtout, se montraient plus impatients de toute contrainte, plus jaloux de leur indépendance.

En ce qui regarde l'éducation des enfants, la famille de Saint-Dominique présente par rapport à celle de Saint-Justin des divergences intéressantes. Nous avons vu que dans la famille traditionnelle de Saint-Justin, et notamment chez celle que nous avons prise comme exemplaire, l'éducation des enfants n'existe guère comme fonction distincte. Elle consiste dans une grande mesure à inculquer à l'enfant par l'exemple ou la parole, dans la pratique quotidienne, une certaine routine fort simple. L'école, même la petite école, tenait beaucoup moins de place dans ce système d'éducation que la vie en famille, le travail de la ferme et la parole du curé. A Saint-Dominique, on observe déjà plus de complication. C'est ainsi qu'Antoine C., bien que lui-même cultivateur de progrès, n'hésite pas à se priver quelque temps, dans le cours de l'été, des services de son jeune fils Omer, pour l'envoyer faire un stage chez un apiculteur de la banlieue de Saint-Hyacinthe. C'est ainsi qu'il met ses enfants, et entre autres son plus jeune fils Hector, à même de faire un cours d'études classiques.

Il est intéressant de constater que dans la même mesure où l'atelier

abondants, plus favorables à la culture que la région montagneuse du nord.

Saint-Dominique, sur le cours mitoyen et sur la rive sud du Saint-Laurent, à 34 milles à l'est de Montréal (exactement 45° 34′ lat. N., par 72° 50′ 30″ long. O. de Greenwich), est situé dans la vallée, et même dans la partie de la vallée où elle atteint sa plus grande largeur, et où parallèlement les argiles et les terres franches acquièrent le plus d'extension. On observera, d'un autre côté, que Saint-Dominique n'est pas au cœur de cette zone de la vallée qui est le mieux partagée au point de vue de la nature du sol, la zone argileuse, mais sur sa bordure extérieure, et à cheval sur la zone sablonneuse moins fertile.[1] Sa situation à cet égard est intermédiaire entre celle de paroisses situées complètement dans la zone argileuse et connues pour la fertilité de leur sol, comme Saint-Simon et Saint-Hugues, et celle d'endroits compris dans la zone sablonneuse et à sol pauvre, comme certaines parties de Saint-Liboire. La terre de C., à proximité du village de Saint-Dominique, sur un exhaussement de la vallée, se compose d'un sol de consistance moyenne, suffisamment profond et calcaire, mais où déjà l'assise rocheuse affleure sur certains points formant des bassins d'un drainage difficile. Au point de vue de la nature du sol, les conditions de la région de Saint-Dominique, ne diffèrent pas très sensiblement de celles présentées par la région de Saint-Justin,[2] sur la rive nord, si ce n'est par le développement beaucoup plus marqué, sur la rive sud, du pays de plaine à sol argileux et fertile. Il importe également de noter que la zone montagneuse qui ferme la vallée à quelque distance au sud de Saint-Dominique est, en règle générale, mieux partagée au point de vue de la nature du sol que la zone montagneuse laurentienne sise immédiatement au nord de Saint-Justin.

Mais c'est surtout en ce qui regarde les moyens de transport que la région de la rive sud, où est située Saint-Dominique, est mieux partagée que la région de la rive nord, où est située Saint-Justin. Le pays plat qui, sur la rive nord, à la hauteur de Saint-Justin, n'a que 15 milles de largeur, atteint 50 milles de largeur sur la rive sud, à la hauteur de Saint-Dominique. Cette configuration plane du sol est par elle-même, on le conçoit facilement, une condition favorable au développement des transports. Il est vrai qu'à l'origine le pays plat, tout comme le pays montagneux, était hérissé de forêts épaisses; mais à travers ces forêts coulaient plusieurs rivières importantes, qui, navigables en été, présentaient en hiver sur leur surface glacée une voie naturelle largement ouverte. Le

[1] Saint-Dominique est indiqué sur la carte par la lettre "b".
[2] Indiqué sur la carte par la lettre "a".

C., son domaine comprend quarante arpents de diverses essences forestières, et notamment une belle érablière; mais en cultivateur prévoyant, à l'affût de tous les progrès, il a déjà, en 1887, commencé à utiliser chez lui comme combustible la tourbe qu'il extrait tout en écobuant sa terre de la Savane.

Le Travail.—Ce qui vient d'être dit permet de se rendre compte que les travaux désignés, en science sociale, sous le nom de simple récolte tiennent assez peu de place à Saint-Dominique. Il en est de même des industries domestiques que, à Saint-Justin, nous l'avons vu naguère, les hommes aussi bien que les femmes pratiquaient en grand nombre accessoirement à la culture. Les femmes dans notre famille type de Saint-Dominique ne filent ni ne tissent; elles font de la couture, mais en utilisant des matériaux achetés au dehors, et en s'inspirant de cahiers de modes obtenus à la ville. Quant aux hommes, il se trouve fort peu de leurs outils qui soient de fabrication domestique; la plupart ont été achetés de maisons faisant une spécialité de la confection d'instruments aratoires.

A peu de distance du village de Saint-Dominique et tout à côté de la ferme de C., sur la crête du plateau et le long de la pente tortueuse qui conduit à la plaine, il a surgi un hameau de carriers et de chaufourniers, il s'est développé une double industrie d'extraction qui a son débouché à la ville voisine.

Enfin, dans toute cette partie du pays, on observe, et on observait dès 1887, date de mes premières observations, un commencement de spécialisation agricole. A ce moment C. s'appliquait surtout à la production du lait. Il nourrissait de vingt à vingt-cinq vaches, dont il portait le lait à une fromagerie établie dans le village même de Saint-Dominique. La fabrication du fromage ne livrant comme déchet qu'un sérum ou petit-lait impropre à l'alimentation des veaux, C. ne pratiquait pas l'élevage. A l'âge de quelques jours, ou au plus de quelques semaines, les veaux étaient abattus, écorchés et les peaux portées à la tannerie. Mais ce petit-lait de fromagerie, additionné de grains moulus ou de farine grossière, est utilisable dans l'engraissement des porcs. Aussi C. engraissait-il chaque année, tant pour la consommation domestique que pour la vente, nombre de cochons.

Accessoirement à cette double spécialité, production de lait pour la fromagerie et engraissement de porcs, C. s'adonnait sur une échelle plus petite à l'élevage des chevaux; il s'en trouvait sept dans son écurie. Dans ce but, de concert avec son fils et voisin Amédée, il avait fait l'achat d'un étalon clyde de race pure. Le poulailler et le jardin potager ne livraient de produits pour les besoins de la famille; le verger com-prenait un peu plus de cinquante pommiers, mais qui ne donnaient pas encore de fruits. Enfin l'installation d'un petit rucher ne datait que de cette année-là. Quant à la culture du sol, elle se faisait entièrement en vue de l'alimentation du troupeau.

Cette spécialisation du travail de la ferme, bien qu'elle ne fût pas poussée très loin encore, avait pour corollaire, on le conçoit, le développement de son aspect commercial, et aussi, comme nous le verrons, un progrès notable dans les méthodes d'exploitation. Nous avons vu que, à Saint-Justin, en 1886, le cultivateur s'appliquait à produire directement tout ce qu'il utilisait ou consommait. A Saint-Dominique, l'année suivante, je constatais que l'achat et la vente tenaient une plus large place dans les opérations du cultivateur. Nous savons déjà que C. n'élevait pas de génisses, mais, au contraire, achetait des vaches, ou en vendait, suivant les nécessités du moment. Il se procurait aussi par voie d'achat des porcs pour l'engraissement, quand les truies de sa porcherie n'avaient pas eu des portées assez nombreuses. Il achetait même, et parfois en assez grande quantité (4,000 livres à la fois), les farines grossières, ou les grains moulus, requis pour leur engraissement. De même aussi, à l'occasion, il achetait des chevaux au dehors, ou en vendait de ceux de son écurie, et moyennant une taxe en argent, louait les services de son reproducteur clyde. Il ne se bornait pas à utiliser les fumiers de ses étables, mais achetait, au prix de 50c la tomberée, tout ce qu'il en pouvait obtenir des artisans du village. En vue de l'ensemencement de ses prairies, il récoltait lui-même sa graine de mil (fléole), mais d'autre part, il se procurait chez les grainetiers de la ville, les graines d'autres plantes fourragères, d'un usage moins général, comme le pâturin d'eau, les agrostides, les fétuques, ainsi que celles des divers trèfles.

Encore assez peu sensible dans l'exploitation proprement dite des vaches, et même des chevaux, le progrès des méthodes était déjà, en 1887, manifeste dans les opérations culturales. Par exemple, C. avait drainé une grande étendue de sa terre au moyen de fossés souterrains. Non seulement avait-il des prairies de trèfle et de diverses graminées, non seulement prenait-il des mesures spéciales pour extirper de ses prairies les mauvaises herbes, et notamment la marguerite, mais il avait réussi à établir chez lui des luzernières, ce qui lui permettait de donner à ses vaches au pâturage, ainsi qu'à ses chevaux, un supplément de nourriture verte dès la fin de mai ou le commencement de juin. La luzerne repoussait assez vite pour permettre au moins trois coupes durant la saison.

C. avait adopté plusieurs autres pratiques de la culture avancée, et grâce à ces pratiques, grâce aussi à l'utilisation d'instruments aratoires quin, jardinier de la banlieue de Saint-Hyacinthe, lui vend des ruches, dont Lamoureux, cultivateur, lui fournit les essaims et qu'il s'engage à garder pour lui, le premier été et le premier hiver. Gévry, le boulanger, Champigny, Beauregard, cultivateurs, etc., sont aussi en relations d'affaires les plus diverses avec le propriétaire de la ferme.

Cette tendance à la spécialisation, ce caractère commercial de la culture, qui se manifestent ici timidement encore, s'observent sous diverses formes dans toute l'étendue de cette large plaine de la rive sud du Saint-Laurent, que baignent les rivières Richelieu et Yamaska. Dans un certain rayon de Montréal, c'est la culture potagère, c'est l'arboriculture fruitière, c'est la production du lait pour la vente. A l'arrière plan, c'est la culture du foin pour l'alimentation des marchés de la grande ville. Puis, au delà de cette zone où la culture se fait en vue de la fourniture des marchés urbains, nous voyons apparaître la production du fromage et du beurre en petites fabriques coopératives et en vue de l'exportation. C'est à Saint-Hyacinthe, à proximité de Saint-Dominique, que se fondait il y a vingt-six ans la société d'industrie laitière de la province de Québec, et c'est là aussi que s'est centralisée toute l'activité de la population de la province à cet égard.

La Propriété.—En 1887, C. était propriétaire, à proximité du village de Saint-Dominique d'une terre de 30 arpents de longueur, par 7 arpents de largeur, soit 210 arpents de superficie, pourvue de nombreux bâtiments de ferme: grange-étable, écurie, porcherie, hangar à grains, remise à bois, maison d'habitation, ayant pour dépendances, une remise, une grange, une porcherie, un poulailler: le tout d'une valeur d'à peu près huit mille dollars. En vue de l'exploitation de ce domaine, C. avait en permanence de 20 à 25 bêtes à cornes, 7 chevaux, et engraissait chaque année de 20 à 25 porcs. Son matériel de ferme, charrues, herses, rouleau, semoir, faucheuse, houe à cheval, rateau à cheval, voitures d'hiver et d'été, batteuse mécanique, était très complet, et avec le troupeau devait avoir une valeur d'au moins deux mille dollars. En outre, C. exploitait accessoirement, à la Savane, à quatre milles du domaine principal, une terre de 120 arpents, d'une valeur approximative de deux mille cinq cents dollars.

En somme la situation financière de la famille C. m'a paru comparable à celle des familles les plus aisées de Saint-Justin, avec cette différence qu'à Saint-Dominique la propriété foncière tenait dans l'économie familiale relativement moins de place, et la richesse mobilière proportionnellement plus de place qu'à Saint-Justin. Au reste, déjà nous avons constaté, en faisant l'analyse des fonctions du groupement famille à Saint-Dominique, qu'on y fait moins qu'à Saint-Justin reposer la prospérité de l'individu sur la constitution et la transmission intégrale d'un domaine agricole.

A Saint-Dominique comme à Saint-Justin, on relève les vestiges d'un ancien régime de grande propriété, mais sans ce qui en est le complément naturel, c'est-à-dire la grande exploitation du sol. Etabli par Richelieu et Louis XIV, dès les débuts de la colonisation de la Nouvelle-France, dans l'espoir de hâter le peuplement du pays, en même temps que dans le but de faire vivre des communautés religieuses et toute une gentilhommerie de robe ou d'épée, ce régime fut maintenu artificiellement par les pouvoirs publics durant toute la période coloniale française et quatre-vingt-dix ans de la période de l'occupation anglaise. En 1854, depuis longtemps battu en brèche par les progrès de l'industrie et du commerce, auxquels il est une entrave, ainsi que par les nouvelles conceptions de l'ordre social qui ont cours au sein de certaines classes de la population, ce régime artificiel de grande propriété est aboli par la législature. Le moulin banal et autres privilèges des seigneurs sont supprimés; le gouvernement rachète à ceux-ci leurs droits de lods et ventes et en décharge les habitants; enfin, ceux-ci sont autorisés à se libérer des droits de cens et rentes, moyennant le versement au seigneur, une fois pour toutes, du capital représenté par ces droits annuels. Or un fait assez significatif et qui atteste bien la formation communautaire du type, c'est que, à Saint-Dominique comme à Saint-Justin, très peu de familles se sont prévalues de cette disposition de la loi et se sont libérées de l'obligation de payer les droits de cens et rentes aux concessionnaires de seigneuries. Même C., homme d'initiative pourtant, ne s'est pas libéré de cette obligation, qui d'ailleurs se réduit au versement de quelques dollars par année.

On le voit, le groupement supérieur de la vie publique, le pouvoir central, sous l'empire de faits et d'idées auxquels la famille rurale était restée dans une grande mesure étrangère, a fait plus que sa part pour la suppression d'une institution surannée et encombrante de la vie privée; tandis que la famille rurale, entravée par sa formation communautaire, a laissé subsister les dernières traces de ce régime sous forme de redevances seigneuriales, d'ailleurs minimes. Lors de mon séjour à Saint-Dominique les cens et rentes étaient payés à une famille de rentiers et de banquiers de Saint-Hyacinthe, détentrice de la seigneurie.

4) Mode d'Existence.—Le régime alimentaire du cultivateur de Saint-Dominique rappelle à beaucoup d'égards celui de l'Habitant de Saint-Justin: il est substantiel, sans être délicat. S'il s'est opéré quelque progrès à cet égard, il s'annonce par les susceptibilités que l'on manifeste sur ce chapitre plutôt que par des réformes accomplies.

Mais relativement à l'habitation, il y a lieu de relever une particularité assez frappante. Tandis que C., avec sa femme et ses enfants, ainsi que son beau-père et sa belle-mère, occupe une des maisons d'habitation de la ferme, son vieux père, remarié, occupe avec sa seconde femme, partie d'une deuxième maison d'habitation, dont l'autre compartiment est occupé par la famille d'Amédée C., fils de C., sujet de la présente monographie, par un premier mariage, et aujourd'hui établi à son compte. On conçoit fort bien qu'Antoine C. garde chez lui son beau-père, vieillard paralytique, et sa belle-mère, en enfance, que leur fille Mme C. est mieux que tout autre en état de soigner. Mais qu'Antoine C., tout en restant en très bons termes avec son vieux père et la seconde femme de celui-ci, leur fasse une installation distincte, à la fois de la sienne et de celle de son fils Amédée, il semble bien que ce soit là la manifestation d'une tendance vers le particularisme encore assez peu commune dans nos campagnes.

En ce qui regarde le vêtement, il y a lieu de noter du nouveau: le remplacement des étoffes et confections domestiques par les tissus et confections du commerce. C'est que, en effet, une telle modification est susceptible de s'opérer beaucoup plus facilement et rapidement que celle du régime alimentaire. Pour changer la manière de s'habiller de tout un groupe de population, il suffit que, par l'intermédiaire des transports, elle ait accès à la ville, au commerce, aux patrons de modes; pour améliorer son régime alimentaire ou son mode de préparation des aliments, il lui faut avoir acquis, en même temps que la conception d'un état social supérieur, un peu de la science et de la pratique de l'économie domestique.

Dans l'ensemble, l'état de santé des membres de la famille de Saint-Dominique, comme celui des membres de la famille de Saint-Justin, sans être très mauvais, n'est pas aussi bon qu'on pourrait s'y attendre dans les conditions favorables de la vie au grand air. Ce défaut paraît devoir s'accentuer avec le temps. Antoine C., chef actuel de la famille, est moins robuste, moins résistant que son père; et les enfants qu'il a eus de son second mariage sont, en général, moins robustes que ceux qu'il avait eus du premier. Au fur et à mesure de la complication de la vie sociale, il semble qu'il soit plus difficile pour un groupe de population de se maintenir en bonne santé, si ce n'est par une observance plus rigoureuse et plus constante des prescriptions de l'hygiène.

5) Phases d'Existence.—Nombre des caractères du groupement à l'étude sont d'origine récente. Ainsi, dès le début, nous avons relevé un *commencement* de séparation entre les deux compartiments de ce groupement mixte, à la fois famille et atelier de travail. Nous avons constaté ensuite que le chef de la famille de Saint-Dominique, dans l'éducation et

l'établissement de ses enfants, suivait une ligne de conduite différente de celle suivie par la famille de Saint-Justin; mais si nous étions remontés à quelques années en arrière, nous aurions retrouvé ce même père de famille de Saint-Dominique appliquant à l'établissement de ses enfants du premier lit, et même de l'aîné du second, une pratique rappelant celle en vogue chez le type traditionnel de la rive nord du Saint-Laurent. C'est ainsi que Amédée, seul fils issu du premier mariage, tient de son père une partie de la terre qu'il exploite encore actuellement. Il est vrai qu'il a dû en conséquence de ce transfert verser au père une certaine somme; et notons ici en passant que cette pratique de régler par voie d'achat et de vente la grosse question de l'établissement des enfants s'observe assez fréquemment dans la région. De même Joseph, aîné des enfants du second lit, doit recevoir en récompense de ses services les 120 arpents de la Savane. Mais nous avons vu, d'autre part, que pour tous les autres enfants issus du second lit le père établit un régime de partage égalitaire, qui n'a pour correctif que l'arbitraire de sa veuve.

Au chapitre des Moyens d'existence, nous avons noté le développement, à une époque assez récente, de grands moyens de transport par terre et par eau, la disparition graduelle des productions spontanées et des industries domestiques, enfin les débuts de la spécialisation du travail de ferme. Parmi les progrès réalisés dans les méthodes de culture, il n'y en avait aucun, nous l'avons constaté, qui fût de date très ancienne, en 1887, année de mon premier séjour à la ferme, et la plupart n'étaient adoptés que de la veille. Il s'agit donc bien d'une époque de transition, d'une ère de transformation, suivant de près l'établissement et l'extension de grands moyens de transport par terre et par eau, et l'avènement d'un nouveau type de groupement social: le grand atelier industriel et commercial.

C. a tiré parti dans une plus grande mesure que beaucoup de ses voisins des conditions favorables créées par le nouveau régime: c'est l'effet de la valeur personnelle de C.; mais il ne faut pas perdre de vue une circonstance heureuse de sa jeunesse, qui a donné l'éveil à ses facultés latentes. Ses parents ne le destinaient pas à la culture: ils l'avaient envoyé au collège y faire un cours d'études classiques, et c'est le mauvais état de sa santé qui le força à quitter le collège pour se remettre à la culture. Il voulut compenser par plus de connaissances théoriques et d'intelligence ce qu'il lui manquait de vigueur physique, et cela au moment où les nouvelles conditions de la vie sociale allaient le mettre à même de le faire avec avantage.

A cet égard, il serait difficile de trouver un contraste plus grand que celui qui se manifeste du père au fils. Autant Antoine C. fils est désireux d'appliquer la science et la raison à la solution du problème agricole, autant son père, âgé seulement de vingt ans de plus, se montre sceptique à l'égard de ces enseignements théoriques. Pour celui-ci tout est affaire de routine et de force musculaire. Sans doute, dit-il, Antoine est assez entendu, mais il ne sera jamais aussi capable que son père, qui dans sa jeunesse était infatigable, et une fois sa journée faite à labourer, passait des parties de nuit à creuser des fossés au clair de la lune. Mais on était fort alors. On ne s'en laissait pas imposer non plus par les messieurs de la ville; s'il y avait quelque affaire à régler, quelque paiement à faire chez les avocats de Saint-Hyacinthe, on savait fort bien se présenter à la porte de devant; et de même, jadis, s'il arrivait qu'on eût des démêlés avec le "seigneur," souvent bureaucrate (partisan de l'oligarchie administrative de 1837), on ne craignait pas de lui parler dans le blanc des yeux et de frapper vigoureusement du poing sur la table.

Le fils, il est vrai, aurait pu répondre que pour sa part il traitait toujours sur un pied d'égalité avec les membres des professions libérales et les bourgeois les plus cossus, et cela sans effort, sans avoir à se mettre en colère. Sa formation pratique de cultivateur, jointe à l'instruction, tout incomplète qu'elle fût, acquise au collège, lui a assuré une supériorité dans toute entreprise se rattachant à l'exploitation des terres. Durant quelque temps chef de culture pour une compagnie betteravière établie à Farnham, il a représenté le comté de Bagot à la législature et a été membre du conseil d'agriculture de la province de Québec.

Note du 18 janvier 1909.—Au moment de remettre son manuscrit à l'imprimeur, l'auteur a voulu se rendre compte de ce qu'il était advenu des divers membres de la famille C. dans l'intervalle des vingt-deux ans écoulés depuis la date de ses premières observations, et voici les principaux renseignements qu'il a pu recueillir au cours d'un rapide voyage à Saint-Dominique.

Antoine C., chef de la famille en 1887, est décédé en 1892, âgé de près de 66 ans. Il n'avait jamais été très robuste et sur la fin de sa vie souffrait de rhumatismes. Son père l'a suivi dans la tombe, deux ans plus tard, âgé de près de 88 ans, à la suite d'une maladie de quelques jours seulement. Depuis plusieurs années il était sourd, mais c'était sa seule infirmité. Sa bru, femme du chef de famille, après avoir perdu son père Abraham V. et sa mère Geneviève Ch., longtemps valétudinaires, est elle-même morte, il y a un peu moins de deux ans, d'un cancer à l'estomac, à l'âge de près de 68 ans.

Les enfants se sont dispersés. Joseph, l'aîné de ceux du second lit, et que son père avait établi à la Savane, n'y est pas demeuré. Convaincu par une expérience de dix ou douze ans que sur une propriété de cette nature il lui serait impossible de prospérer, il s'en est défait au prix de deux mille sept cents dollars, et a fait l'acquisition d'une ferme plus étendue et à sol plus fertile dans la paroisse de Saint-Pie, voisine de Saint-Dominique. Il y vit à l'heure qu'il est avec sa femme et ses dix enfants, et réussit assez bien. Alma, l'aînée des filles, a épousé, encore très jeune, Léon D., dont l'établissement de commerce est le plus important de Saint-Dominique. Mère de deux enfants, elle occupe une fort jolie maison attenante au magasin. Elle a auprès d'elle la plus jeune de ses sœurs, Sara, restée fille, qui est modiste et occupe ses loisirs à peindre. Son autre sœur, Virgina, est depuis plusieurs années à New York, où elle gagne en service vingt-cinq dollars par mois. Hector, le plus jeune fils, marié et père de famille, exerce aujourd'hui, à la suite d'une tentative infructueuse de culture dans la paroisse de Saint-Valérien, rang de l'Egypte, le métier de fromager dans un village des environs.

C'est Omer, le deuxième fils qui détient le domaine paternel. Marié et père de sept enfants, dont l'aînée n'a pas plus de dix ans, il a aussi auprès de lui depuis un an la veuve du grand-père C., Pélagie Demers, laquelle, malgré ses 89 ans, encore active et sans la moindre infirmité, prodigue ses soins aux arrière-petits-enfants de celui qui fut son troisième mari. Omer, dans sa jeunesse annonçait un certain goût pour l'étude; il avait même été question de l'envoyer au collège; mais il ne s'est pas prévalu des bonnes dispositions de ses parents à cet égard, non plus que son frère plus jeune Hector, que le testament même de son père mettait pourtant en mesure de faire un cours d'études complet. Aujourd'hui en possession du domaine paternel, il ne montre pas cette belle confiance en soi, ce bel enthousiasme de la culture qui distinguaient son père. D'une des fenêtres de la pièce assez spacieuse qui sert à la fois de cuisine et de salle à manger, j'aperçois à quelque distance sur le domaine une plantation de 200 jeunes pommiers, une des dernières améliorations effectuées par le père, peu d'années avant sa mort; et tandis qu'une nombreuse marmaille s'agite à nos pieds, Omer m'explique qu'il a renoncé depuis plusieurs années à la culture de la luzerne, dont son père tirait si bon parti, et que l'hiver dernier il n'a pu mettre en hivernement ses abeilles que la sécheresse probablement avait fait mourir. C'est encore l'industrie laitière qui rapporte le plus de bénéfices, si toutefois on peut parler de bénéfices en des années aussi défavorables que l'année dernière et la précédente. Le feu a dévasté un coin de sa forêt l'été dernier; et Omer s'est empressé d'opérer le défrichement de cette partie et d'en tirer du bois de chauffage qu'il a vendu à Saint-Hyacinthe, en même temps que des planches et madriers de bois blanc (tilleul).

Récemment il a vendu la deuxième maison d'habitation (celle occupée jadis en partie par le grand-père et en partie par la famille d'Amédée), ainsi que le petit verger attenant. Toutefois, il avait eu soin avant d'aliéner cet emplacement d'enlever la petite grange qui faisait partie des dépendances et de la transporter à proximité des autres bâtiments de ferme.

Vis-à-vis de cette seconde maison d'habitation, de l'autre côté du chemin public, Amédée, seul fils issu du premier mariage d'Antoine C., s'est construit il y a quelques années déjà, une fort coquette maison dont l'aménagement indique un certain bon goût et une certaine recherche du confort. Bien qu'il n'ait guère plus de cinquante ans, et sa femme pas davantage, il jouit d'une réelle aisance, et voit autour de lui sept ou huit grands enfants, qu'il a pu faire convenablement instruire et dont les aînés commencent déjà à se tirer d'affaire par eux-mêmes. Un des fils est fromager au village même de Saint-Dominique; deux autres assistent leur père dans l'exploitation de la ferme; deux des filles sont encore au pensionnat.

En somme, s'il est difficile de se rendre compte dès à présent de la mesure dans laquelle Omer continuera l'œuvre du père et réussira à maintenir le domaine, le succès d'Amédée paraît assuré. Quant aux six sœurs de ce dernier, qui s'étaient mariées au Canada, elles sont toutes rendues aux Etats-Unis, leurs maris ayant été attirés vers l'Ouest américain par l'espoir d'une vie plus large et plus facile.

6) Relations du groupement famille-atelier avec les autres groupements sociaux.—Commençons par bien nous remettre en mémoire les principaux caractères d'organisation de notre type traditionnel, fondamental. A Saint-Justin, vers 1886, toute la vie sociale se concentre dans trois groupements principaux: la famille de l'Habitant, qui se charge d'assurer, pour le bénéfice de tous ses membres, le maintien du patrimoine commun, et vient en aide à l'établissement des jeunes, en retour des services qu'ils ont rendus à la communauté; le Voisinage ou Rang, dont toutes les familles s'assistent mutuellement au besoin, et coopèrent en vue de certains objets excédant la capacité ordinaire des familles prises isolément; enfin, la Paroisse, dirigée par le curé, se superposant à ces deux groupements élémentaires, étendant sur eux sa direction paternaliste, surtout dans l'ordre moral et spirituel.

A Saint-Dominique, vers le même temps, la situation est un peu plus compliquée. On y retrouve bien ces trois institutions traditionnelles, mais elles n'y ont plus le même caractère de simplicité, et elles n'y occupent plus tout le terrain. La famille de l'Habitant n'y a plus autant de stabilité, autant de cohésion; les relations de voisinage sont moins étroites. Les corvées récréatives, du moins en ce qui regarde les cultivateurs de progrès, comme celui dont il est ici question, sont d'un usage beaucoup moins fréquent. Enfin, l'institution paroissiale n'y a plus autant de prestige, autant d'autorité.

D'autre part, à côté de la traditionnelle famille d'Habitant dont le chef exploite avec l'aide seulement de sa famille, on voit apparaître un type de famille agricole où la routine n'est plus souveraine, où l'initiative individuelle, le désir d'améliorer son sort par ses propres efforts, est plus en évidence; mais, qu'on le remarque bien, ce n'est pas encore ici le type dominant. On y observe même le petit atelier patronal de culture, dont le chef recourt constamment à la main-d'œuvre salariée, comme chez Antoine C.; le petit atelier d'exploitation minière, comme au sein de ce hameau de carriers et de chaufourniers. Le petit atelier de fabrication n'y tient guère plus de place qu'à Saint-Justin; mais d'autre part, on y aperçoit plus vivement un phénomène à peine sensible à Saint-Justin: le patronage collectif exercé de loin par un nouveau type de groupement social, le grand atelier de fabrication, la grande maison de commerce, installée dans les centres urbains, le grand atelier de transports, dont les steamers sillonnent les mers, dont les voies ferrées rayonnent à travers les campagnes.

Dans la même mesure les professions libérales ont acquis de l'importance, les institutions religieuses ont pris de l'ampleur, et l'activité politique s'est développée, non pas tant sur place, non pas tant dans la paroisse même, mais dans les petites villes du voisinage, comme Saint-Hyacinthe, à la fois centre de fabrication, de chemins de fer, de commerce, doté de nombreuses maisons religieuses, collège, couvents, communautés d'hommes, de femmes, et où, enfin, depuis nombre d'années l'activité en matière politique est grande. On sait que ce sont les villages bordant la rivière Richelieu qui ont été les principaux foyers de l'insurrection de 1837, et c'est dans cette même région, à Saint-Hyacinthe notamment, que se sont recrutés, que se recrutent encore, les chefs politiques les plus remuants, les plus influents de la province. Au reste, la ville de Montréal, beaucoup plus populeuse, n'est pas éloignée et fait sentir fortement l'influence de son voisinage.

Résumons en quelques lignes les principales constatations de cette première partie de notre enquête.

Dans les campagnes du pays bas de la rive sud du Saint-Laurent, comme sur la rive nord, il se trouve à la base de la société franco-canadienne, un groupement traditionnel mixte, à la fois famille et atelier de travail.

Chez le type à l'étude, il se manifeste un commencement de spécialisation sociale, un commencement de séparation entre les deux sections du groupement mixte. Comme résultat, la famille tend à mieux remplir sa fonction la plus élevée, qui est l'éducation des enfants, et l'atelier tend aussi à mieux remplir son rôle, qui consiste dans l'exploitation des ressources locales.

Cette évolution a été favorisée par les conditions physiques du pays bas de la rive sud, dont le sol est généralement fertile et la surface plane, sillonnée par plusieurs rivières importantes, quelques-unes navigables, et qui se rattache vers le sud à des régions encore mieux partagées au point de vue de la facilité des communications.

Mais, en dernière analyse, c'est grâce à la constitution et à l'initiative d'un nouveau type de groupement social, d'origine étrangère ou extérieure, le grand atelier de fabrication, de transport, de commerce, que cette évolution sociale a été déterminée.

De même, c'est grâce à l'initiative intelligente de son chef que l'impulsion imprimée par le grand atelier, s'est transmise à la famille décrite ici, avec des effets en somme bienfaisants.

Le progrès est moins marqué en ce qui regarde le mode d'existence, ce côté de la vie sociale échappant dans une grande mesure à l'action du grand atelier. Au reste, ce progrès social est de date récente; il a suivi de près l'établissement des chemins de fer, des grandes usines, des grandes maisons de commerce, et en ce qui est de la famille décrite, il a été entièrement l'œuvre de son chef qui vient de s'éteindre. On ne saurait assurer qu'il va se maintenir à la génération suivante.

En effet, lorsque s'exerce brusquement dans un milieu traditionnel comme celui-ci, l'action énergique du grand atelier, il se produit une sélection. La masse des familles subit cette action plus ou moins passivement, et la passivité revêt deux formes très opposées: résistance pure et simple, ou bien désorganisation complète. Le premier procédé réduit la famille à un régime de privations, et sera désormais de moins en moins praticable; le dernier a l'effet de détacher la famille du sol, de la livrer à toutes les aventures de l'instabilité.

Mais entre ces deux types extrêmes, on observe ici et là des chefs de famille supérieurement doués qui savent s'adapter aux conditions nouvelles, en profitent, sans se laisser désorganiser par elles; et à chaque génération il se fait une nouvelle sélection.

Dans le cas dont nous terminons l'étude, il n'y a pas eu rupture de l'équilibre social, la famille, sous la direction d'un chef intelligent, ayant développé son activité propre dans la mesure où s'exerçait celle du grand atelier.

Toutefois, ce type de famille agricole à tendances particularistes, étant encore exceptionnel dans ce milieu, on ne voit pas que les groupements complémentaires de la vie sociale se soient transformés dans la même mesure. L'avènement du grand atelier a eu l'effet de diminuer l'importance du rôle social de ces institutions traditionnelles, le Rang, la Paroisse; il a augmenté le nombre, amélioré la situation matérielle, des institutions religieuses, mais sans les engager à adapter plus complètement leur action aux conditions du régime nouveau. Ces institutions continuent de se conformer à l'idéal de la masse des familles encore dominées par la tradition, au lieu de s'adapter aux exigences des types encore exceptionnels, précurseurs d'un état social futur.

II.—*Le colon-émigrant de l'Ange-Gardien.*

En 1903, lorsque l'auteur fit la connaissance de la famille Z., elle se composait de 9 ou 10 personnes:

Pierre Z., chef de la famille, âgé de 54 ans.

Elodie T., sa femme, âgée de 52 ans.

Olive Z.,	enfant	demeurant	au	foyer, âgée de	28	ans.
Agnès,	"	"	"	"	19	"
Françoise,	"	"	"	"	16	"
Angéline,	"	"	"	"	14	"
Wilfrid,	"	"	"	âgé	9	"
Philippe,	"	"	"	"	7	"
Oscar,	"	"	"	"	5	"

Déjà cinq enfants s'étaient séparés du groupe familial: Joseph, âgé de 31 ans; Louise, 27 ans, et Rose, 21 ans, mariés et vivant aux Etats-Unis; Georges, 26 ans, et Zéphirin, 24 ans, encore célibataires et vivant aux Etats-Unis. Georges devait revenir se joindre à la famille l'année suivante.

Les relations qu'avaient entre elles ces neuf ou dix personnes donnaient à première vue l'impression d'un type bien caractérisé de famille quasi-communautaire. L'esprit communautaire y était nettement en évidence. Les parents entretenaient avec les enfants, et même la plupart de ceux qui s'étaient détachés du groupe familial, des rapports étroits et suivis. La mère surtout se montrait extrêmement soucieuse du bien-être de ses enfants, désireuse même de satisfaire leurs caprices, n'hésitant pas à s'imposer beaucoup de fatigues et à entreprendre de longs voyages pour prodiguer ses soins à de ses filles mariées depuis quelques années déjà; enfin, à grands frais, et en dépit de bien des obstacles, ramenant au foyer un de ses fils qui, séparé de la famille, montrait peu de conduite et peu d'aptitudes à se tirer d'affaire. Ce vigoureux esprit de famille ne s'arrêtait pas au cercle relativement étroit du foyer familial; il s'étendait aux grands parents, tant du côté paternel que du côté maternel, aux oncles et tantes, aux cousins et cousines, aux neveux et nièces; et c'étaient les survenances notables dans la vie de toute cette parenté, naissances, mariages, décès, établissements, entreprises, déplacements, voyages, accidents, maladies, succès, revers qui formaient le plus souvent le sujet des conversations, de même que les échanges de services ou de visites avec les plus rapprochés de ces parents, et quelques-uns des plus éloignés, fournissaient les incidents les plus ordinaires de l'existence de la famille.

Mais on ne tardait pas à relever à côté de ces manifestations de l'esprit communautaire des traits non équivoques de ce qu'on désigne en science sociale sous le nom de famille instable. C'est ainsi que la paix au foyer était fréquemment troublée, l'autorité du père de famille étant mal reconnue tant par la mère que par les enfants. L'éducation de ces derniers laissait beaucoup à désirer. Un des fils vivait loin de sa famille et sans aucun rapport avec elle, tandis qu'un autre, incapable de se tirer d'affaire par lui-même, revenait, sur les instances de sa mère, vivre aux crochets de son père, quoique presque constamment en mauvais rapports avec lui. Au reste, bien que les parents fussent déjà assez avancés en âge, la famille n'avait réussi à prendre pied nulle part et vivait entièrement du salaire, au jour le jour.

Lorsque l'auteur fit la connaissance de Z., celui-ci venait, avec sa femme et ses enfants, d'entrer au service d'un propriétaire de la zone montagneuse du sud de la province de Québec, pour le compte de qui il exploitait une ferme spécialisée dans la production de crème destinée à la confection du beurre. Il n'y a guère lieu de faire connaître pour le moment les particularités du pays qu'il habitait mais dont les ressources ne contribuaient qu'indirectement à sa subsistance et qui n'était, comme nous le verrons bientôt, qu'une des nombreuses étapes dans sa vie mouvementée. Z. retirait alors, comme rémunération, tant de son propre travail que de services légers rendus par sa femme et deux de ses filles, la somme de trente-deux dollars, portée l'année suivante à trente-sept dollars par mois; plus une prime en argent qui pouvait s'élever, année moyenne, à vingt-cinq dollars par année; plus diverses subventions en nature: un logement, son bois de chauffage, le lait consommé par la famille, sa provision de pommes de terre, d'œufs, etc.

Grâce à ces recettes importantes, tant en nature qu'en argent, la famille Z. vivait dans une abondance relative. Le régime alimentaire, qui ne se distinguait pas par la délicatesse, ni par l'économie dans la préparation et l'utilisation des diverses denrées, était en général très suffisant, et les viandes de boucherie, les pommes de terre, les pâtisseries, y tenaient une large place. La tenue de la maison laissait à désirer au point de vue de la propreté et de l'hygiène, deux facteurs dont on ne tenait pas compte davantage en ce qui regarde le soin de la personne. Aussi, bien que le père et la mère fussent d'apparence robuste, leur santé n'était pas des meilleures; quant aux enfants, ils souffraient presque tous d'infirmités ou de tares assez graves. Françoise était bossue, Philippe était sourd, deux ou trois autres des enfants étaient plus ou moins atteints ou menacés de surdité ou de maladies nerveuses.

Mais c'est le chapitre des Phases d'existence qui fournit sans conteste l'aspect le plus intéressant de cette monographie de famille. Il aide merveilleusement à faire comprendre le type social et la loi de son évolution.

Dans la première moitié du dix-neuvième siècle, le grand-père du chef actuel de la famille Z. habitait les bords de la rivière Richelieu, au cœur de cette fertile zone qui forme la rive sud du Saint-Laurent, à l'est de Montréal. Il était pauvre, et, paraît-il, fort peu laborieux, sa principale occupation, à part de vendre les paniers de jonc confectionnés par sa femme, étant de fumer la pipe, d'où le surnom pittoresque de la Boucane, sous lequel il était généralement connu. A la génération suivante, et notamment avec Mathieu Z., père du chef actuel, la famille s'élève notablement dans l'échelle sociale. Vers 1850, nous trouvons Mathieu Z. tenant à ferme une terre à la pointe de la Savane, dans la paroisse de Richelieu, marié et père de famille. Quelques années plus tard, la famille quitte sa ferme des bords de la Richelieu, pour se fixer, toujours à loyer, sur une terre sise à Saint-Sébastien de la rivière du Sud, à proximité de la baie de Missisquoi. Il s'écoule quatre autres années, et en 1862, Mathieu Z., déjà chargé de plusieurs enfants, se déplace de nouveau, en revenant sur ses pas dans la direction du nord, et fait l'acquisition d'une terre dans la paroisse de l'Ange-Gardien.

Alors adolescent, le chef actuel de la famille, Pierre Z., accompagne son père à l'Ange-Gardien. Mais dans les années suivantes, il commence à quitter périodiquement la maison paternelle, et fait, quatre années de suite, quatre voyages aux Etats-Unis, où il s'engage comme matelot sur les bateaux transportant la brique de Haverstraw sur l'Hudson, à New-York, et même à l'isthme de Panama, dans l'Amérique centrale. Ces voyages ne paraissent pas avoir produit une bien vive impression sur l'esprit de Z.; à quelqu'un qui lui demandait comment il avait trouvé le pays de Panama et s'il n'y avait pas beaucoup souffert de la chaleur, il répondit qu'il s'était très bien trouvé de son séjour là-bas, n'étant pas sorti de la cale du navire, où la température était douce.

Dans les premières années de la période décennale suivante, Pierre Z. se sépare de son père, pour s'établir à son compte. A la suite d'un bref séjour dans une ville manufacturière des Etats-Unis, il retourne à l'Ange-Gardien, et y prend pour femme Elodie T., fille d'un cultivateur originaire de Saint-Mathias, paroisse voisine de celle de Richelieu d'où venaient les Z., et qui, plusieurs années avant les Z., avait émigré à l'Ange-Gardien, dont toute la population alors se réduisait à quatre ou cinq familles de défricheurs. Par sa mère, Elodie T. se rattachait à une des familles les plus anciennes et les mieux établies de Saint-Mathias. A l'Ange-Gardien, la famille T. occupait dans le rang de Saint-Georges une terre peu éloignée de celle habitée par les Z. Durant son dernier séjour aux Etats-Unis, Pierre Z. avait travaillé dans la ville de Manchester, assez rapprochée du petit centre de Manchaug, où Elodie T. elle-même avait été chercher de l'emploi, en compagnie d'une de ses sœurs. Toutes deux avaient quitté l'Ange-Gardien quelques mois auparavant, à la suite d'un de leurs oncles, N., de la même paroisse, que les agents des grandes manufactures avaient réussi à embaucher avec toute sa famille. Aussitôt après leur mariage à l'Ange-Gardien, Pierre Z. et sa femme retournent aux Etats-Unis et y travaillent encore quelques mois dans les usines; puis, ils reviennent au Canada et y font l'acquisition d'un terrain en forêt, dans la paroisse de Saint-Alphonse de Granby, encore plus reculée et moins défrichée que celle de l'Ange-Gardien.[1]

L'Ange-Gardien n'occupe pas dans la vallée une situation aussi avantageuse que les paroisses bordant la rivière Richelieu. On n'y est plus au cœur de la vallée, on n'y est plus dans la zone argileuse, on y est dans la zone sablonneuse confinant à la montagne. Les terres y sont très rocheuses et difficiles de culture. Mais vers 1855 ou 1860, ces terres offraient aux colons une production spontanée de nature à leur faciliter l'existence durant la période pénible du défrichement: le bois. Au début, une fois le meilleur bois de construction enlevé, et faute de moyens suffisants de communication, on se bornait à brûler les arbres et à en tirer de la potasse, produit marchand d'une assez grande valeur sous un faible volume. Mais à la suite de la construction des voies ferrées, les colons trouvèrent plus avantageux de disposer des produits de la forêt sous forme de bois de chauffage. Les Z. ont vendu beaucoup de ce combustible récolté sur leurs terres de l'Ange-Gardien et de Saint-Alphonse. Mais finalement c'est de la vente d'écorce de "pruche" qu'ils ont obtenu les ressources supplémentaires les plus importantes. L'Habitant donne le nom de "pruche" à un arbre de la famille des conifères, le sapin du

[1] L'Ange-Gardien est indiqué sur la carte par la lettre "d".

Canada (*abies* ou *tsuga canadensis*), dont l'écorce épaisse est très riche en tannin. Ce produit s'est vendu à des prix variant de un dollar cinquante à cinq et six dollars la corde. C'est même, à ce qu'il m'a déclaré, principalement en vue de se faire un magot par la récolte et la vente des produits de la forêt, et par-dessus tout de l'écorce de pruche, et de revendre le fond à bénéfice à quelqu'un désireux d'y faire de la culture, que Pierre Z. faisait l'acquisition de terrains.

Mais voici qu'il se produit une crise dans l'existence de la famille Z. Il y avait alors vingt ans que l'Ange-Gardien avait reçu ses premiers colons, et dix ou douze ans que Mathieu Z. y était établi. Le bois, cette grande ressource accessoire du colon, commençait à se faire rare. C'est dans la paroisse plus reculée de Saint-Alphonse de Granby, qu'on allait désormais chercher des terres et du bois. D'autre part, les jeunes gens étaient de plus en plus portés à émigrer aux Etats-Unis. Mathieu Z. n'était pas sans en concevoir quelque inquiétude; il commençait à vieillir, et déjà son fils aîné l'avait quitté pour s'établir à son compte. Il lui restait bien dix enfants, cinq filles et cinq garçons; mais il se trouvait que les aînés étaient des filles: Philomène, Victoire, Lucie; puis venaient trois garçons, Edmond, Thomas, Honoré, qui n'étaient encore qu'adolescents. Enfin, les quatre derniers, Emma, Théodore, Louis, Marie, étaient encore très jeunes, et ne pouvaient rendre de services appréciables dans l'exploitation d'une terre. Mathieu Z. cherche à surmonter cette difficulté par un moyen qui est bien de tradition communautaire: donner moyennant rente viagère sa terre de l'Ange-Gardien à son fils aîné, qui est revenu des Etats-Unis avec sa femme, et qui sans doute sera mieux en état que son vieux père de tirer parti du bien par le travail de ses bras et de ceux de ses frères et sœurs, et d'assurer ainsi le maintien du foyer familial. Mais cette proposition se heurte de part et d'autre à des objections qui nous font voir à quel point déjà les traditions communautaires étaient battues en brèche par l'influence des conditions nouvelles, et notamment celle du voisinage des centres industriels des Etats-Unis. Les frères et sœurs de Pierre Z. verraient d'un mauvais œil le bien paternel passer aux mains de leur frère aîné, et d'un autre côté, la jeune femme de Pierre Z. verrait d'un mauvais œil celui-ci se charger du paiement d'une rente viagère, en retour du simple droit de cultiver quelques arpents d'une terre rocheuse et difficile d'exploitation.

Ce premier projet n'ayant pas abouti, Pierre Z. quitte sa terre de Saint-Alphonse et reprend avec sa femme le chemin des Etats-Unis, tandis que, de son côté, Mathieu Z. afferme à un étranger la terre qu'il avait voulu donner à son fils aîné, et ne tarde pas à aller avec sa femme et ses dix enfants retrouver aux Etats-Unis ce fils aîné. Or bientôt

Pierre Z., dont la femme, grosse de son deuxième enfant, n'est plus guère en état de l'aider à gagner de l'argent dans les manufactures, conçoit le dessein de retourner au Canada. Il conclut avec son père un marché en vertu duquel il se substitue dès le printemps suivant au locataire étranger, et prend à ferme le bien paternel de l'Ange-Gardien, le père restant entretemps aux Etats-Unis avec toute sa famille. Il paraîtrait que ce ne fût pas là une opération très brillante de la part du fils: c'est à partir de ce moment, et en vue d'acquitter ce fermage exigé par son père, que Pierre Z. aurait commencé " à se casser le cou ".

C'était dans une ville manufacturière du New-Hampshire que Pierre Z. avait travaillé quelque temps à la suite de ses voyages à Haverstraw, New York et Panama; c'était dans un petit centre du Massachusetts que sa femme avait séjourné avant leur mariage; et c'est à North-Grosvenordale, dans l'état du Connecticut, que toute la famille émigre en dernier lieu. On sait que le Connecticut est un des états de l'Union américaine où la fabrication en grand atelier a pris le plus d'extension depuis cinquante ou soixante ans. Eu égard au chiffre de sa population, le Connecticut est au deuxième rang des cinquante-deux états de l'Union par la valeur de l'ensemble des articles fabriqués. Dans sa partie nord-est, il est traversé par une rivière à cascades, la Quinebaug, le long de laquelle s'échelonnent plusieurs centres de fabrication d'importance variable: North-Grosvenordale, Grosvenordale, Putnam, Danielson, Brooklyn, etc.

Nous allons voir que cette vallée de la Quinebaug a tenu beaucoup de place dans la vie de la famille Z. Pierre Z. retourne donc à l'Ange-Gardien avec sa femme et s'installe sur la terre paternelle, tandis que Mathieu Z., son père, s'arrange pour gagner le plus d'argent possible avec ses enfants à North-Grosvenordale. Naguère sa fille aînée Philomène était douée d'une force musculaire remarquable, et le père en avait tiré tout le profit possible dans l'exploitation de la ferme. Elle maniait la hache du bûcheron avec autant d'aise que ses frères. Au reste, c'était la pratique chez les Z. d'exiger des filles à peu près le même travail que des hommes, et notamment un frère de Mathieu Z. exploitant une scierie dans l'Ange-Gardien, mettait ses massives filles à conduire les bœufs qui traînaient les troncs d'arbres à la scierie. Mais arrivé à North-Grosvenordale, Mathieu Z. s'aperçut que sa fille aînée, pour avoir trop travaillé à la ferme, était épuisée avant l'âge. Puis le travail dans les manufactures répugnait à Edmond, le deuxième fils. Le père le renvoie chez Pierre Z. à l'Ange-Gardien, ainsi que Philomène, et avec l'aide des huit autres enfants et de sa femme (lui-même et Thomas sur la terre de la compagnie manufacturière, les autres dans la filature), il réussit à

Les ouvriers ne s'y sont même pas, à l'exemple de ceux de centres plus importants, organisés pour la défense de leurs intérêts, et cela en dépit des efforts tentés dans ce but par des agents venus tout exprès de Fall-River. La population, qui comprend un nombreux groupe de Canadiens français, s'est grossie récemment d'un fort appoint d'émigrants polonais.

Après un séjour de onze années consécutives à Danielson, Pierre Z. et sa famille se déplacent de nouveau et vont se fixer à Putnam, à sept ou huit milles de Danielson, en remontant le cours de la Quinebaug. Cette année même, la famille se voyait privée d'un de ses membres les plus actifs, par suite du mariage de Joseph, l'aîné des enfants. Mais la mère et ses filles les plus âgées travaillèrent courageusement à l'usine, tandis que le père, de son côté, employait bien le temps, soit à l'usine, soit dans le bois, où il exerçait son ancien métier de bûcheron. A partir de cette année, qui est le commencement de la dispersion des jeunes, la famille de Pierre Z. semble éprouver de plus en plus de difficulté à se faire un foyer stable. A l'expiration d'un an, la famille quitte Putnam pour s'établir à North-Grosvenordale, un peu plus haut sur la Quinebaug, où Louise, la deuxième des filles, épouse un ouvrier de fabrique.

La filature de North-Grosvenordale, plus importante que celle de Danielson, donnait de l'emploi à 1,800 ouvriers, avait en activité 2,000 métiers et payait 7,000 dollars de salaires par semaine. La ferme attachée à la filature de North-Grosvenordale couvrait 600 acres et portait 30 vaches et 22 chevaux. Pierre Z. fut chargé de conduire l'omnibus faisant le service entre North-Grosvenordale et Grosvenordale, village voisin, mais de temps à autre on l'enlevait à cette besogne pour lui confier la direction du travail à la ferme. D'autre part, Pierre Z. ne sachant ni lire ni écrire, n'était pas en mesure d'exercer en permanence les fonctions de contremaître sur cette ferme, car elles comprenaient la réception et l'expédition de grandes quantités de coton, la filature de North-Grosvenordale étant très importante.

Après un séjour de quatre ans dans ce dernier centre, Pierre Z. constatant que les salaires sont plus élevés à Danielson, y retourne avec sa famille, et se remet au service de ses anciens patrons. Mais à peine s'est-il écoulé trois ans que l'on n'est plus satisfait, que la famille sent le besoin de se déplacer de nouveau, cette fois pour reprendre le chemin du Canada.

Il n'est pas très difficile de se rendre compte des raisons qui engageaient la famille Z. à revenir au pays natal. Dans ce type de groupement communautaire, on a dû l'observer, parents et enfants sont très dépendants les uns des autres. Les parents surtout comptent beaucoup sur l'aide qu'ils peuvent tirer de leurs enfants. Or les conditions de vie dans les centres de fabrication de la Nouvelle-Angleterre étaient à bien des égards défavorables au maintien d'une étroite communauté familiale. Il fallait compter notamment avec les cas de maladie, les éducations manquées, les mariages hâtifs et l'intervention parfois intempestive des pouvoirs publics. Olive, l'aînée des filles, qui avait été plusieurs mois gravement malade pendant le séjour de la famille à North-Grosvenordale, ne put travailler à l'usine que par intermittences durant les trois années qui précédèrent le retour de la famille au Canada. Georges et Zéphirin étaient bien en état de rendre des services, mais peu laborieux, rebelles à toute discipline, ils étaient plutôt un fardeau et une source d'inquiétudes pour leurs parents. D'autre part, Joseph, l'aîné des enfants, et l'un des mieux doués, qui devait bientôt s'élever au rang de contremaître chargé de la surveillance de 150 métiers, s'était dès sa dix-neuvième année, marié et établi à son compte. Louise, à l'âge de 18 ans, avait épousé à North-Grosvenordale un ouvrier intelligent, futur contremaître. Enfin, Rose, vers la vingtaine, venait de se marier à Danielson.

Notons ici en passant un fait curieux : c'est que chez le groupe d'émigrants canadiens-français que nous avons à l'étude le séjour dans les villes de fabrication des Etats-Unis, paraît avoir eu l'effet dans bien des cas de hâter l'époque du mariage. Dans la famille de Pierre Z., et au moins deux autres de sa parenté, ceux de l'ancienne génération au Canada s'étaient mariés à l'âge de vingt-cinq ans ou plus. Dans ces mêmes familles, une fois établies aux Etats-Unis, les jeunes gens de conduite et d'initiative, grâce, sans doute, aux conditions de vie plus faciles, n'attendent pas la vingtaine pour s'établir à leur compte.

Dans les dernières années de leur séjour aux Etats-Unis, les Z. n'étaient même plus en mesure de tirer parti de la bonne volonté de leurs enfants, car la loi interdisait le travail d'usine aux enfants n'ayant pas atteint l'âge requis, dix, douze, quatorze ans, ou n'ayant pas fait un certain stage dans les écoles. Dans ces conditions, Agnès, âgée de 17 ou 18 ans, était à même de travailler à l'usine avec ses parents; mais Françoise était infirme et malade, et les quatre autres enfants encore trop jeunes. On conçoit dès lors que Pierre Z. ait agréé la proposition que lui faisait son frère Thomas de venir le retrouver au Canada, avec toute sa famille, pour y exploiter de concert avec lui et le grand-père Mathieu, une ferme dont ils venaient de faire l'acquisition dans la zone montagneuse du Sud. La somme de 75 dollars que lui envoyait son frère permit à Pierre Z. de solder les frais de retour de sa famille.

C'est qu'en effet il se préparait un mouvement d'émigration de plusieurs familles alliées vers une même région agricole du Canada. On se rappelle que vingt ans auparavant le vieux Mathieu Z. était venu se fixer à North-Grosvenordale, avec sa femme et dix enfants, et qu'à l'expiration de deux années il avait repris le chemin du Canada, il était revenu à l'Ange-Gardien, avec ses plus jeunes enfants; les aînés (sauf Philomène et Edmond, qui avaient précédé leurs parents au Canada) demeurant aux Etats-Unis. Il est intéressant de nous rendre compte de ce qu'était devenu dans l'intervalle chacun de ces enfants. Victoire, la deuxième fille, s'était mariée à North-Grosvenordale; Philomène, Lucie, Emma, de retour au Canada s'étaient mariées également et vivaient, Lucie à l'Ange-Gardien, les deux autres à Granby, petite ville du comté voisin. Marie, la plus jeune fille, avait épousé un ouvrier de Danielson. Quant aux garçons, Edmond s'est fixé à Franklin, dans le New-Hampshire, où il exerce le métier de maçon; Louis habite Franklin Falls, centre très voisin du précédent, où il est contremaître dans une usine à papier. Honoré, qui a commencé par apprendre le métier de maçon en compagnie de son frère Edmond, à Franklin, devient, à la suite d'un accident qui l'a forcé d'interrompre ce travail, palefrenier chez le médecin qui l'a soigné et chez un avocat ami de ce médecin. Ceux-ci s'intéressent à lui, lui donnent un commencement d'instruction, et plus tard s'associent à lui en vue de l'exploitation d'une carrière située dans la Nouvelle-Ecosse. Honoré y est devenu entrepreneur de maçonnerie et s'est élevé à une certaine fortune. Théodore, de retour à l'Ange-Gardien y est demeuré longtemps auprès de son père, a fini par acheter une des terres de celui-ci à l'Ange-Gardien, et subséquemment s'est établi à Granby; il cherche maintenant à se défaire du terrain qu'il a acheté de son père. Thomas, resté célibataire, a toujours suivi le père Mathieu; récemment, à la suite d'un dernier séjour aux Etats-Unis, il a fait de concert avec son père l'achat d'une ferme dans le comté de Compton, zone montagneuse du Sud de la province de Québec, et c'est de là qu'il écrit à son frère Pierre, l'invitant à venir les retrouver avec sa femme et ses enfants.

Thomas Z. lui-même était allé s'établir dans ce pays sur le conseil de Philippe T., de l'Ange-Gardien. Ce Philippe T. était frère d'Elodie, femme de Pierre Z. Fils unique, il avait, conformément à l'ancienne coutume des familles rurales du Canada français, hérité du bien paternel, à l'exclusion de ses cinq sœurs, qui toutes, du reste, trouvèrent à se marier, une à Pierre Z., comme nous savons, une autre à Joseph V., qui naguère voisin de Pierre Z., à Saint-Alphonse de Granby, s'était plus tard établi à Danielson, dans le Connecticut, et avait engagé Pierre Z. à venir l'y retrouver. Quant à Philippe T., grâce à l'héritage de 60 arpents de terre qu'il tenait de son père, et qu'il avait arrondi de 90 arpents d'une terre attenante, il avait pu se dispenser d'émigrer aux Etats-Unis. Sans aptitudes très prononcées pour la culture, il exerçait accessoirement la profession de boucher. Au cours d'un voyage qu'il fit en 1898, sans idées bien arrêtées, dans la zone montagneuse située à l'est de l'Ange-Gardien, il crut avoir trouvé une affaire avantageuse, vendit sa terre de l'Ange-Gardien, et fit l'acquisition d'une ferme de quelques centaines d'acres sur le plateau de Compton, qui domine à l'est le cours de la rivière Coaticooke, à peu de distance de la petite ville du même nom. C'est alors que se produit ce mouvement d'émigration de toute une parenté, frappante manifestation de l'esprit communautaire de nos familles rurales.

A peine installé sur sa terre de Compton, avec sa femme et ses enfants, son père et sa mère, Philippe T. attire de ce côté le vieux Mathieu Z. et son fils Thomas Z. Ceux-ci, devenus propriétaires d'une petite ferme à proximité de celle de Philippe T., font venir des Etats-Unis Pierre Z. et sa famille; et l'année suivante le groupe se grossit de la famille de Paul V. (neveu de Philippe T. et de la femme de Pierre Z.), et aussi de la famille d'Isidore S., beau-frère de ce dernier par son mariage avec Victoire Z., comme nous l'avons vu. Toutefois cette dernière recrue ne demeure pas longtemps à Compton; après quelques mois, Isidore S. remet à Philippe T. le lopin que celui-ci avait détaché de sa terre à son intention, et retourne aux Etats-Unis. On observera que c'est toujours ainsi que ces colons ont pratiqué l'émigration: c'est par groupes de familles alliées qu'ils avaient jadis colonisé l'Ange-Gardien; c'est par groupes de familles alliées qu'ils ont émigré aux Etats-Unis, et c'est par groupes de familles alliées qu'ils opèrent leur retour au Canada et s'établissent dans la région montagneuse du Sud. Les familles du groupe en question établies à Compton, ne tardent pas à contracter des alliances dans leur nouveau pays. Une fille de Philippe T., une fille de Paul V., deux filles de Pierre Z., se marient avec de jeunes colons du voisinage. Bientôt les parents des uns et des autres viennent leur rendre visite; ils affluent, par deux ou trois à la fois, de l'Ange-Gardien, du New-Hampshire, du Connecticut, de la Nouvelle-Ecosse, les frères de Pierre Z., la mère de Paul V., les fils ou les filles de Mme Z., et bientôt tout le pays fourmille de cet essaimage quasi-patriarcal.

Cependant la famille de Pierre Z. ne parvient pas davantage à se créer un foyer permanent. Il y avait à peine un an qu'elle vivait au foyer du père Mathieu Z. et de son fils célibataire Thomas, qu'il fallut se séparer. Les enfants de Pierre Z., habitués aux mœurs plus tapageuses et à l'allure plus libre de la petite ville américaine, trouvent que le grand-père et l'oncle vieux garçon leur font la vie trop tranquille et trop monotone à la campagne. C'est alors que Pierre Z. ayant trouvé une place de contremaître dans une ferme du voisinage, s'y transporte avec sa famille, laissant son vieux père et son frère Thomas continuer seuls l'exploitation de leur propriété. Malgré les avantages que lui assurait sa nouvelle situation, Pierre Z. ne la garde que trois ans; et la cause en est un vice de formation sociale, qui rend les relations désagréables et difficiles entre le père d'une part, la mère et les enfants de l'autre, entre le père et les garçons de ferme, entre la famille du contremaître et celle du propriétaire. Ce qui fait défaut ici, ce n'est pas tant l'habileté technique, ce n'est pas tant l'esprit de travail; c'est plutôt l'aptitude à suivre bien longtemps une ligne de conduite qu'on s'impose à soi-même, ou qu'on accepte d'autrui. En d'autres termes, nous avons sous les yeux un groupement d'origine communautaire tendant à l'instabilité, et qui échoue dans l'exécution de la tâche compliquée de l'exploitation d'une ferme importante, et cela par suite de l'insuffisance de l'autorité et des lumières chez les parents, ainsi que de l'insubordination des enfants, sans développement correspondant de l'initiative. Il est instructif de noter ici la désorganisation et l'impuissance de la famille communautaire placée dans une situation exigeant une initiative et des aptitudes plus qu'ordinaires.

En quittant cette ferme où il a été contremaître trois ans, Pierre Z. retourne avec sa famille chez son père, Mathieu Z., et son frère Thomas. Il n'y reste encore qu'une année, comme la première fois, puis se charge d'exploiter à mi-fruits une terre que son beau-frère Philippe T. vient d'acheter dans ce même township de Compton. En effet, Philippe T., en sa qualité d'héritier du domaine paternel à l'Ange-Gardien, et conformément à la tradition communautaire, paraît toujours se considérer le protecteur naturel de la famille de sa sœur et vient à son secours dans tous ses embarras. Mais à peine s'est-il écoulé encore une autre année que l'affaire ne marche plus et qu'il est question pour la famille Z. de retourner chez l'oncle Thomas, qui vit absolument seul depuis la mort récente du grand-père Mathieu.

En somme, dans l'espace de cinquante ans, Pierre Z. et sa famille se sont déplacés vingt fois en quête de nouveaux moyens d'existence, et il se trouve aujourd'hui des membres de la famille, tant de l'ancienne que de la jeune génération dispersés dans deux provinces du Canada et plusieurs villes des Etats-Unis. On observera que dans le cours de ces pérégrinations, de ces nombreuses tentatives d'établissement, la famille Z., d'une génération à l'autre, a fait preuve d'une grande variété d'aptitudes dans les arts manuels et d'une extraordinaire mobilité. L'esprit communautaire s'y est maintenu dans une mesure surprenante. D'autre milieu quasi-communautaire, et par l'action tutélaire d'une autre nature de groupement : la corporation religieuse.

Le clergé catholique-romain forme le deuxième grand organisme indépendant qui se superpose à la famille de l'ouvrier canadien-français. Il joue dans sa vie intellectuelle, morale, religieuse, un rôle analogue à celui du grand atelier industriel et commercial pour la satisfaction des besoins de sa vie matérielle. Ce clergé est indépendant de la famille ouvrière canadienne-française par son personnel [illegible] de même que son personnel, dans tous les pays du monde, est réparti entre de nombreuses [illegible] dont la direction générale est [illegible] à Rome. [illegible] du clergé sur ses ouailles, déjà très grande lorsque le prêtre se borne à remplir sa fonction essentielle, qui est d'enseigner la vérité religieuse et de travailler au salut éternel des âmes, grandit [illegible] [illegible] que les [illegible] se borne [illegible] [illegible] [illegible] des [illegible] plus graves, à [illegible] [illegible] ont négligé de [illegible] [illegible] canadiennes-françaises.

[illegible]

[illegible]

que l'éducation donnée par la famille et tout le milieu social communautaire n'a pas développé suffisamment la personnalité humaine, l'initiative individuelle, surtout dans l'ordre intellectuel, moral et religieux. Ce vice de formation, assez peu senti tant que se sont maintenues les conditions relativement simples de la vie rurale au Canada, aboutit à des résultats désastreux parfois, dans le milieu compliqué des centres industriels: défections, défaillances morales de toutes sortes.

On se rappelle l'importance du rôle joué par le groupement voisinage dans le milieu traditionel de Saint-Justin. Déjà la monographie du cultivateur de Saint-Dominique nous a montré ce groupement occupant une place beaucoup moins importante dans le régime du travail. D'autre part, chez le colon-émigrant de l'Ange-Gardien, resté plus communautaire, les corvées récréatives ont encore de l'importance dans le régime du travail, tant que la famille vit de l'exploitation d'un domaine rural. Mais, à la campagne comme à la ville, le voisinage paraît avoir pour principale utilité, aux yeux de ce type social, de provoquer des réunions nombreuses de parents et d'amis pour des fins de récréation. Dans les centres urbains, l'action utilitaire du voisinage est complétée par l'affiliation à des sociétés de secours mutuels, d'origine ou d'inspiration yankee, qui s'engagent à verser une indemnité en cas de mort ou de chômage causé par la maladie.

Il est un dernier ordre de groupement qui se superpose à la famille ouvrière: ce sont les pouvoirs publics, soit locaux, soit généraux. Ces organismes, tant au Canada qu'aux Etats-Unis recrutent leur personnel dirigeant par le moyen d'élections au suffrage quasi-universel, qui permettent la participation du plus grand nombre des citoyens à la gestion des affaires publiques. Aux Etats-Unis comme au Canada, l'organisation des pouvoirs publics, d'origine anglo-saxonne, repose sur une large base d'autonomie locale et provinciale. Dès lors, dans les milieux à population mixte, les pouvoirs publics sont assez souvent les intermédiaires par lesquels s'exerce l'action d'une race sur l'autre, d'un type social sur l'autre. Au Canada, les groupes français subissent la concurrence des groupes anglo-saxons et autres surtout dans la vie publique centrale et dans la vie publique provinciale, même dans celle de leur propre province de Québec, où ils sont en très grande majorité. Ils ressentent cette influence beaucoup moins fortement et beaucoup plus rarement dans la vie publique locale, tant qu'ils restent dans l'isolement de leurs paroisses du pays natal. Mais, dans les centres de fabrication des Etats-Unis, ils se trouvent soumis à l'action de groupes étrangers, et notamment de groupes d'origine anglo-saxonne, tant dans la vie publique locale que dans la vie publique centrale. Or, cette action des pouvoirs publics, précisément parce qu'elle s'exerce en grande partie du dehors, sur des groupes mal préparés à la subir, ne produit pas des effets très marqués, très durables. C'est ainsi que les Z., pendant leur séjour à North-Grosvenordale, à Putnam, à Danielson, ont été parfois gênés dans leurs habitudes communautaires par des règlements municipaux, ou des lois relatives à l'hygiène, aux écoles, à la fréquentation des ateliers de travail, mais ne paraissent pas avoir beaucoup modifié en conséquence leurs idées ou leurs habitudes à ces divers égards.

En somme, abstraction faite du voisinage et des sociétés de secours mutuels, dont le rôle n'est pas très important, toute la vie sociale de ces groupes, en dehors de la famille, s'effectue par le moyen de trois grands groupements extérieurs: le grand atelier, la corporation religieuse, les pouvoirs publics, tous trois très indépendants de la famille ouvrière, mais qui précisément pour cette raison exercent sur celle-ci une action plutôt superficielle.

Il ne reste plus qu'à résumer les indications et à formuler les conclusions les plus utiles qui se dégagent de cette double étude:

Dans le pays bas de la rive sud du Saint-Laurent, à côté de familles rurales sur lesquelles le nouveau régime industriel et commercial a exercé une action en somme bienfaisante, on en observe d'autres sur lesquelles cette même évolution de l'industrie et du commerce a eu une influence défavorable. Au sein d'un groupe de population organisé en familles communautaires et soumis à l'action de plus en plus énergique d'un groupement supérieur, comme le grand atelier, il se produit une sélection, les unes s'adaptant plus rapidement et plus complètement que les autres aux conditions nouvelles. Les unes se soustraient aux dangers et aux inconvénients du nouveau régime, grâce au développement de l'initiative individuelle, de la valeur personnelle, chez leurs membres; en d'autres termes, grâce à leur évolution vers la formation particulariste à la fois dans l'ordre matériel et dans l'ordre moral. Les autres, au contraire rétrogradent vers une formation communautaire aggravée, se cramponnent aux rapports de parenté et de voisinage comme à une planche de salut, et se laissent aller sans le contrepoids de l'initiative individuelle à l'attraction puissante du grand atelier; elles sont déséquilibrées, arrachées à la culture et à la propriété du sol, et finalement dégénèrent vers le type de la famille instable.

Parmi les issus de ces familles désorganisées, il se produit à chaque génération une nouvelle sélection: quelques individus mieux doués réagissent contre les tendances de leur milieu et évoluent vers le particularisme, tandis que les autres membres du groupe tombent dans une instabilité de plus en plus impuissante.

Ces familles désorganisées qui ne détiennent plus leurs propres moyens d'existence ne sauraient constituer par elles-mêmes les organismes sociaux complémentaires; elles entrent passivement dans les cadres formés à leur intention par les grands ateliers de travail, les grandes corporations religieuses, les pouvoirs publics. Mais du fait même de l'insuffisance de l'initiative développée chez leurs membres, ces familles désorganisées ne reçoivent de ces groupements complémentaires qu'une direction extérieure, insuffisante.

Le seul moyen pour le moment de porter remède aux maux résultant d'un tel état de choses me paraît être une croisade menée par tous les esprits dirigeants, en vue de la réorganisation de la famille ouvrière, communautaire ou instable, sur le modèle particulariste, c'est-à-dire avec développement plus général et plus intense de l'initiative individuelle, de la personnalité humaine, dans l'ordre matériel, intellectuel, moral et religieux.

III.—*Jean-Baptiste Bouchette.*

Par M. BENJAMIN SULTE.

(Lu le 26 mai 1908.)

On dit que les soldats font l'histoire—ce que les hommes politiques trouvent peut-être exclusif. Ces deux classes ont droit au partage en ce genre de mérite. Elles dirigent l'action des peuples. Il y a aussi le clergé, qui est un autre grand corps organisé. Et le commerce? l'industrie? la navigation?

J'ai à vous parler d'un simple marin qui, un jour, a servi de pivot, ou si vous voulez, de point tournant à l'histoire du Canada. Son cas est rare. Il était seul et décidait du sort d'un pays. Avoir eu une heure semblable dans son existence, c'est assez pour vivre toujours.

* * *

Marc Bouchet, fils d'Alain Bouchet et de Servienne Bureau, de la paroisse Saint-Charles, ville de Saint-Malo, en Bretagne, épousa, à Québec, le 2 septembre 1724, Marie-Thérèse, née en cette ville et âgée de dix-sept ans, fille de Jean Grenet et de Marie-Hélène Lavergne. Leur fils, Jean-Baptiste, né à Québec le 5 juillet 1736, fut le seul garçon qui continua la famille. Marc a dû mourir vers 1737, puisque sa veuve se remaria, le 9 février 1739, à Québec, avec François Rolet, dont elle eut Jean-Joseph, père des fameux Rolet de l'ouest et de Charles-Frédéric qui se distingua dans la guerre de 1812.[1]

D'après la coutume de Normandie, les Canadiens prononcent Bellette, Bouchette, Gaudette, Nicolette, Rolette pour Bellet, Bouchet, Gaudet, Nicolet, Rolet et, dans certains cas, l'on finit par écrire d'après cette prononciation.

Jean-Baptiste, âgé de vingt-trois ans, lors du siège de Québec par Wolfe (1759), a dû servir avec la milice de cette époque. En 1762, à Saint-Joseph de la Beauce on voit un nommé Jean-Baptiste Bouchet parrain d'une Abénaquise. C'est sans doute le même.[2] On a publié plus d'une fois que Jean-Baptiste était à la bataille des plaines d'Abraham, ce qui est très possible, mais la preuve fait défaut. Nous allons voir ce qu'il est devenu.

---

[1] Dictionnaire Tanguay, I. 282; II. 391; VII. 33. Tassé: *Canadiens de l'Ouest*, I. 144-5, 209.

[2] Il y avait alors à Québec un marchand du nom de Jacques Bouchet marié à Madeleine Loisy. Tanguay II. 391.

Pierre de Sales Laterrière, né dans le Languedoc en 1747, étudiait la médecine à Paris, en 1764-66, lorsqu'il résolut de partir pour le Canada, où il fut employé dans le commerce, par Alexandre Dumas (originaire de la Guienne) jusqu'à 1769, où la maison croula par suite de la répudiation du papier-monnaie de l'ancien régime. Il alla demeurer à Saint-Thomas de Montmagny et, en 1771, retourna à Québec sur l'invitation de Dumas qui devenait associé de la compagnie des forges Saint-Maurice et avait besoin d'un agent à Québec. Laterrière dit, dans ses *Mémoires et Traverses,* que la société de la ville était remplie de charmes. Il ajoute: "Entre les jeunes demoiselles dont je trouvais la physionomie charmante, je ne sentais réellement une tendre affection que pour trois seulement: Angélique Duhamel, Josette Roussel et mademoiselle Catherine Delzène, et encore ces amitiés étaient-elles différentes et inégalement vives. Un jour je demandai à mon bon ami Alexandre Dumas ce que l'on penserait si je me mariais avec la première; il répondit que ce serait folie, vu mon extrême jeunesse, mon (peu de) crédit et mes ressources fort légères; que je perdrais l'amitié et l'estime de la compagnie des forges; que la médecine n'allait point; que je me verrais, avec ma famille, réduit à la misère. Cela me fit tant de peur que, quelques avances que j'eusse déjà faites, il me fallut les abandonner, non sans une douleur, un regret des plus sensibles, tant l'habitude d'une sincérité qui m'est naturelle m'avait attaché à cette aimable enfant."

La médecine qu'exerçait Laterrière ne paraît pas avoir alourdi sa bourse; cependant il était expert dans son art, mais très peu exigeant quant aux honoraires. Les conseils de Dumas, remplis de sagesse, étaient bons à suivre et c'est ce qui arriva, sans toutefois écarter le jeune homme du cercle des trois enchanteresses. "J'avais, dit-il encore, fait la connaissance de mademoiselle Roussel dans le même temps que celle de ma présente épouse, Marie-Catherine Delzène. Quoique fort jolie et spirituelle, elle ne pouvait effacer l'impression plus forte que j'avais reçue de cette dernière, plus jeune et plus jolie. Melle Delzène m'aimait beaucoup, mais son père et sa mère la réservaient, en secret, au vieux veuf Pélissier, homme fort riche, de qui ils espéraient de grands secours." La vraie situation était celle-ci: Christophe Pélissier, chef de la compagnie des forges Saint-Maurice, avait à peine quarante ans, et Delzène,[1] orfèvre, petit marchand, devait naturellement favoriser l'inclination que cet homme manifestait envers sa fille.

[1] Ignace-François Delzenne, né en 1717, à Lille, en Flandre, marié à Montréal, en 1748, avec Catherine Janson. Leur fille, Marie-Catherine, née à Québec, le 26 mars 1755, épousa Christophe Pélissier, à Bécancour, le 8 mars 1775 et, plus tard, Pierre de Sales Laterrière.

Revenant sur le sujet de Melle Duhamel, son amoureux se lamente et il nous dit que le père "marin au caractère dur", l'a mariée avec un garçon qui n'était pas beau, et pourtant, s'écrie-t-il, " elle était belle, de riche taille et bien faite, hé! comment l'oublier..." Ce mariage a dû avoir lieu en 1772. Laterrière ne donne pas le nom du marié— ce devait être Jean-Baptiste Bouchet, navigateur, conduisant lui-même sa goëlette ou brigantin et faisant le commerce des pêcheries du golfe Saint-Laurent, d'après ce que m'a raconté son petit-fils, R. S. M. Bouchette. L'historien Bibaud dit que, en 1775, Bouchet commandait un brigantin, le *Gaspé*. C'était peut-être le sien, mais en 1775, ce vaisseau (un pont, deux mâts) devait être armé. Ceci a fait croire à Fennings Taylor[1] que "le commodore Bouchette portait l'uniforme d'un officier anglais lorsque naquit son fils Joseph". La naissance de ce dernier est du 14 mai 1774[2], alors que personne en Canada ne s'était encore mis sur le pied de guerre. Il y a place ici pour une autre remarque: puisque Bouchet n'était pas joli garçon par sa figure et que Marie-Anne-Angélique Duhamel possédait une grande beauté, rendue plus frappante par une riche et noble taille, c'est elle qui a transmis ces avantages à leur fils Joseph, l'un des plus beaux hommes de son temps.

* * *

Nous entrons maintenant dans la grande histoire. Le général Guy Carleton, nommé gouverneur en chef et commandant des troupes, le 22 septembre 1766, s'absenta en 1770 pour aller à Londres faire comprendre aux ministres du roi les affaires du Canada et les ajuster, autant que possible, à la satisfaction de tout le monde. Il laissait l'administration de la colonie aux mains de M. Hector-Théophile Cramahé avec le titre de président du Conseil. Dès ce moment la révolution américaine grondait. Pitt n'était plus au pouvoir. Le ministère anglais commettait des maladresses qui l'ont rendu célèbre. La mission de notre gouverneur dura plus de quatre ans, mais il finit par obtenir à peu près ce qu'il demandait. *L'Acte de Québec* étant passé au parlement, de bonne heure en 1774, Carleton rentra à Québec au mois d'octobre suivant et reprit la direction des affaires, sans avoir pu amener avec lui aucunes troupes, malgré les menaces grandissantes d'une insurrection des colonies anglaises.[3]

Le 26 mai 1775, le gouverneur arrivait à Montréal pour organiser la défense de cette partie du Canada contre une invasion imminente.

---

[1] *Portraits of British Americans*, II. 122.

[2] *Montreal Times*, 3 avril 1885.

[3] Bouchette: *British Dominions in North America*, II. 447; McCord: *Errors in Canadian History*, p. 31; *Vie de la Sœur Bourgeois*, II. 433.

dressé de fortes batteries à Sorel et dans différentes parties des îles qui sont au nord, quand il n'en était rien. Il fit tirer un coup de canon pour appeler tous les capitaines de ses vaisseaux à son propre bord, leur exposa sa position et leur demanda quel était leur avis." Ne pourrait-on pas dire, sans crainte de se tromper, que les opérations avaient été jusque là, conduites à l'européenne et que, se voyant perdu, le gouverneur allait se recommander aux Canadiens? L'affaire de Sorel se trouverait expliquée.

Continuant son journal, M. Berthelot entre dans les détails: "Tous les capitaines furent d'accord qu'il fallait tenter tous les moyens possibles pour le conduire à Québec, qui était alors le seul endroit capable d'arrêter les progrès de l'ennemi et où sa présence (le gouverneur) était de la plus grande importance. Le capitaine Belette, qui était un ancien marin d'un courage à toute épreuve, à qui on avait confié les poudres enlevées de Montréal et qui avait fait bastinguer sa goëlette armée pour se garantir des boulets que pouvaient tirer les chaloupes de l'ennemi, ouvrit le premier son avis. Il dit qu'il ne voyait pas un danger bien imminent et qu'il répondait sur sa tête de sauver le gouverneur et toute la flotte; qu'il s'engageait à lui seul à donner tant d'occupation aux chaloupes américaines, si toutefois il ne les coulait pas toutes à fond, qu'il lui donnerait le temps de se rendre en toute sûreté à Québec avec tout son monde."

Le lecteur doit s'intéresser à chacun des personnages de cet article, car autrement j'écrirais sans résultat. Faisons connaissance avec François Bellet, né en 1730, dans le diocèse de la Rochelle et marié à Québec en 1748 avec Marie-Anne Réaume. Au moment de l'aventure de Carleton il est probable que les deux Bellet, père et fils, (Antoine-François âgé de vingt-cinq ans) agissaient ensemble. Tous deux, demeurant rue Champlain, sont inscrits au nombre des miliciens de Québec l'hiver de 1775-76. Au printemps, le père fut capturé par les Américains puis, au mois de mai, sa goëlette croisait dans le lac Saint-Pierre, gênant beaucoup les mouvements de l'ennemi. Peut-être que, dans ce dernier cas, le bâtiment était commandé par le fils. Celui-ci vécut jusqu'à 1827.

M. Berthelot continue: "Le capitaine Bouchette, que l'on surnommait la Tourtre à cause de la célérité de ses voyages, s'offrit de conduire le gouverneur en berge et cet avis prévalut."

Un autre annaliste mérite d'être cité en cet endroit. Le docteur Jacques Labrie, membre de la législature de Québec (1827), avait écrit une histoire du Canada qui a été détruite dans le feu de Saint-Benoit en 1838. Le passage concernant les faits qui nous occupent avait été copié par Joseph Bouchette qui le publia à Londres dans le *United* bouche le récit du passage des détroits de Berthier sur lesquels se concentrait, pour lui, l'action la plus dramatique et le plus palpitante de cette course historique.

Ces hommes peuvent être classés comme suit, selon leur âge: Niverville 60 ans, Carleton 51, Bouchette 39, Lanaudière 32, Bouthiller 25.

Suivons le récit de M. Berthelot: "La nuit du 16 au 17, le gouverneur confia sa personne au capitaine Bouchette. La partie des rames qui portait sur le bois était enveloppée de drap [1] afin d'éviter le bruit. En passant par le chenal de l'île Dupas, les hommes ne nageaient qu'avec les mains. Pendant cette nuit, on ne rencontra aucun Américain". Au contraire, ils en virent un grand nombre.

Le docteur Labrie observe que la nuit était sombre et humide. Chaque homme portait trois biscuits. Bouchette touchait l'épaule de son plus proche voisin, lui donnait ses ordres à voix basse et celui-ci les communiquait à un autre de la même manière. Aux approches des îles de Berthier, le petit équipage était inquiet parceque l'ennemi occupait le rivage et se tenait surtout dans les îles du sud-ouest du lac; les chenaux, de ce côté, étaient en son pouvoir. Cinq hommes, dans une frêle embarcation, jouaient avec audace et dextérité le sort du Canada. Ils comprenaient très bien la responsabilité qui pesait sur eux. Traverser ces parages, où les passes navigables étaient bordées de bivouacs et si faciles à intercepter, présentait un problême que l'adresse seule pouvait résoudre. C'était se mettre dans la gueule du loup, risquer la mort sous le feu ou la captivité — plus encore — l'enlèvement du gouverneur qui portait avec lui le salut de la colonie, car sa présence à Québec, avant le blocus de la place, pouvait assurer la résistance jusqu'à l'arrivée de la flotte anglaise attendue, ou du moins espérée au printemps. La région des îles qui rétrécit le fleuve en le transformant à l'état de simples canaux, devenait la clef de toute l'aventure. "Le courage fait entreprendre, mais l'audace fait réussir, et l'adresse couronne le tout." Par bonheur, l'autorité était entre bonne main. Bouchette prit la passe du nord, mais là aussi les Américains tenaient le rivage et tout en suivant le fil de l'eau on pouvait être vu. Le plus grand péril se présenta aux détroits de Berthier lorsqu'il fallut se glisser entre les foyers lumineux des campements qui se reflétaient sur les deux rives. Les rames furent rentrées. Chaque homme s'écrasa au fond de la berge pour lui donner l'apparence d'une embarcation abandonnée. La lenteur du courant doublait les impatiences des navigateurs. D'un

---

[1] Bibaud dit que les bords de la berge, de même qu'une portion des rames, étaient recouverts de flanelle.

instant à l'autre on s'attendait à un *qui vive,* à la décharge d'un fusil, à l'abordage de quelque canot. Les aboiements des chiens à terre et les *All's well* des sentinelles troublaient de temps en temps le silence de la nuit. Enfin les feux devinrent plus rares et la nuit plus sombre. On se reprit à nager avec les mains pour accélérer la descente. Le moindre coup d'aviron dans l'eau pouvait être entendu de ceux qui étaient couchés à terre, car on sait avec quelle facilité de pareilles vibrations se transmettent sur une nappe liquide. Durant un parcours de neuf milles les canotiers trempèrent leurs bras dans le fleuve malgré la température de novembre et ne reprirent l'aviron qu'en voyant sur leur droite le lac Saint-Pierre dégarni d'îles. A la première lueur du jour ils mirent pied à terre vers la Pointe-du-Lac pour se délasser. Les habitants leur apprirent que l'armée américaine était en marche dans la direction des Trois-Rivières.

On allait donc continuer cette marche périlleuse côte à côte avec l'ennemi. Le sort du Canada tremblait dans la balance, comme aux jours de Dollard, de Frontenac et de Salaberry. Si le gouverneur n'entrait pas dans Québec, les Américains s'emparaient de la place et y seraient encore, probablement, car la guerre leur a été favorable du commencement à la fin, excepté au Canada, grâce à l'énergie de Carleton.

* * *

Le notaire Jean-Baptiste Badeaux des Trois-Rivières, qui tenait registre des événements quotidiens en cette dernière ville, s'exprime ainsi: "Le 17 novembre, un vendredi, est arrivé sur le midi, M. le général Carleton, accompagné de M. le chevalier de Niverville et de M. de Lanaudière, fils. Ils étaient en berge et conduits par le capitaine La Tourtre. En débarquant au port, M. le général Carleton ayant fait rencontre du sieur Malcolm Fraser lui demanda si les Yankees étaient venus jusqu'ici. Celui-ci lui fit réponse que non, mais que l'on avait appris qu'ils étaient à la Longue-Pointe, près de Québec. M. le général ne le voulait point croire, mais étant arrivé chez M. de Tonnancour, cette nouvelle lui fut confirmée par M. le chevalier de Tonnancour qui arrivait dans le même moment de Québec.[1] M. Maillet,[2] en allant lui rendre visite, lui annonça qu'il y en avait six cents à Machiche qui ne tardaient que le moment d'arriver. M. le général dîna et partit en-

[1] Arnold, venu avec ses troupes par la rivière Chaudière, avait traversé le fleuve à la Pointe-aux-Trembles et occupait les plaines d'Abraham depuis le 14 novembre.

[2] Charles Maillet, notaire, plus tard juge des prérogatives pour le gouvernement des Trois-Rivières.

viron sur les trois heures, espérant marcher toute la nuit et se rendre à Québec sans dangers. ...Que Dieu le veuille!"

Le docteur Labrie donne certains autres détails. Carleton, accablé de fatigue, se serait endormi après le repas, la tête sur une table. Des militaires américains survinrent tout à coup pour annoncer l'approche de leurs troupes et s'assurer des logements.

La maison de Tonnancour était naturellement choisie pour recevoir les officiers. C'était une vaste construction à trois étages, au coin des rues Notre-Dame et Saint-Louis, avec la principale porte regardant la place d'Armes. Carleton la connaissait bien. Il prenait plaisir à aller s'asseoir, en été, sous l'orme géant qui couvrait de son ombre tout le jardin situé du côté de la rue Notre-Dame. Le 6 septembre précédent, il y était encore. En cette occasion, il remarqua un homme armé qui semblait surveiller les portes de la maison et du jardin. C'était Charles Létourneau [1] que M. Tonnancour avait mis de garde auprès de la personne du gouverneur. Celui-ci apprenant ce que c'était, avança vers le factionnaire improvisé et dit: "Voilà le premier Canadien que j'ai l'honneur de voir sous les armes", et tirant de sa poche deux guinées, il lui en donna une pour lui, l'autre pour ses compagnons de garde. Lorsque l'orme subit le supplice de la hache, en 1894, il mesurait dix-neuf pieds de circonférence. La maison a brûlé au mois de janvier 1901.

M. Bibaud rapporte que "à peine le gouverneur était-il entré dans la ville qu'un parti américain y arriva et que l'hôtellerie où il était descendu se trouva remplie, mais grâce au ton familier que sut prendre avec lui l'ingénieux et loyal Bouchette, il ne fut pas reconnu." L'hôtellerie, c'était la maison de Tonnancour. Il va de soi que les domestiques connaissaient à qui ils avaient affaire et qu'ils gardèrent le secret. Au moment de partir, Bouchette secoua le dormeur par l'épaule et lui cria "embarque!" tout comme il faisait d'ordinaire avec ses matelots. Le gouverneur s'en alla sans façon sur les pas de son maître. Il était trois heures de l'après-midi. Une fois dans la berge les rameurs firent toute la diligence possible pour gagner du temps; ils étaient quatre seulement, de Niverville étant resté chez lui aux Trois-Rivières, jugeant que son départ avec les autres pourrait donner l'éveil.

Au pieds des rapides Richelieu, à la pointe du Platon, était mouillé le senault [2] *Fell*, capitaine Napier, armé en guerre, qui reçut le petit équipage avec joie et, comme le vent était favorable, on fit voile vers Québec, traînant en remorque la berge de Bouchette. C'était le samedi

---

[1] Forgeron. Baptisé aux Trois-Rivières le 3 avril 1752.

[2] Et senau, espèce de navire à deux mâts; c'est aussi une barque longue dont les Flamands se servent pour la course. (*Dictionnaire de Trevoux*). Les Anglais écrivent "snow."

18 novembre. Ni à la Pointe-aux-Trembles [1] ni ailleurs le petit bâtiment ne rencontra d'obstacle et, le lendemain, entre quatre et cinq heures de l'après-midi, la berge prenait, à bord du *Fell*, le gouverneur, Lanaudière, Bouchette, Bouthiller, le capitaine Owen, le lieutenant Selwyn du 7e régiment *Royal Fusiliers*, quelques soldats et les débarquait à la basse-ville de Québec. Aussitôt les cloches sonnèrent pour convoquer une assemblée publique et, en quelques heures, la milice fut organisée.[2] Nous savons que, malgré leurs attaques, durant quatre mois de l'hiver, les Américains ne réussirent pas à entrer dans la ville.

Le lieutenant Thomas Anbury qui était dans le Bas-Canada l'année suivante, écrit que "le gouverneur Carleton fit usage d'un canot d'écorce pour passer, avec un aide-de-camp, à travers la flotte ennemie losqu'il quitta Montréal pour aller mettre Québec en état de défense", mais nous avons vu que, de Montréal à la Valtrie, le trajet eut lieu au moyen des brigantins et goëlettes qui composaient la flotte; de Lavaltrie jusqu'au bas du Richelieu on se servit d'une berge que le *Fell* amena devant Québec et qui fut employée pour mettre à terre, en l'absence de quais.

M. de Gaspé donne à entendre dans ses *Mémoires* que le gouverneur descendit de Montréal avec trois cents Canadiens. Ceci doit se rapporter aux trois cents hommes de l'armée anglaise dont parle Sanguinet, le 11 novembre, et qui restèrent à Lavaltrie. En effet, tandis que Carleton et Bouchette entraient au château Saint-Louis pour se refraîchir, le 19 novembre après-midi, et que les cloches des églises sonnaient à toute volée pour annoncer l'événement du jour, la flotte de Lavaltrie se rendait aux Américains. "Le vent contraire la retenant toujours, dit M. Berthelot, le colonel Easton (américain) en faisant montre de quelques chaloupes canonnières, vint à bout d'intimider le colonel (anglais) Richard Prescott qui en avait alors le commandement. Suivant les ordres qu'il avait reçus du gouverneur avant son départ, il fit jeter les poudres et les boulets à l'eau. Le 19 au matin le colonel Easton l'ayant sommé, par le major Brown, de se rendre, il dit qu'il était prêt à livrer la flotte, à condition qu'il lui fût permis de se rendre à Québec avec sa troupe. Le colonel Easton rejetta la proposition en lui faisant dire que, si, sous quatre heures, les bâtiments ne se rendaient, il les ferait prendre à l'abordage. Ce fut ainsi que le colonel anglais livra onze vaisseaux et se rendit prisonnier de guerre avec plusieurs officiers et cent vingt soldats, quand plusieurs de ces vaisseaux

---

[1] Garneau dit que le gouverneur, ayant voulu aborder à la Pointe-aux-Trembles, faillit être enlevé.

[2] Berthelot, Labrie, Sanguinet, la *Gazette de Québec* du 23 novembre.

étaient bien armés et bien équipés. Pour combler les désastres du gouverneur, cette flotte fut conduite à Montréal, où Montgomery en fit usage pour aller rejoindre Arnold."

* * *

La page d'histoire qui vient d'être retracée met en lumière l'action d'un homme courageux et habile, dont la carrière aurait pu se poursuivre dans l'obscurité sans diminuer son mérite; mais nous allons voir qu'il était susceptible de reparaître avec honneur, grâce à des circonstances nouvelles et différentes des premières, c'est-à-dire dans le service public en temps de paix.

De tous ceux qui se sont distingués au cours des événements qui rendent nos annales si intéressantes, un bon nombre n'ont jamais reçu aucune récompense; il en est même que l'oubli a recouvert pour toujours, tant il est vrai que la fortune est aveugle et parfois ingrate. Dans le cas qui nous occupe, il est plus consolant de constater une situation satisfaisante et de pouvoir dire encore une fois qu'un bienfait n'est pas perdu

Jusqu'ici, nous nous sommes tenus sur le Saint-Laurent, entre Montréal et Québec. Il va falloir nous transporter au lac Ontario pour suivre la carrière du personnage qui nous occupe. Depuis 1758, il ne restait dans ces parages aucun établissement militaire ni bâtiment armé. Il faut croire que la déclaration de l'Indépendance (juillet 1776) avait attiré l'attention du gouverneur Carleton du côté du Haut-Canada, puisque, l'automne de 1777, il y avait au Détroit un nommé Alexandre Legrand " commandeur des vaisseaux de Sa Majesté sur les lacs."[1] En 1778, le général Frédéric Haldimand remplaça Carleton et, comme la guerre continuait, il songea à la défense de cette région et y employa le capitaine Schank, mais sans le dégager de ses devoirs comme officier naval aux environs de Québec, d'après ce que voici: Pierre Ducalvet, arrêté le 27 septembre 1780, fut mis à bord du *Canceaux,* dans la rade de Québec, sous le commandement du capitaine Schank. Celui-ci expliqua au gouverneur qu'il ne pouvait rester assidûment à son poste à cause de ses visites officielles sur les lacs,[2] ce qui amena probablement la décision de choisir un commodore particulier pour ce service. Le 15 novembre suivant, Haldimand écrivait au capitaine Laforce: "Pour vous montrer la haute opinion que j'ai de vos mérites, je viens de vous nommer au commandement des navires du lac Ontario et je vous assure que je serai heureux de vous conserver dans cette charge importante. En même temps, mon amitié pour vous me porte

[1] Tanguay, V. 300.

[2] *Archives Canadiennes,* 1888, p. XXIII.

à vous dire qu'il pourrait arriver, le printemps prochain, des officiers de la marine royale dont le rang dans le service de Sa Majesté les placerait au dessus de vous, mais à moins de cela j'entends vous maintenir entièrement dans le poste de chef que je vous confie." Laforce et son collègue Côté ont correspondu avec Haldimand jusqu'à 1783 au sujet du lac Ontario et fourni une grande carte géographique qui se trouve au département des archives, à Ottawa.

L'*Ontario*, un navire neuf de 16 canons, portant 30 hommes du 34e régiment, partit du fort Niagara le 31 octobre 1780. On l'aperçut, deux jours après, à la côte nord du lac, et l'on n'a jamais retrouvé de ses débris.

Bibaud dit que le gouvernement ayant établi un dépôt de marine dans le Haut-Canada, en 1784, le capitaine Bouchette commanda sur les lacs. Haldimand partit l'année suivante. La paix était signée. Carleton, devenu lord Dorchester, arriva en 1786. En 1789, Bouchette établit un dock à Kingston.

* * *

L'endroit où se trouve la ville de Toronto était encore désert lorsque, le 10 juin 1791, M. Collins, assistant arpenteur général, écrivit, de Québec, à M. Augustus Jones, assistant arpenteur provincial, que "Son Excellence lord Dorchester accordait mille acres de terres à Toronto, qu'il faudra délimiter par arpentage, en faveur de M. de Rocheblave; et, aux capitaines Laforce et Bouchette, chacun sept cents acres au même endroit." La province du Haut-Canada allait être créée. On parlait d'établir sa capitale à Toronto,[1] mais faute d'habitation la première législature s'assembla (1792) à Newark, Niagara-sur-le-Lac, à présent. Les terres ci-dessus mentionnées n'avaient point encore été vues des arpenteurs puisque le 15 juin 1792, M. Jones faisait rapport à M. Collins que ses instructions du 10 juin 1791 ne lui étaient parvenues que depuis peu de jours. Il ajoute que le bureau des terres de la couronne ne croyait pas devoir agir vu la proclamation du gouverneur Simcoe prenant possession des affaires de la province. Donc, il lui fallait de nouvelles instructions. Plus tard, les choses s'arrangèrent. La concession de Bouchette passa en 1802 au colonel James Givins.[2]

---

[1] Le gouverneur Simcoe choisit la baie de Toronto en 1793 comme cite d'une ville et lui imposa le nom d'York. En 1794 il y construisit une résidence d'été. L'année suivante on y comptait 12 maisons et une caserne. La ville prit le nom de Toronto en 1834.

[2] Scadding: *Toronto of Old*, pp. 17-18, 355, 358; Robertson: *Landmarks of Toronto*, I. 1.

Joseph Bouchette, fils du commodore, était employé sur les lacs à titre d'hydrographe et arpenteur. Au printemps de 1793 il releva les sondages [1] du port où est la ville de Toronto dont l'emplacement ne comptait qu'une seule cabane sauvage. Un an après les travaux de construction commencèrent et le village prit le nom du duc d'York.[2]

La rivière Holland, non loin de Toronto, a reçu son nom du major Samuel Holland, arpenteur général de 1763 à 1801. Il avait pris part aux campagnes de Louisbourg et Québec en 1758 et 1759. C'était un homme actif, très entendu en son art, coulant avec le monde, fort instruit. Il a fait des relevés des côtes américaines. On lui doit une superbe carte du Haut-Canada (1791) à l'échelle de six pouces au mille carré.[3] Il décéda le 28 décembre 1801, et Joseph Bouchette, qui le remplaçait depuis le mois de juillet, fut chargé, le 8 janvier 1802, de continuer la fonction d'arpenteur général, mais il ne fut nommé en titre qu'en 1804.[4]

De François Rolet et de Thérèse Grenet, veuve de Marc Bouchet, naquit à Québec, le 8 décembre 1744, Jean-Joseph Rolet, qui épousa, à Québec, le 23 novembre 1778, Marie-Angélique Lortie et mourut à Nicolet en 1828. Il y eut huit enfants de ce mariage: Jean-Joseph, né à Québec en 1781, célèbre dans l'ouest où il a vécu longtemps et laissé une nombreuse descendance. Ensuite Charles-Frédéric, officier naval distingué, qui épousa en 1811, Lucie, la plus jeune des filles de Jean-Baptiste Bouchette. Hyppolite et Laurent ont fait aussi leur carrière dans l'ouest. Des quatre filles, la plus jeune, Marie-Josephte, se maria avec le major Samuel Holland, arpenteur général.

* * *

Le duc de la Rochefoucauld-Liancourt, partisan de la révolution française, mais opposé à Robespierre, visitait les Etats-Unis en 1795 et se rendit auprès du gouverneur Simcoe qui le reçut fort bien; toutefois lord Dorchester ne lui permit pas de descendre plus bas que Kingston; aussi le noble voyageur ne le ménage guère dans ses écrits tandis qu'il est tout miel pour le général Simcoe. En juillet 1795, il part dans l'espérance de voir le Bas-Canada, n'ayant pas encore été prié de rester où il était ou de reprendre la route des Etats-Unis:

---

[1] Scadding, *Toronto of Old*, p. 332, attribue cet ouvrage au commodore Bouchette et il donne aussi ce dernier comme l'auteur de *British Dominions in N. A.* —mais à la page 509 il se corrige.

[2] *British Dominions in North America*, I. 89.

[3] Scadding: *Toronto of Old*, pp. 492, 493.

[4] *Colonial Office Records*, Q. pp. 73, 88—Archives d'Ottawa. *Bulletin des Recherches*, 1899, p. 186.

"C'est sur l'*Onondago,* une des goëlettes appartenant à la marine militaire du lac que nous nous sommes embarqués (à York) pour aller à Kingston. Cette goëlette est percée pour douze canons de six livres de balles et n'en monte que la moitié en temps de paix. Quand ces sortes de bâtiments ne sont pas chargés d'effets pour le service du roi, ils portent des marchandises pour les négociants, qui payent en conséquence ou qui chargent une autre fois pareille quantité d'effets du roi sur leurs bâtiments. L'*Onondago* est du port de quatre-vingts tonneaux... Kingston est la place où lord Dorchester voudrait que le gouverneur Simcoe établît sa capitale du Haut-Canada; il semble lier à ce choix l'avantage d'avoir, en cas d'attaque, toutes les troupes plus rapprochées de Québec, seul point que ce gouverneur regarde comme possible à défendre dans le Bas-Canada... La ville de Kingston est à l'entrée de la baie de ce nom, à laquelle les Français avaient toujours laissé le nom indien de Cadarakwe. Cent vingt à cent trente maisons la composent... Toutes les maisons sont bâties sur la côte nord de la baie. Sur le côté du midi sont l'établissement naval militaire, le chantier, le logement de tout ce qui tient à cette petite partie de la marine. Les bâtiments du roi sont à l'ancre dans la rivière en avant de ces établissements, et ont aussi leur port et leur rade séparés de ceux du commerce... Kingston, comme ville, est très inférieure à Newark. Le nombre des maisons est à peu près égal entre les deux villes, peut-être même un peu plus grand à Kingston, mais elles sont plus petites, plus vilaines; il y en a beaucoup en troncs d'arbres; celles en menuiserie sont mal faites et mal peintes; on en bâtit peu de nouvelles; il n'y a point encore de maison-de-ville; point de cour de justice, point de prisons... On ne distingue aucun édifice beaucoup plus soigné que les autres; le seul plus considérable, un peu en avant duquel est planté le pavillon anglais, est le corps de casernes, bâtiment de pierres, entouré de palissades... Ces casernes sont bâties à la même place où, du temps des Français, était le fort Frontenac... elles ne sont construites que depuis dix ans... Les troupes anglaises avaient été en mouvement pendant la guerre d'Amérique et, depuis, étaient établies à un fort dans l'île appelée par les Français île aux Chevreaux et nommée dans la nouvelle nomenclature anglaise Carleton, du nom de Lord Dorchester[1] ... L'établissement de la marine du roi mérite peu d'être vu; six vaisseaux sont toute la force du lac; deux d'entre eux sont les petites chaloupes-canonnières que nous avons trouvées à Niagara et qui restent à York. Deux goëlettes de douze canons, dont l'*Onondago,* sur lequel nous avons passé; le *Mohawck,* qui vient d'être construit; un petit

[1] C'est l'île à la Biche de la carte de 1680.

sloop de quarante tonneaux monté de six canons; enfin, le *Missassoga* de la force de deux goëlettes, à présent en réparation sur les chantiers, complètent le nombre. Tous ces vaisseaux sont faits de bois vert, aussi ne durent-ils pas plus de cinq ou six ans. Encore, pour les faire autant durer, leur faut-il un radoub, un carénage, une réparation entière, qui coûte au moins de mille à douze cents guinées. Ils reviennent à quatre mille guinées avant de naviguer, j'entends le plus gros de ces bâtiments; ce prix, quoiqu'exhorbitant, est moins cher qu'au lac Erié, parceque, sur ce lac, il faut apporter toutes les provisions de Kingston et que la main d'œuvre y est plus chère encore. Le *Mississoga,* bâti depuis trois ans, est pourri dans presque toutes ses parties. Il serait si aisé de s'approvisionner de bois pour un grand nombre d'années, puisqu'il ne coûte que la peine de le couper, à une distance bien rapprochée du chantier, que l'on ne peut concevoir comment ce soin n'est pas pris. Deux chaloupes-canonnières, de celles que le gouverneur Simcoe destine à ne servir qu'en temps de guerre, sont aussi sur le chantier où huit charpentiers seulement sont employés... On en fait le reproche au commissaire de la marine... Le capitaine Bouchette, commodore de la marine du lac Ontario, est à la tête de tous ces établissements, mais sans rien ordonner pour les dépenses. C'est un homme en qui lord Dorchester et le gouverneur Simcoe ont une grande confiance. Canadien d'extraction, resté au service de l'Angleterre quand le Canada a passé sous sa domination; c'est lui qui, dans le moment où Arnold et Montgomery assiégeaient Québec, y a fait entrer, sur son bateau, lord Dorchester déguisé en Canadien; il a dans cette occasion donné une grande preuve d'activité, d'audace et de courage; on ne peut s'étonner que lord Dorchester n'ait pas oublié ce service signalé. Ses propos sont ceux d'un homme pur en fait d'argent, et d'un officier facile pour ses subalternes. Les salaires de la marine royale du lac Ontario sont dix schellings par jour par capitaine, six par lieutenant... Le commodore Bouchette est un des plus grands détracteurs du projet de faire de York le centre de la marine du lac. Il a sa famille et ses terres à Kingston; de pareilles raisons sont assez communément influentes pour déterminer les opinions politiques... Aucune habitation régulière d'Indiens n'est rapprochée de Kingston de plus de quarante milles, et ce sont des Mohawcks; il y a aussi, à la même distance de la ville, quelques villages de Mississogas; mais des tribus vagabondes de cette nation errent continuellement sur tous ces rivages."[1]

Bouchette resta une vingtaine d'années à la tête des forces navales

[1] *Voyage dans les Etats-Unis*, pp. 117, 123, 125, 131, 133-34, 150-51, 154.

sur les grands lacs, occupant avec sa famille les logements du fort Frédéric, à Kingston, ancien Frontenac. C'est là, je crois, qu'il mourut en 1804.

La paix régnait dans toute l'Amérique du Nord au moment où le duc de la Rochefoucauld visitait Kingston. Disons aussi que, à la suite d'enquêtes concernant les dépenses de la marine militaire sur le lac Ontario, le gouvernement anglais s'était effrayé, de sorte que toute chose était alors à l'état de stagnation et de réduction. Bouchette n'avait que voix consultative; sa fonction consistait à armer et équiper selon les moyens qu'on lui fournissait. C'est cependant sous son administration et peut-être sur son initiative, qu'eurent lieu, après cela, de nouvelles enquêtes dont il résulta de grandes améliorations dans le service. De ce moment, et jusqu'à la guerre de 1812, l'escadre devint de plus en plus forte et la construction s'augmenta au point qu'on vit sortir des chantiers de Kingston le *Saint-Laurent,* vaisseau de guerre de premier ordre montant 102 canons. Il est vrai qu'à la même époque, à Sackett's Harbour, vis-à-vis Kingston, les Américains mirent à flot le plus grand navire de guerre du monde, mesurant 210 pieds de longueur à l'entrepont—à mille milles des bouches du fleuve Saint-Laurent.

C'est au milieu de ces travaux importants, quoiqu'assez monotones en temps de paix, que Bouchette vivait à Kingston, s'attachant à faire valoir la position stratégique de l'endroit de préférence à celle de Toronto et, en cela, les événements l'ont justifié. Par son fils Joseph, qui avait eu une grande part à la création de Toronto ou York et où il possédait une belle concession de terre, il s'intéressait à ce nouveau poste; toutefois sa pensée militaire était pour Kingston. Les deux clefs du lac sont Niagara et Kingston—toutes deux agissent indépendamment l'une de l'autre. Quant à la flotte, lorsque nous l'avons perdue en 1813, non seulement le lac, mais tout le Haut-Canada nous a échappé. Le point capital était de rester maître de l'Ontario. Bouchette appliquait tous ses soins, malgré l'infériorité de ses ressources, à nous y conserver une situation dominante et il y parvint. Ses gréements, ses canons étaient de meilleure qualité que ceux des Américains; les navires étaient mieux construits, quoique de moindres dimensions.[1] Comme il arrive souvent, le désaccord entre les chefs gênait l'exécution des plans. Le gouverneur Simcoe employait tous ses efforts en faveur d'York; en 1796 il y amena le siège du gouvernement qui se tenait à Newark—puis il fut remplacé dans ses fonctions. Lord Dorchester, qui tenait pour Kingston, donna alors plus de facilité à Bouchette dans

[1] *British Dominions in North America*, I. 72-73.

l'armement du lac. Voilà, si je ne me trompe, tout le mystère de ces transactions.

Vers 1801, Bouchette paraît avoir fait savoir qu'il songeait à prendre sa retraite, d'après la lettre suivante datée du palais de Kensington le 9 mars 1802: "Le capitaine Dodd, secrétaire militaire et aide-de-camp du duc de Kent, est chargé par Son Altesse Royale de faire savoir au capitaine Bouchette que, pensant qu'il serait de son avantage de se démettre de sa laborieuse situation, pourvu qu'il retînt toute sa paie actuelle de dix schillings[1] par jour, comme pension de retraite, le duc en a parlé aux lords de la trésorerie et il a raison de croire que, si le capitaine Bouchette présente un mémoire constatant ses longs et fidèles services, son âge avancé et demandant de se retirer avec son salaire entier, cette démarche sera bien accueillie. Au cas où le capitaine Bouchette entrerait dans ces vues, il pourra écrire à Son Altesse Royale et être certain que le mémoire sera supporté de tout ce que le duc peut faire en sa faveur." L'adresse porte: " Capitaine Bouchette, commandant les vaisseaux armés de Sa Majesté sur le lac Ontario." Le duc de Kent avait exprimé le désir de demander une décoration ou un titre pour Bouchette—celui-ci l'en dissuada. Les lettres et rapports de Bouchette à Carleton, Haldimand et Simcoe sont en très bon français—et les réponses de ces gouverneurs également. A ce propos, disons que la correspondance officielle se faisait en français du moment où un Canadien s'y trouvait concerné. Les hommes instruits dans le service britannique parlaient et écrivaient aisément notre langue. Durant le XIXe siècle cette règle ou coutume s'est affaiblie.

Il y a apparence que le décès du brave Bouchette survint avant sa mise à la retraite, mais cela n'est d'aucune importance. Il laissait comme héritage l'exemple de sa vie à Joseph, son fils, dont les œuvres mériteraient une étude spéciale. De Joseph sont nés: Joseph, Jean et Robert, tous trois dignes d'attention par une haute intelligence, les travaux qu'ils ont exécutés et leurs qualités sociales. N'oublions pas Errol, fils de Robert, notre collègue à la Société Royale.

---

[1] Cette somme valait $6 de notre argent. Il y avait, en outre, des avantages, mais que la retraite faisait perdre.

IV.

GOUVERNEURS,

LIEUTENANTS-GOUVERNEURS,

ET

ADMINISTRATEURS

DE LA

PROVINCE DE QUEBEC,

DES

BAS ET HAUT CANADAS,

DU

CANADA SOUS L'UNION

ET DE LA

PUISSANCE DU CANADA.

1763-1908.

Par Francis J. AUDET
des Archives fédérales.

(Présenté par M. B. Sulte, lu le 26 mai 1908).

PROVINCE DE QUEBEC—1763-1791

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
21 nov. 1763	13 août 1764	Murray, James	Gouv. en chef (1)	12 avril 1768	28 juin 1766	
	30 juin 1766	Irving, Paulus Æmilius	Prés. et Adm. (2)	24 sept. 1766	....	
7 avril 1766	24 sept. 1766	Carleton, Guy	Lieut.-Gouv. et Adm. (3)	26 oct. 1768	....	
12 avril 1768	26 oct. 1768	Carleton, Guy	Gouv. en chef	27 juin 1778	30 juil. 1778	Sa commission révoque celle de Murray.
	9 août 1770	Cramahé, Hector Theophilus	Administrateur (4)	18 sept. 1774	....	
6 juin 1771	26 sept. 1771	Cramahé, Hector Theophilus	Lieut.-Gouv.	23 avril 1782	....	Nouvelle commission datée le 7 avril 1775, prenant effet le 1er mai suivant.
18 sept. 1777	27 juin 1778	Haldimand, Frederick	Gouv. en chef (5)	22 avril 1786	16 nov. 1784	Décédé en 1791.
23 avril 1782	24 juin 1782	Hamilton, Henry	Lieut.-Gouv. (6)	13 août 1785	....	
	16 nov. 1784	Hamilton, Henry	Administrateur	2 nov. 1785	6 nov. 1785	
13 août 1785	2 nov. 1785	Hope, Henry	Lieut.-Gouv. (7)	....	....	Décédé le 13 avril 1789.
	2 nov. 1785	Hope, Henry	Administrateur	23 oct. 1786	....	
22 avril 1786	23 oct. 1786	Dorchester, Lord	Gouv. en chef	25 déc. 1791	....	Sa commission révoque celle d'Haldimand.
19 mars 1790	8 oct. 1790	Clarke, Alured, Major-Gén'l.	Lieut.-Gouv. (8)	24 juin 1795	....	

BAS-CANADA—1791-1841

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
12 sept. 1791	26 déc. 1791	Dorchester, Lord	Gouv. en chef	15 déc. 1796	9 juil. 1796	
	25 août 1791	Clarke, Alured	Administrateur	24 sept. 1793	oct. 1793	
12 sept. 1791		Clarke, Alured	Lieut.-Gouv.	21 janv. 1796	....	
21 janv. 1796	21 juin 1796	Prescott, Robert, Général	Lieut.-Gouv. (9)	15 déc. 1796	....	
	12 juil. 1796	Prescott, Robert	Administrateur	27 avril 1797	....	
15 déc. 1796	27 avril 1797	Prescott, Robert	Gouv. en chef	29 août 1807	29 juil. 1799	Sa commission révoque celle de Dorchester du 12 sept. 1791.
4 nov. 1797	....	Milnes, Robert Shore	Lieut.-Gouv. (10)	29 nov. 1808	....	
	30 juil. 1799	Milnes, Robert Shore	Administrateur	12 août 1805	5 août 1805	
	12 août 1805	Dunn, Thomas	Prés. et Adm. (11)	24 oct. 1807	....	
29 août 1807	24 oct. 1807	Craig, Sir James Henry	Gouv. en chef. (12)	21 oct. 1811	19 juin 1811	Sa commission révoque celle de Prescott.
29 nov. 1808	....	Burton, Francis Nathaniel	Lieut.-Gouv. (13)	27 janv. 1832	....	
	19 juin 1811	Dunn, Thomas	Prés. et Adm.	14 sept. 1811	....	
	14 sept. 1811	Prevost, Sir George	Administrateur (14)	15 juil. 1812	....	
	9 avril 1812	Brock, Isaac, Major-Gén'l	Administrateur (15)	....	....	A reçu une commission mais n'a pas agi.
21 oct. 1811	15 juil. 1812	Prevost, Sir George	Gouv. en chef	4 avril 1815	3 avril 1815	Sa commission révoque celle de Craig.
	20 fév. 1813	de Rottenburg, baron Francis	Prés. et Adm. (16)	16 mars 1813	....	
	12 mai 1813	de Rottenburg, baron Francis	" "	14 juin 1813	....	
	14 juin 1813	Glasgow, George, Major-Gén'l	" " (17)	25 sept. 1813	....	
	11 oct. 1814	de Rottenburg, baron Francis	" "	30 nov. 1814	....	
28 déc. 1814	4 avril 1815	Drummond, Sir Gordon	Administrateur (18)	21 mai 1816	21 mai 1816	Sa commission révoque celle de Prevost.
15 nov. 1815	21 mai 1816	Wilson, John, Major-Gén'l	Administrateur (19)	12 juil. 1816	15 juil. 1816	Nommé par lettre du Secrétaire d'Etat pour les Colonies.
25 mars 1816	12 juil. 1816	Sherbrooke, Sir John C.	Gouv. en chef (20)	30 juil. 1818	12 août 1818	

BAS-CANADA—1791-1841—Suite

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
8 mai 1818	30 juil. 1818	Richmond, Duc de	Gouv. en chef (21)	....	....	Mort d'hydrophobie le 28 août 1819.
	20 sept 1819	Monk, James	Prés. & Adm. (22)	17 mars 1820	....	
13 oct. 1819	....	Dalhousie, Lord	Administrateur (23)	....	....	Etant hors de la province, il délégua son autorité à Sir P. Maitland.
	17 mars 1820	Maitland, Sir Peregrine	Administrateur (24)	19 juin 1820	20 juin 1820	
12 avril 1820	19 juin 1820	Dalhousie, Lord	Gouv. en chef	8 sept. 1828	8 sept. 1828	
....	7 juin 1824	Burton, Sir Francis Nathaniel	Administrateur	16 sept. 1825	6 oct. 1825	
10 avril 1828	8 sept. 1828	Kempt, Sir James	Administrateur (25)	20 oct. 1830	20 oct. 1830	
13 août 1830	20 oct. 1830	Aylmer, Lord	Administrateur (26)	4 fév. 1831	....	
24 nov. 1830	4 fév. 1831	Aylmer, Lord	Gouv. en chef	24 août 1835	17 sept. 1835	Sa commission révoque celle de Dalhousie.
2 avril 1835	....	Amherst, Lord	Gouv. en chef et Haut Com. (27)	....	....	Ne vint pas au Canada. Il démissionna en mai de la même année. Sa commission révoque celle d'Aylmer.
1 juil. 1835	24 août 1835	Gosford, Lord	Gouv. en chef et Haut Com. (28)	30 mars 1838	27 fév. 1838	Sa commission révoque la précédente.
27 nov. 1837	27 fév. 1838	Colborne, Sir John	Administrateur(29)	29 mai 1838	....	Nommé par dépêche du Secrétaire d'Etat pour les Colonies.
30 mars 1838	29 mai 1838	Durham, Lord	Gouv. en chef (30)	1 nov. 1838	3 nov. 1838	Il démissionna.
	1 nov. 1838	Colborne, Sir John	Administrateur	17 janv. 1839	....	
13 déc. 1838	17 jan. 1839	Colborne, Sir John	Gouv. en chef	19 oct. 1839	23 oct. 1839	
6 sept. 1839	19 oct. 1839	Poulett Thomson, Charles	Gouv. en chef (31)	10 fév. 1841	....	
	18 nov. 1839	Jackson, Sir Rich. Downes	Administrateur(32)	19 fév. 1840	....	Durant un voyage de M. Thomson dans le Haut-Canada.
	8 juil. 1840	Jackson, Sir Rich. Downes	Administrateur	31 juil. 1840	....	Durant une visite de M. Thomson au Nouveau-Brunswick.

HAUT-CANADA—1791-1841

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
12 sept. 1791	8 juil. 1792	Simcoe, Colonel John Graves...	Lieut. Gouv. (33)	10 avril 1799	20 juil. 1796	
18 juil. 1796	20 juil. 1796	Russell, Peter............	Prés. & Adm (34)	17 août 1799	....	Nommé par com. de Simcoe.
10 avril 1799	17 août 1799	Hunter, Lieut.-Général Peter...	Lieut.-Gouv. (35)	21 août 1805	....	Mort 21 août 1805.
	11 sept. 1805	Grant, Alexander............	Prés. & Adm. (36)	25 août 1806	....	
22 janv. 1806	25 août 1806	Gore, Francis................	Lieut.-Gouv. (37)	....	9 oct. 1811	Remplaçant Hunter.
14 sept. 1811	9 oct. 1811	Brock, Major-Général Isaac....	Prés. & Adm.	13 oct. 1812	....	Nommé par lettre de Sir G. Prevost, durant l'absence de Gore.
	20 oct. 1812	Sheaffe, Major-Gén'l Roger Hale	Prés. & Adm. (38)	19 juin 1813	....	Après la mort de Brock.
	19 juin 1813	Rottenburg, Major-Général Francis, baron de........	Pres. & Adm....	13 déc. 1813	....	
	13 déc. 1813	Drummond, Lieut.-Général G..	Prés. & Adm.......	25 avril 1815	....	
	25 avril 1815	Murray, Lieut. Général Sir Geo. C. C. B..................	Lieut.-Gouv. Provisoire (39)	1 juil. 1815	....	
	1 juil. 1815	Robinson, Major Général, Sir Fred. Philipse K. C. B.....	Lieut.-Gouv. Provisoire (40)	21 sept. 1815	....	
	21 sept. 1815	Gore, Francis................	Lieut.-Gouv........	6 janv. 1818	11 juin 1817	
10 juin 1817	11 juin 1817	Smith, Samuel, Lt.-Col........	Administrateur (41)	13 août 1818	....	Commission signée par Gore
6 janv. 1818	13 août 1818	Maitland, Major-Général, Sir Peregrine, K. C. B.........	Lieut.-Gouv.......	....	....	
	8 mars 1820	Smith, Samuel Lieut -Colonel..	Administrateur......	30 juin 1820		Durant un voyage de Maitland dans le Bas-Canada.
	30 juin 1820	Maitland, Major-Général Sir Peregrine.................	Lieut.-Gouv........	23 août 1828	4 nov. 1823	Absent de la Province en février 1820. Il ne paraît pas y avoir eu d'administrateur.
23 août 1828	4 nov. 1828	Colborne, Major-Général Sir John, K. C. B.............	Lieut.-Gouv.	30 nov. 1835	26 janv. 1836	
30 nov. 1835	25 jan. 1836	Head, Sir Francis Bond, K.C.H..	Lieut.-Gouv. (42)	23 mars 1838	23 mars 1838	
22 déc. 1837	23 mars 1838	Arthur, Major-Général Sir Geo. K.C.H..................	Lieut.-Gouv. (43)	9 fév. 1841	11 fév. 1841	

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques.
29 août 1840	10 fév. 1841	Sydenham, Lord	Gouv. en chef			Mort à Kingston, des suites d'une chute de cheval, le 19 sept. 1841.
	21 sept. 1841	Jackson, Sir Rich. Downes	Administrateur	12 janv. 1842		
7 oct. 1841	12 janv. 1842	Bagot, Sir Charles	Gouv. en chef (44)	30 mars 1843		Mort à Kingston le 19 mai 1843.
24 fév. 1843	30 mars 1843	Metcalfe, Sir Chs. Theophilus	Gouv. en chef (45)	26 nov. 1845		Sa commission révoque celle de Bagot. Décédé en sept. 1846.
	26 nov. 1845	Cathcart, Lord	Administrateur (46)	24 avril 1846		
16 mars 1846	24 avril 1846	Cathcart, Lord	Gouv. en chef	30 janv. 1847		
1 oct. 1846	30 janv. 1847	Elgin, Lord	Gouv. en chef (47)	19 déc. 1854	22 déc. 1854	
	23 août 1853	Rowan, William	Administrateur (48)	10 juin 1854		Durant l'absence de Lord Elgin.
20 sept. 1854	19 déc. 1854	Head, Sir Edmund W	Gouv. en chef (49)	25 oct. 1861	24 oct. 1861	
	20 juin 1857	Eyre, Sir William, Lieut.-Gén'l.	Administrateur (50)	2 nov. 1857		Durant l'absence de Sir E. Head.
	12 oct. 1860	Williams, Sir William F	Administrateur (51)	23 fév. 1861		Durant l'absence de Sir E. Head.
2 oct. 1861	25 oct. 1861	Monck, Vicomte	Administrateur (52)	28 nov. 1861		
2 nov. 1861	28 nov. 1861	Monck, Vicomte	Gouv. en chef	30 juin. 1867		
	30 sept. 1865	Michel, Sir John, Major-Gén'l.	Administrateur (53)	12 fév. 1866		Durant l'absence de Monck.
	10 déc. 1866	Michel, Sir John, Lieut.-Gén'l.	Administrateur	25 juin 1867		Durant l'absence de Monck.

PUISSANCE DU CANADA—1867-1908

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
1 juin 1867	1 juil. 1867	Monck, Vicomte	Gouv. Général	13 nov. 1868	14 nov. 1868	
	14 nov. 1868	Windham, Sir Charles A.	Administrateur (54)	30 nov. 1868	....	Durant l'absence de Monck.
10 nov. 1868	1 déc. 1868	Young, Sir John	Administrateur (55)	1 fév. 1869	....	Durant l'absence de Monck.
29 déc. 1868	2 fév. 1869	Young, Sir John	Gouv. Général	21 juin 1872	21 juin 1872	Créé Baron Lisgar le 2 nov. 1870. Mort le 6 oct. 1876.
	22 juin 1872	Doyle, Sir Chs. H., Lieut.-Gen'l.	Administrateur (56)	24 juin 1872	....	
22 mai 1872	25 juin 1872	Dufferin, Lord	Gouv. Général. (57)	14 nov. 1878	19 oct. 1878	
	12 oct. 1874	O'Grady-Haly W., Lieut.-Gén'l.	Administrateur (58)	2 nov. 1874	....	
	15 mai 1875	O'Grady-Haly, William	Administrateur	21 oct. 1875	....	
	21 jan. 1878	O'Grady-Haly, Sir William	Administrateur	3 fév. 1878	....	Aucune proclamation ne fut publiée.
	19 oct. 1878	MacDougall, Sir Pat. Leonard	Administrateur (59)	24 nov. 1878	....	Proclamation dans la Gazette du Canada, mais non enregistrée au bureau du Reg. Général du Canada.
7 oct. 1878	25 nov. 1878	Lorne, Marquis de	Gouv. Général (60)	21 oct. 1883	27 oct. 1883	
	11 nov. 1881	MacDougall, Sir P. L.	Administrateur	20 janv. 1882	....	
	18 déc. 1882	MacDougall, Sir P. L.	Administrateur	30 janv. 1883	....	
18 août 1883	23 oct. 1883	Lansdowne, Marquis de	Gouv. Général (61)	30 mai 1888	25 mai 1888	
	5 août 1886	Russell, Lord Alex. George	Administrateur (62)	7 nov. 1886	....	
	26 mai 1888	Ross, Sir John, Lieut.-Gén'l.	Administrateur (63)	10 juin 1888	....	
1 mai 1888	11 juin 1888	Stanley of Preston, Baron	Gouv. Général (64)	6 sept. 1893	15 juil. 1893	
	15 juil. 1893	Montgomery-Moore, Alex. Geo. Lieut.-Général	Administrateur (65)	17 sept. 1893	....	
22 mai 1893	18 sept. 1893	Aberdeen, Comte d'	Gouv. Général (66)	12 nov. 1898	14 nov. 1898	
	13 oct. 1893	Montgomery-Moore, A. G.	Administrateur	22 oct. 1893	....	
	29 nov. 1894	Montgomery-Moore, A. G.	Administrateur	4 déc. 1894	....	

PUISSANCE DU CANADA—1867-1908—Suite

Date de la Commission	Assermentation et Proclamation	NOMS	Rang	Terme d'office	Départ du pays	Remarques
	13 fév. 1897	Montgomery-Moore, A. G......	Administrateur......	26 fév. 1897	....	
	20 oct. 1897	Montgomery-Moore, A. G......	Administrateur......	25 oct. 1897	....	
	28 juin 1898	Seymour, Lord William F. E....	Administrateur (67)	30 juin 1898	....	
30 juil. 1898	12 nov. 1898	Minto, Comte de............	Gouv. Général (68)	20 nov. 1904	18 nov. 1904	
	4 oct. 1899	Seymour, Lord Wm. F. E......	Administrateur......	7 oct. 1899	....	
	9 juin 1902	Strong, Sir Henry............	Administrateur (69)	26 juil. 1902	....	
	21 nov. 1904	Taschereau, Sir H. Elzéar......	Administrateur (70)	9 déc. 1904	....	
26 sept. 1904	10 déc. 1904	Grey, Comte.................	Gouv. Général (71)	15 juin 1905	....	Nouvelle commission datée du 15 juin 1905, comme gouverneur général et commandant en chef.
	30 mars 1906	Sedgwick, Robert............	Administrateur (72)	9 avril 1906	....	
	16 avril 1907	Fitzpatrick, Charles..........	Administrateur (73)	21 avril 1907	....	
	13 mai 1907	Fitzpatrick, Charles..........	Administrateur.....	8 juin 1907	....	

NOTES BIOGRAPHIQUES.

Aux tableaux qui précèdent, j'ai cru devoir ajouter quelques explications sur chacun des personnages qui ont présidé à nos destinées, afin de donner une idée de leurs carrières. Je n'ai nullement eu l'intention de faire ces notes complètes; cela aurait demandé beaucoup trop d'espace.

Je ne dis rien non plus de leur séjour ni de leurs travaux dans le pays; ceci peut être étudié dans n'importe quelle histoire du Canada. Garneau, Christie, Turcotte, Sulte, Kingsford, et une foule d'autres, ont traité de cette partie de leur carrière. Je me suis donc contenté d'indiquer sommairement ce qu'ils étaient avant de venir ici et ce qu'ils sont devenus ensuite. Afin d'aider à qui voudra se renseigner davantage sur ces personnages, j'ai ajouté à ce travail une liste des principaux ouvrages consultés.

Il n'est peut-être pas inutile d'ajouter que chaque nom, chaque date et chaque fait, contenus dans les tableaux ont été recueillis dans des documents originaux ou des copies officielles, déposés aux Archives fédérales ou à la Secrétairerie d'Etat, Ottawa, tels que: Commissions des gouverneurs et lieutenants-gouverneurs, Minutes du Conseil Exécutif, Proclamations; Dépêches échangées entre le Bureau Colonial et les gouverneurs du Canada, Correspondance des Commandants en chef, Gazettes Officielles, Rapports sur les Archives, etc. Il n'en est pas ainsi pour les notes; j'ai eu recours à une foule d'ouvrages imprimés, en sus des manuscrits. Je ne puis donc garantir leur absolue correction.

La question de savoir si une liste des gouverneurs du Canada devrait comprendre le nom d'Amherst a été mainte fois discutée. Les uns disent oui, les autres non. Le camp est à peu près également partagé. J'ai cru devoir laisser ce nom de côté; considérant qu'Amherst était plutôt un gouverneur militaire qu'un gouverneur civil, de même que Murray, avant de recevoir sa commission du 27 novembre 1763.

1. MURRAY, JAMES. 1719(?)–1794.

Cinquième fils d'Alexander, quatrième baron Elibank. Entra dans l'armée, 1738; servit aux Indes Occidentales, en Flandre et en Bretagne. Major, 1749; lieutenant-colonel, 1751. Se distingua au siège de Louisbourg, 1758, ainsi qu'à celui de Québec, 1759; major-général, 1762; lieutenant-général, 1772; gouverneur de Minorque, 1774; se distingua par sa belle défense de cette île en 1781. Général, 1783. Il mourut à Beauport, Ang., le 18 juin 1794 et fut enterré à Westminster.

Murray fut le neuvième seigneur de Lauzon. Il avait acquis cette seigneurie d'Etienne Charest le 12 février 1765.

2. IRVING, PAULUS ÆMILIUS.

Lieutenant-colonel dans l'armée et commandant en chef de la province de Québec, en même temps qu'administrateur. Avait été lieutenant-gouverneur du district de Montréal en 1764, puis membre du Conseil nommé par Murray. Servit en Amérique et au Canada, avec le 15e régiment d'infanterie, dont il devint le commandant.

Son fils, Sir Paulus Æmilius, fut un militaire distingué; il fut créé baronnet en 1809.

3. CARLETON, Sir GUY, Lord DORCHESTER. 1724—1808.

Troisième fils de Christopher, naquit en 1724. Il descendait d'une famille très ancienne du pays de Galles. Enseigne, 1742; lieutenant-colonel, 1757; servit en Amérique, 1758–1762; colonel, 1762; major-général, 1772; défendit Québec contre les Américains, 1775–1776; défit les Américains sur le lac Champlain, octobre 1776. Il fut élevé à la pairie le 21 août 1786, sous le titre de baron Dorchester. Fait Chevalier du Bain (K.B.) au commencement de l'année 1777; reçut, après la guerre de l'Indépendance, une pension annuelle de £1000. Général, 1793. Avait épousé, le 22 mai 1772, Maria, fille du comte d'Effingham. Mort en 1808.

4. CRAMAHÉ, HECTOR THEOPHILUS. –1789(?).

Secrétaire de Murray après la conquête, fut nommé, en août 1777, Receveur Général de la Province en l'absence de Sir Thomas Mills, et devint président du Conseil. Il était Suisse de naissance, et officier dans l'armée anglaise. Nommé lieutenant-gouverneur et surintendant de Détroit le 12 octobre 1785. Décédé vers 1789.

5. HALDIMAND, Sir FREDERICK. 1718–1791.

Né à Yverdun, Suisse. Fit du service dans l'armée des Pays-Bas, entra dans l'armée anglaise, devint lieutenant-colonel dans le 62e Royal Americans (Kings Royal Rifle Corps) en 1756, puis commandant de ce corps dont le titre fut changé en celui de 60e régiment d'infanterie. Se distingua à Carillon, 1758; à Oswego, 1759; durant l'expédition d'Amherst contre Montréal, 1760; gouverneur de Trois-Rivières, 1763–1765; en Floride, 1766–1768; commandant général en Amérique en 1776, lieutenant-général dans l'armée en 1777, et commandant en chef de la province de Québec, 1778–1785. Chevalier du Bain (K.B.) en 1785. Mourut dans sa ville natale.

Sa correspondance est déposée au British Museum. Copie aux Archives fédérales à Ottawa.

6. HAMILTON, HENRY, Général.

Gouverneur de Détroit, capitaine au 15e régiment d'infanterie. Etait gouverneur du poste de Vincennes lors de l'attaque et de la prise de cette place par George Rogers Clark le 24 février 1779. Il fut fait prisonnier et subit une dure captivité. Ce fut en récompense de sa conduite en cette occasion, et aussi en guise d'indemnité, qu'il fut fait lieutenant-gouverneur de la province de Québec.

7. HOPE, HENRY. –1789.

Colonel, promu brigadier-général en Canada lors de sa nomination comme lieutenant-gouverneur. Mourut le 13 janvier 1789.

8. CLARKE, Sir ALURED. 1745(?)–1832.

Entra dans l'armée, devint lieutenant en 1760; servit en Allemagne; devint capitaine en 1767; lieutenant-colonel, 1775; servit en Amérique et aux Indes Occidentales, 1776–1794; gouverneur de la Jamaïque; major-général; servit au Cap de Bonne-Espérance, 1795; fait Chevalier du Bain, 1797; commandant en chef au Bengal, 1797; puis aux Indes, 1798–1801; créé feld-maréchal, 1830.

9. PRESCOTT, ROBERT. 1725–1816.

Servit à Rochefort, 1757; à Louisbourg, 1758; à la Martinique, 1761; fut présent à plusieurs engagements durant la guerre de l'Indépendance américaine, conquit la Martinique et en fut nommé gouverneur, 1794. Etait général en 1796.

10. MILNES, Sir ROBERT SHORE. 1746–1837.

Fils aîné de John Milnes, Esq., de Wakefield, Ang. Il naquit en 1746. Devint officier dans le régiment des Royal Horseguards. Gouverneur de la Martinique en 1795. Créé baronnet le 21 mars 1801. Mourut vers la fin de l'année 1837.

11. DUNN, THOMAS. 1731–1817.

Né en 1731; juge de la Cour du Banc du Roi, 20 avril 1775. Membre du premier Conseil Législatif, 17 août 1775; membre du Conseil Exécutif, août 1776. Fut Président des Conseils Exécutif et Législatif de la Province de Québec et du Bas-Canada; juge de la Cour du Banc du Roi du Bas-Canada, etc., etc. Etait seigneur de Saint-Armand. Il épousa Henriette Guichaud, Canadienne, veuve de M. Fargues. Mourut le 5 avril 1817. Etait très aimé des Canadiens.

12. Craig, Sir James Henry. 1748–1812.

Entra dans l'armée comme enseigne en 1763, devint capitaine, 1771; servit en Amérique, 1774–1781; lieutenant-colonel, 1781; servit dans les Pays-Bas, 1794; major-général, 1794; s'empara de la Colonie du Cap, 1795, et en fut gouverneur jusqu'en 1797; Chevalier du Bain, 1797; servit aux Indes, 1797–1802; lieutenant-général, 1801; commandant des troupes en Italie et en Sicile, 1805–1806; général, 1812.

13. Burton, Sir Francis Nathaniel. 1767–1832.

Décédé à Bath, Ang., le 27 janvier 1832, à l'âge de 65 ans. Chevalier Commandeur de l'Ordre des Guelfes (K.C.H.). Fut gouverneur du comté de Clare, Irlande, et colonel de la milice de ce comté. Il était le frère jumeau du marquis de Conyngham.

14. Prevost, Sir George. 1767–1816.

Fils aîné d'Augustin Prévost, natif de Genève, mais domicilié en Angleterre, et devenu major-général dans l'armée anglaise. Il naquit le 19 mai 1767. Devint colonel commandant du 5e bataillon du 60e régiment d'infanterie, le 8 septembre 1806; monta en grade, devint lieutenant-général le 4 juin 1811, puis commandant en chef des forces dans l'Amérique britannique du Nord. Gouverneur militaire de Sainte-Lucie, 1798; puis gouverneur civil, 1801. Gouverneur de la Dominique, 1802. Fut créé baronnet le 6 décembre 1805. Lieutenant-gouverneur de la Nouvelle-Ecosse, 1808. Colonel du 16e régiment le 17 février 1814. Mourut à Belmont, Ang., le 5 janvier 1816.

15. Brock, Sir Isaac. 1769–1812.

Né le 6 octobre 1769 au Port Saint-Pierre, Guernesey. Enseigne dans le 8e régiment d'infanterie, 1785; leva une compagnie indépendante et en fut nommé capitaine; servit aux Indes Occidentales, 1791–1793; major, 1795; servit en Hollande, 1799, et prit part aux opérations sur la Baltique, 1801; en Canada, 1802–1805, et à partir de 1806, commandant à Québec; en 1810 sert dans le Haut-Canada; major-général, 1811; battit le général Hull à Détroit et le fit prisonnier avec son armée. Fut fait Chevalier Commandeur du Bain, 1812. Tué le 13 octobre 1812, à la bataille de Queenston, où un monument lui a été érigé.

16. Rottenburg, baron Francis de. –1832.

Major dans les Hussards de Hompesch, 1795; lieutenant-colonel l'année suivante; fut nommé colonel du 60e régiment d'infanterie vers la fin de 1797. Servit en Irlande durant la rébellion de 1798; était présent à la prise de Surinam, 1799. Colonel en 1805, brigadier-général en 1808. Commandait les troupes légères durant l'expédition de Walcheren, en 1809; en mai 1810, fut transféré à l'état-major en Canada, et commanda la garnison de Québec. Major-général, juillet 1810. Fut élevé au commandement du district de Montréal en juillet 1812, et l'année suivante, commandant dans le Haut-Canada. Retourna en Angleterre en septembre 1815. Lieutenant-général en 1819. Il mourut à Portsmouth le 24 avril 1832.

17. GLASGOW, GEORGE. –1820.

Entra dans l'artillerie royale en qualité de second lieutenant, 1774; lieutenant-colonel, 1801; major-général, 1811; lieutenant-général, 1819. Mort à Charlton, Ang., 1820.

18. DRUMMOND, Sir GORDON. 1771(?)–1854.

Fils de Colin Drummond, député paie-maître-général, est né à Québec en 1771, d'après Taylor, " Cardinal facts of Canadian history "; en 1772, suivant le " Dictionary of National Biography." Enseigne en 1789; lieutenant, 1791; capitaine, 1792; major, 1794; devint lieutenant-colonel du 8e régiment le 22 avril 1794; se distingua à Nineguen; colonel en 1798, fut présent à la prise d'Alexandrie et à celle du Caire, 1801, major-général, 1805; lieutenant-général, 1811; défit les Américains à Niagara, 1814; Commandeur du Bain, 1815; colonel du 71e régiment, janvier 1824; général, 1828. Grand'croix du Bain, 1837. Mort à Londres en 1854.

19. WILSON, JOHN.

Etait major-général dans l'armée anglaise. Fut envoyé au Canada pour remplacer Sir Gordon Drummond qui demandait à retourner en Angleterre. Il arriva à Québec le 25 mars 1816, mais ne devint administrateur, et commandant des forces des Haut et Bas Canadas, qu'au départ de Drummond.

20. SHERBROOKE, Sir JOHN COAPE. 1764–1830.

Servit dans les Pays-Bas en qualité de lieutenant-colonel du 33e d'infanterie, en 1794; aux Indes, commandant l'aile droite à l'assaut de Seringapatam; commanda en Sicile, 1805–1808; commanda en second sous Wellesley (plus tard duc de Wellington) durant la guerre de la Péninsule, 1809; fait Commandeur du Bain après la victoire de Talavera; retourna malade en Angleterre; lieutenant-gouverneur de la Nouvelle-Ecosse durant la guerre de 1812; Grand'croix du Bain en 1815.

21. RICHMOND, CHARLES, duc de. 1764–1819.

Quatrième duc, naquit en 1764. Servit aux Iles Sous-le-Vent; député aux Communes pour Sussex, 1790; colonel, 1795; lieutenant-général, 1805; membre du Conseil Privé, 1807; lord lieutenant d'Irlande, 1807–1813; général, 1814; présent à la bataille de Waterloo. "Avant de venir en Canada il avait," dit Garneau, "gouverné l'Irlande tant bien que mal, et il était réduit à voyager ainsi d'un pays à l'autre pour refaire une fortune qu'il avait dissipée par son faste et ses extravagances." Il mourut d'hydrophobie, le 28 août 1819, près du village de Richmond, Haut-Canada, ainsi nommé en son honneur.

22. MONK, Sir JAMES. 1745–1826.

Fils de James Monk et de Ann Dering, il naquit à Boston le 9 mars 1745. Il étudia d'abord dans sa ville natale, puis il alla terminer ses études en Angleterre, où il fit son droit. Fut successivement procureur-général du Bas-Canada, 1792; membre des Conseils Exécutif et Législatif, 13 août 1794; juge en chef du district de Montréal, 8 août 1794; Président de la Cour d'Appel, 9 janvier 1809; Président pro-tem du Conseil Législatif, 14 janvier 1815, et administrateur de la province du Bas-Canada en conséquence de la mort du duc de Richmond. Fait "Knight Bachelor" le 27 avril 1825. Mort à Cheltenham, Ang., le 18 novembre 1826. La nouvelle ne fut reçue à Montréal que le 15 janvier suivant.

23. DALHOUSIE, GEORGE, comte. 1770–1838.

Neuvième comte, naquit le 22 octobre 1770. Il se distingua durant les guerres avec la France, surtout à Waterloo. Il était général dans l'armée, et colonel du 26e régiment d'infanterie. Il fut fait Grand'croix du Bain. Le 11 août 1815, il fut créé pair du Royaume-Uni sous le titre de baron Dalhousie of Dalhousie Castle. Il est mort le 21 mars 1838.

24. MAITLAND, Sir PEREGRINE. 1777–1854.

Entra dans l'armée en 1792; servit dans les Flandres, 1794–1798; en Espagne en 1809 et 1812; major-général, 1814; prit part à la bataille de Waterloo, 1815; Chevalier Commandeur du Bain (K.C.B.), 1815; lieutenant-gouverneur du Haut-Canada, 1818–1828; de la Nouvelle-Ecosse, 1828–1834; commandant en chef de l'armée de Madras, 1836-1838, commandant du Cap de Bonne-Espérance, 1844–1847; général en 1846; Grand'croix du Bain, 1852. Etait le gendre du duc de Richmond qui fut gouverneur du Bas-Canada.

MAITLAND A-T-IL ÉTÉ ADMINISTRATEUR DU BAS-CANADA LE 8 FÉVRIER 1820?

Le 7 février 1820, Maitland, lieutenant-gouverneur du Haut-Canada, arrivait à Québec, et il en repartait le surlendemain, laissant sa femme et sa suite dans la vieille capitale. On a cru (et avec beaucoup d'apparence de raison) que Maitland avait alors pris en mains les rênes de l'administration. Cette croyance était probablement basée sur un entrefilet paru dans le *Quebec Mercury* du 8 février 1820, et qui se lit ainsi: "Yesterday at four o'clock arrived in town His Excellency Sir Pere-"grine Maitland, Lady Maitland and suite. This morning His Excel-"lency was sworn in as administrator of the Government of the Pro-"vince of Quebec." [1]

Ceci est catégorique. Kingsford a dû se baser sur cet entrefilet du *Mercury* quand il dit: "He arrived there on the 7th of February, and assumed Government."

Cependant, après un examen attentif du Registre des Minutes du Conseil Exécutif du Bas-Canada, je n'y trouve rien pour appuyer cette assertion. Plus que cela, d'après ce registre, il n'y a même pas eu de réunion du Conseil ce jour-là. Le Conseil ne s'est pas réuni entre le 8 décembre 1819 et le 1er mars 1820. Maitland n'a donc pu prêter les serments requis avant son entrée en fonctions. Cela me paraît clair. Mais il y a plus. A la séance suivante, qui eut lieu le 17 du même mois, Maitland étant présent, Monk prit le fauteuil, et après avoir ouvert la séance, il communiqua au Conseil une dépêche de Lord Dalhousie dans laquelle celui-ci annonçait à Monk que Maitland avait été nommé pour administrer la Province en attendant que lui, Dalhousie, put se rendre à Québec, ce qu'il ne pourrait probablement pas faire avant l'ouverture de la navigation au printemps suivant. Maitland présenta ensuite un Warrant, ou Commission, sous les seing et sceau du Prince Régent nommant Dalhousie gouverneur. Les serments d'usage furent ensuite prêtés et souscrits par le nouvel administrateur, qui prit le siège que laissa Monk.

Voici d'ailleurs une dépêche de Maitland à Bathurst, qui semble ne laisser aucun doute sur la question.

Quebec, 8th Feby., 1820.

My Lord,

I have the Honor to inform Your Lordship that in obedience to an Order forwarded to me by Lord Dalhousie, together with His Royal

[1] Cette note est due à l'obligeance de M. Joseph Desjardins, Assistant Bibliothécaire de la Législature de Québec, et auteur d'un Guide Parlementaire historique de la province de Québec.

Highness The Prince Regent's Warrant empowering me to assume the Government of Lower Canada in His Lordship's absence, I have proceeded to Quebec and *am making the necessary arrangements to comply with the intent of the Instruction: Deeming it, however, essential to His Majesty's Interests that I should meet the Parliament of the Upper Province it is my intention to proceed to York immediately for that purpose, and after having delivered the Administration of that Government to the Senior Executive Counsellor, I shall lose no time in returning to Quebec and assuming the Administration of the Government of the Lower Province.*[1]

I have the honor to be,
My Lord,
Your Lordship's
most Obedient humble Servant,
P. MAITLAND.

The Rt. Honble EARL BATHURST, K.G., &c., &c.

Tout ce qui précède me paraît amplement prouver que Maitland n'a pas été administrateur le 8 février 1820.

Faut-il une autre preuve? La voici. Pendant ce voyage de Maitland à Québec, il ne paraît pas y avoir eu d'administrateur de nommé dans le Haut-Canada. Il n'y eut pas de séance du Conseil Exécutif du Haut-Canada durant l'absence de Maitland. Donc, ce dernier, ne pouvait être en même temps administrateur du Haut et du Bas-Canada; car l'administrateur d'une province était obligé de résider dans cette province.

25. KEMPT, Sir JAMES. 1764–1854.

Servit en qualité d'aide-de-camp de Sir Ralph Abercromby en Hollande, 1799; sur la Méditerranée, 1800; en Egypte, 1801; puis sous Hely-Hutchinson; commanda les troupes légères à Maida, 1806; général de brigade sous Picton, dans la Péninsule; gravement blessé à Badajoz, 1812; commandant une brigade de troupes légères en 1813–1814, remplaça Picton dans le commandement de sa division lorsque celui-ci tomba blessé durant la bataille de Waterloo; Grand'croix du Bain, 1815; lieutenant-gouverneur de la Nouvelle-Ecosse, 1820–1828; membre du Conseil Privé, 1830; maître-général de l'artillerie, 1834–1838; général, 1841.

26. AYLMER, MATTHEW, Lord. 1775–1850.

Cinquième baron, fils du quatrième baron. Entra dans l'armée, enseigne dans le 49e régiment, 1787; servit aux Barbades et à Saint-

[1] J'ai moi-même souligné la dernière partie de la dépêche.

Domingue. Présent à l'attaque de Quibéron. Fut blessé à l'assaut du Fort Lacul, près de Leagone. Lieutenant, 1791; capitaine, 1794. Aide-de-camp du général Leland, 1797; servit en Hollande, fait prisonnier dans une descente près d'Ostende, en mai 1798. Aide-de-camp de Lord Charles Somerset, puis major dans le 85e régiment d'infanterie, 9 octobre 1800. Servit en Jamaïque, 1801. Lieutenant-colonel, 1802; en 1803 il passe aux Coldstream Guards. Servit sous Lord Cathcart, dans l'expédition du Hanovre, 1805. Présent au siège de Copenhague. Assistant-adjudant-général pour le district de Kent, en 1807. Accompagna le général Sherbrooke en Portugal en 1809. Colonel en 1805; aide-de-camp du Roi, la même année. Major-général, 4 juin 1813. Servit en Espagne, 1813. Après la guerre, il fut fait major-général et attaché à l'état-major d'Irlande, puis adjudant-général. Général, 27 mai 1825. Chevalier Commandeur du Bain, 1815; et Grand'croix, 1836. Ajouta, par permission royale, le nom de Whitworth au sien (c'était celui de sa mère). Mort en 1850.

27. Amherst, William Pitt, Lord. 1773–1857.

Second baron, naquit en 1773. Il fut successivement ambassadeur en Chine, 1816–1817; et gouverneur aux Indes, 1823–1828; créé vicomte Holmesdale et comte Amherst, dans la pairie du Royaume-Uni, le 19 décembre 1826; mourut le 13 mars 1857. Il était le neveu et l'héritier du célèbre général Jeffery Amherst. Nommé gouverneur en chef et haut commissaire le 2 avril 1835, il ne vint pas au Canada, mais démissionna en mai de la même année. Le poste de haut commissaire avait d'abord été offert à Lord Canterbury (Manners Sutton), puis à Sir Stratford Canning, qui déclinèrent tous deux cet honneur. Lord Amherst fut nommé, mais il dut bientôt démissionner à cause du changement de ministère, et Lord Gosford avec Sir Charles Grey et Sir George Gipps furent nommés commissaires conjoints.

28. Gosford, Archibald, Lord. –1849.

Deuxième comte, fils aîné du premier comte. Lord lieutenant d'Armagh, 1832; fait membre du Conseil Privé et capitaine dans les Yeomen of the Guard, 3 septembre 1834; Grand'croix du Bain, 29 août 1835; mort le 27 mars 1849.

29. Colborne, Sir John. 1778–1863.

Créé baron Seaton par lettres patentes datées le 14 décembre 1839; Grand'croix du Bain, Grand'croix de l'Ordre des Guelfes, Grand'croix de l'Ordre de Saint-Michel et Saint-George, etc., colonel du Second Life

Guards ; servit en Hollande, en Egypte, 1801, et en Calabre, 1806 ; fut secrétaire militaire de Sir John Moore, 1808–1809 ; commanda une brigade en Portugal, en Espagne et en France, durant les années 1810, 1811, 1813 et 1814. Servit sous Wellington à Waterloo. Fut lieutenant-gouverneur de Guernesey, puis du Haut-Canada. Etouffa la rébellion de 1837–1838, dans le Bas-Canada. Après son départ du Canada, fut nommé lord haut commissaire des îles Ioniennes et membre du Conseil Privé. Devint commandant des forces en Irlande. Il démissionna en 1860 et fut promu, le 30 mars de cette année, au poste de feld-maréchal.

30. DURHAM, JOHN GEORGE LAMBTON, comte de. 1792–1840.

Né le 12 avril 1792, représenta le comté Durham au Parlement ; il fut élevé à la pairie sous le titre de baron Durham, le 29 janvier 1828, devint vicomte Lambton et comte de Durham, le 23 mars 1833. Fut ambassadeur à Saint-Petersbourg, lord "privy seal" de 1830 à 1835 ; Grand'croix du Bain, 27 juin 1837 ; membre de plusieurs ordres étrangers ; membre du Conseil Privé, grand intendant de Hull (High Steward of Hull).

31. POULETT THOMSON, CHARLES EDWARD, baron SYDENHAM. 1799–1841.

Plus jeune fils de John, marchand de Londres, naquit le 13 septembre 1799. S'occupa d'abord de commerce, devint membre du Parlement, représentant Dover, en 1826, puis à plusieurs reprises, à partir de 1832, la ville de Manchester. Fut vice-président du Board of Trade, 1830 ; président, en 1834, il réforma plusieurs abus. Ce fut pendant son administration que s'opéra l'union du Haut et du Bas-Canada. Créé baron, 1840. Mourut à Kingston, des suites d'une chute de cheval, le 19 septembre 1841.

32. JACKSON, Sir RICHARD DOWNES. –1845.

Entra dans l'armée en 1794 en qualité d'enseigne au second régiment d'infanterie ; servit en Irlande, durant la Rébellion ; fit partie de l'expédition en Allemagne, 1798 ; ainsi que de celle de 1805 ; présent au siège de Copenhague, 1807. En mars 1810 il s'embarqua pour Cadiz avec un détachement des Coldstream Guards et il prit part au siège de cette place.

Il se distingua tout particulièrement à la bataille de Barrosa, à la tête d'un détachement des Coldstream Guards, lesquels, soutenus par les 67e et 87e régiments d'infanterie, repoussèrent l'aile droite de l'armée française. Il servit pendant toute la durée de la guerre dans la Péninsule, et remplaça, en 1820, Sir Benjamin D'Urban, en qualité de député quartier-maître-général. Major-général, 1825; colonel du 81e d'infanterie en 1829; lieutenant-général, 1838; commandant en chef en Amérique britannique du Nord, 1839; colonel du 35e d'infanterie en 1840. Il mourut d'apoplexie à Montréal, le 9 juin 1845.

33. SIMCOE, JOHN GRAVES. 1752–1806.

Fils de John Graves Simcoe, commandant du navire de Sa Majesté le "Pembroke," mort pendant l'expédition contre Québec en 1759. Fit ses études à Eton puis à Merton College, Oxford. Il devint enseigne dans le 35e régiment d'infanterie, qui fut envoyé en Amérique pendant la guerre de la Révolution américaine.

Quelque temps après, il acheta une compagnie, et devint capitaine dans le 40e régiment. Il se distingua à la bataille de Brandywine, le 11 septembre 1777, où Sir William Howe défit Washington et s'empara de Philadelphie. Promu major et commandant des Queen's Rangers le 15 octobre suivant. Il fit toutes les campagnes de 1777 à 1781. Devint lieutenant-colonel, 1778. Premier lieutenant-governeur du Haut-Canada, 1791 à 1799. Major-général, 1792; gouverneur de Saint-Domingue, 1796, tout en conservant son titre de lieutenant-gouverneur du Haut-Canada; lieutenant-général, 1798. Il fut nommé commandant en chef aux Indes, mais il mourut avant de pouvoir se rendre à son poste.

34. RUSSELL, PETER. –1808.

Né à Cork, Irlande, il fit ses études à Cambridge. Il entra dans l'armée, et le 18 août 1778, il devenait capitaine au 64e régiment d'infanterie. Il fit partie de l'expédition contre Savannah et Charleston, 1779–1780.

Il descendait des Russell de Bedford, et il s'établit de bonne heure à Niagara. C'est en sa qualité de doyen du Conseil Exécutif du Haut-Canada qu'il succéda à Simcoe comme Président et Administrateur de la Province. Il avait été nommé au Conseil le 9 juillet 1792. Il ne paraît guère avoir été aimé de ses administrés; ce fut, dit-on, le fondateur du "Family Compact." Il fut aussi membre du Conseil Législatif et Receveur Général. Il est mort à Russell Abbey, York, H.C., le 30 septembre 1808.

35. HUNTER, PETER. 1746–1805.

Il descendait d'une très ancienne famille écossaise. Il entra tout jeune dans l'armée, et fit les diverses campagnes de la guerre de l'Indépendance américaine, et devint commandant du 60e régiment d'infanterie, avec ses quartiers à Niagara. Fut membre du "Land Board" du district de Nassau, constitué par Lord Dorchester, le 13 octobre 1788. Promu colonel de son régiment, puis lieutenant-général dans l'armée anglaise et commandant en chef du Bas et du Haut-Canada, remplaçant Prescott le 29 juillet 1799. Il mourut le 21 août 1805, et fut enterré dans le cimetière anglais à Québec.

Il avait été Surintendant du Honduras anglais en 1790.

36. Grant, Alexander. 1727–1813.

Il était le quatrième fils du septième seigneur (laird) de Glen Morriston, Invernessshire. Il servit d'abord comme aspirant de marine. En 1757 il était officier dans un régiment de Highlanders. En 1759, il accompagna Amherst sur le lac Champlain, et commandait l'un des vaisseaux que ce général avait fait construire à Ticondéroga. Il fut ensuite mis à la tête d'une petite flottille sur les lacs Erié et Huron, avec quartiers généraux à Détroit, d'où son titre de commodore.

La tradition rapporte qu'il avait épousé une Canadienne-française, et qu'ils eurent dix filles et un garçon.

Etant âgé de quatre-vingt-cinq ans lorsque la guerre de 1812 éclata, il dut céder son poste au capitaine Barclay. Il avait été nommé conseiller exécutif le 11 juillet 1792. Mort à Grosse Pointe, près de Détroit.

37. Gore, Francis. 1769–

Né à Blackheath, Kent, en 1769, il était descendant des comtes d'Arran. Il entra dans le 44e régiment d'infanterie en 1787, à Jersey. En 1793, lieutenant dans une compagnie indépendante. Au bout de quelques mois il fut transféré au 54e régiment. Fit du service sur le continent en 1794. Capitaine, l'année suivante, dans le 17e Lanciers. Aide-de-Camp de Lord Camden, en Irlande. Major en 1799. Prend sa retraite après la paix d'Amiens. Retourne à l'armée en 1803 comme lieutenant-colonel temporaire, et nommé officier d'état-major des Volontaires. Gouverneur des Bermudes en 1805.

38. Sheaffe, Sir Roger Hale, baronnet. 1763–1851.

Né à Boston le 15 juillet 1763; troisième fils de William Sheaffe, député contrôleur des Douanes. Epousa Margaret, fille de John Coffin, de Québec. Servit en Canada, 1797, comme capitaine dans le 5e régiment d'infanterie. Prit le commandement à Queenston après la mort de Brock, et défit les Américains. Créé baronnet, en récompense de ses services, le 1er décembre 1812. Mort à Edimbourg, Ecosse, en 1851.

39. Murray, Sir George. 1772–1846.

Général et homme d'Etat. Etudia à l'Université d'Edimbourg; entra dans l'armée, 1789; servit en Flandre; lieutenant-colonel, 1799; servit en Egypte, aux Indes Occidentales, 1802; en Irlande, 1804; quartier-maître-général durant la guerre de la Péninsule; major-général, 1812; Grand'croix du Bain, 1813; lieutenant-général, 1814; servit dans l'armée de Flandre, après Waterloo, 1815–1818; gouverneur du collège militaire de Sandhurst, 1819–1824; représentant de Perth aux Communes anglaises, 1823; commandant en chef en Irlande, 1825–1828; conseilier privé et secrétaire colonial, 1828–1830; maître-général de l'artillerie; général, 1841. A publié les dépêches de Marlborough, 1845.

40. ROBINSON, Sir FREDERICK PHILIPSE. 1765–1852.

Né près de New-York; devint enseigne dans un régiment loyal durant la guerre de l'Indépendance, 1777; lieutenant au 38e d'infanterie, 1788; major au 127e d'infanterie, 1794; colonel, 1810; commanda une brigade en Espagne, 1812–1814; commandant des troupes aux Iles du Vent et Sous-le-Vent, 1816–1821; gouverneur de Tobago; colonel du 59e régiment, 1827; puis du 39e, 1840; Grand'croix du Bain, 1838; général, 1841.

41. SMITH, SAMUEL. 1756–1826.

Né à Long Island, N.Y., en 1756. Lors de la Révolution américaine il entra dans l'armée anglaise en qualité d'enseigne dans les Queen's Rangers. Il vint s'établir à Niagara en 1793. Nommé conseiller exécutif le 11 octobre 1815. Fut le dernier lieutenant-colonel des Queen's Rangers (First Americans). Ce régiment fut licencié par ordre du Prince Régent daté le 10 juin 1802. Décédé le 20 octobre 1826.

42. HEAD, Sir FRANCIS BOND, premier baronnet. 1793–1875.

Etait le frère de Sir George Head. Servit dans les Ingénieurs Royaux, 1811–1825; fut présent à Waterloo; voyagea dans l'Amérique du Sud comme directeur gérant de la "Rio Plata Mining Association", 1825–1826; Commandeur de l'Ordre des Guelfes, 1835. Créé baronnet cette même année. Membre du Conseil Privé, 1867. Ecrivit dans la "Quarterly Review": publia entre autres ouvrages: Rough Notes of Journeys in the Pampas and Andes; et les vies de Bruce the Traveller, 1830; et de Sir J. M. Burgoyne, 1872.

43. ARTHUR, Sir GEORGE. 1784–1854.

Entra dans le 91e ou Argyllshire Highlanders, 1804; lieutenant, en Italie, 1806; en Egypte, 1807; capitaine, en Sicile, 1808; à Walcheren, 1809; député assistant adjudant-général; secrétaire militaire de Sir George Don, gouverneur de Jersey; major au 7e ou West India; assistant quartier-maître général, Jamaïque, 1812; lieutenant-gouverneur du Honduras, 1814–1822; de Van Diemen's Land, 1823–1837. Baronnet, 1841; gouverneur de Bombay, 1842; élu gouverneur général provisoire, mais empêché par la maladie d'occuper ce poste, 1846; conseiller privé, et D.C.L. honoraire d'Oxford; colonel du 50^{e} ou Queen's Own, 1853.

44. BAGOT, Sir CHARLES. 1781–1843.

Deuxième fils de William, premier baron. Il naquit le 23 septembre 1781. Sous-secrétaire d'Etat aux Affaires Etrangères sous M. Canning. Il fut envoyé, en 1814, en mission spéciale à Paris, où il passa plusieurs mois. Grand'croix du Bain, 20 mai 1820; membre du Conseil Privé, 4 décembre 1815; et ministre plénipotentiaire aux Etats-Unis, à St-Petersbourg, et à la Haye, le 11 juillet 1814. Mourut à Kingston le 19 mai 1843.

45. METCALFE, Sir CHARLES THEOPHILUS. 1785–1846.

Naquit le 30 janvier 1785. Etudia à Eton. Il fut membre du Conseil Supérieur du Bengal, gouverneur d'Agra, Résident de Delhi, 1811–1820; et Résident de Hyderabad, 1820–1827. Fut élevé à la pairie sous le titre de baron Metcalfe, en janvier 1845. Mort sans postérité, en septembre 1846.

46. CATHCART, CHARLES MURRAY, comte. 1783–1859.

Deuxième comte, naquit le 21 décembre 1783. Cornette, 1800; servit en Italie et en Sicile, 1805–1806; major, 1807; présent à Walcheren, 1809; lieutenant-colonel, 1810; guerre de la Péninsule, 1810–1812; quartier-maître général, 1814–1823; à Waterloo, 1815. Il était colonel du 1er régiment des Dragons. Fut gouverneur du château d'Edimbourg et commandant des forces en Ecosse, 1837–1842. S'occupait de géologie; a découvert le mineral "Greenockite," 1841. Mort le 16 janvier 1859.

47. ELGIN and KINCARDINE, JAMES BRUCE, huitième comte d'Elgin, et douzième de Kincardine. 1811–1863.

Etudia à Eton et Oxford, agrégé de Merton College, 1832; représentant de Southampton aux Communes, 1841; gouverneur de la Jamaïque, 1842; devint Haut Commissaire et Ministre plénipotentiaire, en mission spéciale auprès de l'empereur de Chine, 1852; Maître-Général des Postes en juin 1859; nommé Vice-roi et gouverneur général des Indes, le 21 janvier 1862; lord lieutenant du Fifeshire. Il était né le 20 juillet 1811. Il épousa en seconde noces Marie-Louise, fille de feu le comte de Durham, ancien gouverneur du Bas-Canada.

48. ROWAN, Sir WILLIAM. 1789–1879.

Enseigne dans le 52e régiment d'infanterie, 1803; lieutenant, 1804; servit en Sicile en 1806–1807; en Suède, 1808; dans la Péninsule, en France et à Waterloo; lieutenant-colonel, 1819; secrétaire civil et militaire en Canada, 1836–1839, et commandant des forces en Canada, 1849–1855; général, 1862; feld-maréchal, 1877; Grand'croix du Bain (G.C.B), 1856. Mort le 26 septembre 1879.

49. HEAD, Sir EDMUND WALKER. 1805–1868.

Huitième baronnet, fils unique du révérend Sir John Head, M.A., est né en 1805. Agrégé de Merton College, Oxford, 1830–1837; M.A., 1830; lieutenant-gouverneur du Nouveau-Brunswick, 1847–1854; membre du Conseil Privé, 27 août 1857; Chevalier Commandeur du Bain, 11 décembre 1860. D.C.L., Oxford, 1862. A publié l'ouvrage de G. C. Lewis: "Essays on the Administrations of Great Britain," et le "Handbook of Painting" de Kugler. Mort le 28 janvier 1868.

50. EYRE, Sir WILLIAM. 1805–1859.

Fils cadet du vice-amiral Sir George Eyre, né le 21 octobre 1805. Entra dans l'armée en 1823, en qualité d'enseigne dans le 6e régiment. Lieutenant en 1825; capitaine dans le 73e régiment en 1829; major en 1839, pendant un séjour en Canada où il demeura jusqu'en 1844. Servit à Monte Video, au Cap de Bonne-Esperance, dans la guerre des Cafres de 1847, et celle de 1851, où il se distingua. Fait Compagnon du Bain, nommé aide-de-camp de la reine, et promu colonel le 28 mai 1852. Etait présent à la bataille de l'Alma, et son nom fut honorablement mentionné dans les dépêches pour ses services comme commandant dans les tranchées à la bataille d'Inkerman. Après cette bataille il devint commandant de la 3e division, quoiqu'il ne reçut le grade de major-général que le 12 décembre 1854. Il passa le terrible hiver de 1854–1855 en Crimée, et resta dans ce pays jusqu'à la fin de la guerre. Chevalier Commandeur du Bain, 10 juillet 1855, et Chevalier de la Légion d'Honneur et de l'Ordre du Medjidie, l'année suivante. Fait commandant des forces en Canada en juillet 1856. Il démissionna en juin 1859 pour cause de santé. Mort le 18 septembre 1859.

51. WILLIAMS of KARS, Sir WILLIAM FENWICK. 1799(?)–1883.

Baronnet, Chevalier Commandeur du Bain, major-général dans l'armée; lieutenant-général durant son commandement en Canada; commandant de la garnison de Woolwich, ancien député de Calne; né le 4 décembre 1800, d'après Burke's Peerage; probablement en décembre

1799, d'après Calnek, *History of the County of Annapolis*, à Annapolis, Nouvelle-Ecosse. Il fut fait baronnet le 18 juillet 1856, pour son héroïque défense de Kars contre les Russes. Il était le fils de Thomas Williams, commissaire général et intendant général des casernes à Halifax. Mort à Londres, le 26 juillet 1883.

52. MONCK, CHARLES STANLEY, vicomte. 1819–1894.

Vicomte et baron Monck, pairie d'Irlande, né le 10 octobre 1819. B.A., Trinity College, Dublin, 1841; LL.D., 1870; admis au Barreau d'Irlande, à King's Inn, Dublin, 1841. Lord Trésorier du Royaume-Uni, 1855; Grand'croix Saint-Michel et Saint-George, 23 juin 1869; lord lieutenant du comté de Dublin, 1874; membre du Conseil Privé, 7 août 1869. Mort le 30 novembre 1894.

53. MICHEL, Sir JOHN. 1804–1886.

Entra dans l'armée, 1823; lieutenant, 1825; major, 1840; lieutenant-colonel, 1842; campagnes: guerres des Cafres, 1846–1847, 1852–1853; colonel, 1854; chef de l'état-major du contingent Turc durant la guerre de Crimée; servit au Cap, 1856; envoyé en Chine mais fit naufrage et fut transporté à Singapore, 1857; fit partie de l'état-major de Bombay, 1858; major-général, 1858; défit les rebelles à Beorora, Mingrauli et Sindwaha, 1858; fait Chevalier Commandeur du Bain; commanda à Sinho et Pékin, 1860; Grand'croix du Bain; lieutenant-général, 1866; général, 1874; Conseiller Privé pour l'Irlande, et commandant des forces dans cette île, 1875–1880; feld-maréchal, 1885.

54. WINDHAM, Sir CHARLES ASH. 1810–1870.

Enseigne et lieutenant, Coldstream Guards, 1826; capitaine et lieutenant-colonel, 1846. Servit en Canada, 1838–1842; colonel, 1854; assistant, puis quartier-maître général de la 4[e] division de l'armée de l'Est en Crimée, 1854; présent à l'Alma, à Balaclava et à Inkerman; Compagnon du Bain, 1855; commanda la seconde brigade de la deuxième division, 1855; à l'assaut du Redan; major-général, 8 septembre 1855; commandant de la 4[e] division, chef de l'état-major de Sir William John Codrington, 1855; député libéral d'East Norfolk, 1857; commandant des troupes à Cawnpore, 1857; défit la division du centre des troupes Gwalior commandées par Tautia Topi, mais ne put retenir Cawnpore; commandant de la division de Lahore, 1859–1861; lieutenant-général, 5 février 1863; Chevalier Commandeur du Bain, 1865; commandant en chef en Canada, 1867–1870.

55. YOUNG, Sir JOHN, Lord LISGAR. 1807–1876.

Deuxième baronnet, né à Bombay le 31 août 1807. Etudia à Eton et Corpus Christi College, Oxford. B.A., 1829; avocat, Lincoln's Inn, 1834. Représenta le comté de Cavan aux Communes de 1831 à 1855. Lord Trésorier du Royaume-Uni, de 1841 à 1844; Secrétaire du Trésor, 21 mai 1844–1846; Secrétaire en chef pour l'Irlande et membre du Conseil Privé, 1852; Grand'croix de St-Michel et St-George, 1855; Lord haut commissaire pour les îles Ioniennes, 20 mars 1855; Chevalier Commandeur du Bain, 4 février 1859; gouverneur de la Nouvelle-Galles du Sud, 1861–1867; Grand'croix du Bain, 15 novembre 1868; créé baron Lisgar, 2 novembre 1870; lord lieutenant de Cavan, 1871; mort le 6 octobre 1876.

56. DOYLE, Sir CHARLES HASTINGS. 1804–1883.

Fils du lieutenant-général Sir Chs. Wm. Doyle. Né à Londres le 10 avril 1804. Entra dans l'armée le 22 décembre 1819 en qualité d'enseigne au 87e régiment; devint lieutenant au 4e Dragons le 27 septembre 1822; capitaine, 1825; major, 1838; lieutenant-colonel, 1846; colonel, 1854; major-général, 1860; commandant en Nouvelle-Ecosse, 1861; lieutenant-gouverneur du Nouveau-Brunswick, 1866, de la Nouvelle-Ecosse, 1867–1873; commandant du 70e, 9 mars 1868; du 87e, le 10 octobre 1870; Chevalier Commandeur de St-Michel et St-George, 23 juin 1869; lieutenant-général, 10 janvier 1870; général, 15 mars 1877.

57. DUFFERIN, FREDERICK TEMPLE, Lord. 1826–1902.

Cinquième baron, né le 21 juin 1826; créé vicomte Clandeboye et comte de Dufferin dans le Royaume-Uni, en 1871; et comte d'Ava et marquis de Dufferin et d'Ava, 1888. Fut gentilhomme de la chambre auprès de la reine Victoria, 1848–1852, et de 1854 à 1858; sous-secrétaire d'Etat pour les Indes, 1864–1866, pour la guerre, 1866; membre du Conseil Privé, 12 décembre 1868. Chancelier du duché de Lancaster et paie-maître général, 1868–1872; ambassadeur extraordinaire et ministre plénipotentiaire à Saint-Petersbourg, 1879–1881, puis à Constantinople, 1881–1884; à Rome, 1888–1891; ambassadeur à Paris, 1891–1896; mort en 1902.

58. O'GRADY-HALY, Sir WILLIAM. –1878.

Fils d'Aylmer Haly, du Château Wadhurst. Entra dans l'armée en juin 1823. Enseigne dans le 106e régiment d'infanterie (Bombay Light Infantry) le 17 juin 1828; lieutenant le 19 juillet 1831; capitaine le 25 avril 1834, major le 19 mai 1846; lieutenant-colonel, 27 décembre 1850; colonel, 28 novembre 1854; major-général, 12 janvier 1869; lieutenant-général, 26 mai 1873; Chevalier Commandeur du Bain; commandant du 106e régiment d'infanterie, 1874; transféré au 47e en novembre 1875; général, octobre 1877. Servit avec distinction durant la guerre de Crimée. Avait été fait Compagnon du Bain en 1855. Il reçut aussi la troisième classe de l'Ordre du Medjidie et la médaille de Turquie. Fait commandant des forces en Canada, 1873.

59. MacDougall, Sir Patrick Leonard. 1819–1894.

Etudia à l'Académie Militaire d'Edimbourg, et à Sandhurst. Lieutenant, 36e régiment d'infanterie, 1839; major, 1849; major-général, 1868; lieutenant-général, 1877; colonel du 2nd bataillon du régiment West India, 1881; du régiment Leinster, 1891; général, 1883. Servit en Canada, 1844–1854; surintendant des études, Sandhurst, 1854–1858; mais servit en Crimée, 1854–1855; adjudant-général de la milice canadienne, 1865–1869; député inspecteur général des forces auxiliaires aux quartiers généraux, 1871; chef du service des renseignements au Bureau de la Guerre, 1873–1878; Chevalier Commandeur du Bain, 1877; commandant des forces dans l'Amérique Britannique du Nord, 21 août 1878 à 1883; prend sa retraite, 1885. A publié "The Theory of War," 1856.

60. Lorne, John Douglass Sutherland Campbell, marquis de. 1845– .

Né le 6 août 1845. Fit ses études à Eton, à St-Andrews et à Trinity College, Cambridge. Représenta Argyllshire aux Communes, 1868–1878, puis Manchester (division sud) 1898–1900. Fut secrétaire particulier de son père à l'" India Office", 1868–1871. Nommé gouverneur et connétable du château Windsor, 1892; est gouverneur des Chevaliers de Windsor. Est shérif héréditaire de l'Argyllshire, Maître de la Maison de la Reine en Ecosse; Vice-amiral d'Argyll et de la côte occidentale de l'Ecosse, Chancelier de l'Ordre de St-Michel et St-George, etc., etc. A épousé la princesse Louise, quatrième fille de la reine Victoria. Devint duc d'Argyll à la mort de son père, 1900.

61. Lansdowne, Henry Charles Keith Fitzmaurice, Lord. 1845–

Cinquième marquis, né le 14 janvier 1845. Etudia à Eton et au Collège Balliol, Oxford (M.A., 1884; D.C.L. hon., 1888; LL.D. hon. McGill, 1884; Cambridge, 1897). Commissaire de l'Echiquier de la Grande-Bretagne, et Trésorier pour l'Irlande, 1863–1872; Sous-Secrétaire d'Etat pour la Guerre, 1872–1874; Sous-Secrétaire d'Etat pour les Indes en 1880; vice-roi des Indes, 1888–1894; Secrétaire d'Etat pour la Guerre, 1895–1900; Secrétaire d'Etat pour les Affaires Etrangères, 1900–1905.

62. RUSSELL, Lord ALEXANDER GEORGE 1821–

Né en 1821, dixième fils du sixième duc de Bedford. Fut aide-de-camp du gouverneur du Canada, 1847; député assistant-quartier-maître général au Cap, 1852–1853. Servit durant la guerre des Cafres; en Crimée et à Sébastopol; Chevalier de Medjidie; commandant des troupes, Shorncliffe, 1873–1874; du district du sud-est, 1877–1880; lieutenant-général, 20 mars 1878; commandant en chef en Canada, 1883–1888; à la retraite, 1888. Colonel du régiment Liverpool, 1889–1891; colonel commandant le premier bataillon de la "Rifle Brigade" depuis 1861.

63. ROSS, Sir JOHN. 1829–1905.

Né à Stonehouse, 1829, fils du feld-maréchal Sir Henry Dalrymple Ross. Second lieutenant, 1846; présent aux batailles d'Alma, Inkerman et Sébastopol, 1854–1855; major, 1856; à Cawnpore, Lucknow, pendant la mutinerie, 1857–1858; fit la campagne sur la frontière nord-ouest des Indes, 1863–1864; brigadier-général du Bengal, 1874–1880; commandant de l'expédition Pérak, 1875–1876; des forces à Malte, 1878; de la division Poona de l'armée de Bombay, 1881–1886; commandant en chef en Canada, 1888–1893; général, 1891; à la retraite 1896. Décédé le 5 janvier 1905.

64. STANLEY de PRESTON, FREDERICK ARTHUR, baron. 1841–1908.

Né le 15 janvier 1841; créé baron Stanley de Preston, 1886. Devint le seizième comte de Derby en 1893. Etudia à Eton; capitaine dans les Grenadiers; aide-de-camp surnuméraire de Sa Majesté; lord lieutenant du Lancashire et juge de paix pour Westmoreland; lord de l'Amirauté (division civile) d'août à novembre 1868; secrétaire financier du War Office, 1874–1877; secrétaire du Trésor, 1877–1878; secrétaire d'Etat pour les colonies, 1885–1886; président du Board of Trade, 1886–1888; lord maire de Liverpool, 1895; et maire de Preston, 1901. Représenta Preston aux Communes, 1865–1868, puis Lancashire nord, 1868–1885; enfin la division Black-pool de Lancashire nord, 1885–1886. Membre du Conseil Privé, 1878; Grand'croix du Bain (civil); Chevalier de la Jarretière, 1897; Grand'croix de l'Ordre de Victoria, 1905. Décédé le 14 juin 1908.

65. MONTGOMERY-MOORE, Sir ALEXANDER GEORGE. 1833–

Né en 1833, étudia à Eton; entra dans la Garde des Dragons, 1850; capitaine, 1856; major dans le 4^e^ Hussards, 1867; lieutenant-colonel, 1868; colonel, 1873; major-général, 1884; lieutenant-général, 1892; général, 1896; à la retraite, 1900. Fut aide-de-camp du général commandant les forces en Irlande, 1856–1857 et 1858–1860; assistant-adjudant et quartier-maître général, district de Dublin, 1880–1884; commandant du district de Belfast, 1886–1887; du district Sud-Est, 1887–1891; des forces en Canada, 1893–1898; à Aldershot, 1899–1900. Colonel du 18e Hussards, 1892; et colonel du 4e Hussards, 1904. A épousé la fille de Lord Seaton (Sir John Colborne); Chevalier Commandeur du Bain, 1900.

66. ABERDEEN, JOHN CAMPBELL GORDON, septième comte. 1847–

Né le 3 août 1847. Fit ses études à St-Andrews University et à University College, Oxford; (B.A., 1871; M.A., 1877; LL.D. Aberdeen, 1883); LL.D. honoraire des Universités de Queen's, de McGill, de Toronto, d'Ottawa et de Laval, 1894; de Princeton, 1897; de Harvard, 1898; D.C.L. honoraire de Bishop's College, Lennoxville, Que., 1895; et d'Oxford, 1906. Est lord lieutenant de l'Aberdeenshire. A été lord Haut Commissaire de l'Assemblée générale de l'Eglise d'Ecosse, 1881–1885; lord lieutenant d'Irlande, de janvier à juillet 1886, et depuis décembre 1905. Grand'croix de Saint-Michel et Saint-George, 1895; Chevalier du Chardon, 1906.

67. SEYMOUR, Lord WILLIAM FREDERICK ERNEST. 1838–

Né le 8 décembre 1838. Entra dans la marine, servit sur la Baltique, 1854; entra dans les Coldstream Guards, 1855; devint colonel, 1880; major-général, 1889; lieutenant-général, 1896; général, 1902; à la retraite, 1905. Servit en Crimée, 1856; en Egypte, 1892; Assistant Quartier-Maître Général aux quartiers généraux, 1885–1888; commandant du district Sud-Est, 1891–1896; des forces en Canada, 1898–1900; faisant fonctions de Secrétaire Militaire aux quartiers généraux, 1901–1902; lieutenant de la Tour de Londres, 1902–1905.

68. MINTO, GILBERT JOHN ELLIOTT, comte de—et baronnet. 1845–

Né le 9 juillet 1845. Etudia à Eton et au Trinity College, Cambridge (B.A., 1866); LL.D. honoraire de l'Université de Queen's, Kingston, 1898; ci-devant lieutenant dans la Garde Ecossaise, puis brigadier-général; commanda la brigade d'infanterie volontaire du sud de l'Ecosse; vice-président du Royal Colonial Institute; attaché à l'armée turque durant la guerre Russo-turque, 1877; servit en Afghanistan, 1879; accompagna Lord Roberts au Sud-africain en qualité de secrétaire particulier, 1881; servit dans l'infanterie montée durant la campagne d'Egypte, 1882 (fut blessé le 24 août); commandant de l'infanterie du Caire; chef d'état-major durant la rébellion du Nord-Ouest canadien, 1885; fut secrétaire civil et militaire de Lord Lansdowne, gouverneur-général du Canada, du 24 octobre 1883 au 28 décembre 1885; vice-roi des Indes depuis 1905.

69. STRONG, Sir SAMUEL HENRY. 1825– .

Fils de feu le révérend S. S. Strong, est né en 1825. Admis au Barreau d'Ontario en 1849; Conseil de la Reine, 1863; commissaire pour la refonte des statuts du Canada; vice-chancelier d'Ontario, 1869–1874; juge puisné de la Cour d'Appel d'Ontario, 1874–1875; puis juge en chef de la Cour Suprême du Canada, 1892–1903. Fait chevalier, 1893; membre du Comité Judiciaire du Conseil Privé du Royaume-Uni, 1897.

70. TASCHEREAU, Sir HENRI ELZÉAR. 1836– .

Fils aîné de feu Pierre Elzéar Taschereau, député de Sainte-Marie, Beauce, est né en 1836. Etudia au Séminaire de Québec; admis au Barreau de Québec, 1857; Conseil de la Reine, 1867; siégea dans l'Assemblée législative, 1861–1867; juge puisné de la Cour Supérieure de la province de Québec, 1871–1878; juge puisné de la Cour Suprême du Canada, 1878–1902; puis juge en chef de cette cour, 1902–1906. Membre du Comité Judiciaire du Conseil Privé du Royaume-Uni, 1904; doyen de la faculté de droit de l'Université d'Ottawa. Fait chevalier en 1902.

71. GREY, ALBERT HENRY GEORGE, quatrième comte, et baronnet. 1851– .

Né le 28 novembre 1851. Etudia à Harrow et au Trinity College, Cambridge. LL.D. honoraire de McGill, 1904; de Toronto, 1905. Lord lieutenant de Northumberland, 1899–1904; fut un des directeurs de la British South Africa Company, et, durant quelque temps, administrateur du territoire de cette compagnie; député de Northumberland aux Communes, 1880–1885; de la division Tyneside de Northumberland, 1885–1886; est commandant en chef en Canada depuis 1905. Grand'-croix de Saint-Michel et Saint-George, 1904. Fait membre du Conseil Privé du Royaume-Uni, et Grand'croix de l'Ordre de Victoria, en juillet 1908, lors de la célébration du troisième centenaire de la fondation de Québec.

72. SEDGWICK, ROBERT. 1848–1908.

Troisième fils de feu le révérend Robert Sedgwick, est né à Aberdeen, Ecosse, le 18 mai 1848. Il vint tout jeune au Canada avec ses parents. Etudia au collège Dalhousie, Halifax. (B.A., 1867; LL.D., 1893). Fit son droit sous l'honorable J. S. Macdonald. Admis au Barreau d'Ontario, 1872; de la Nouvelle-Ecosse, 1873; Conseil de la Reine, 1880; Recorder d'Halifax, 1885. Etait l'un des gouverneurs du collège Dalhousie. Se présenta à la députation à Halifax, en 1874, pour la législature provinciale, mais fut défait. Nommé sous-ministre de la Justice le 25 février 1888; promu juge puisné de la Cour Suprême du Canada le 18 février 1893. Décédé à Halifax, le 4 août 1908.

73. Fitzpatrick, Sir Charles. 1853–

Fils de feu John Fitzpatrick, marchand de bois de Québec; né le 19 décembre 1853. Fit ses études au collège Sainte-Anne, au séminaire de Québec et à l'Université Laval. (B.A., 1873.) Admis au Barreau de Québec, 1876. Conseil de la Reine, 1893. Admis au Barreau d'Ontario, 1876. Défenseur de Riel en 1885; de l'honorable Honoré Mercier, dans le procès que lui intenta le gouvernement qui suivit son administration; de Thomas McGreevy devant le comité des Elections à la Chambre des Communes. A plaidé plusieurs causes importantes devant le Comité Judiciaire du Conseil Privé. A représenté le comté de Québec à l'Assemblée législative, de 1890 à 1896. Fut ensuite élu dans le même comté pour la Chambre des Communes. Devint Solliciteur-général le 13 juillet 1896. Ré-élu en 1900 et 1904. Assermenté comme membre du Conseil Privé du Canada et ministre de la Justice le 11 février 1902. Juge en chef de la Cour Suprême du Canada, le 4 juin 1906; Chevalier Commandeur de Saint-Michel et Saint-George, 28 juin 1907; membre du Conseil Privé du Royaume-Uni, le 4 juillet 1908.

BIBLIOGRAPHIE.

En outre de nombreux manuscrits les imprimés suivants ont été consultés pour les notes qui précèdent:—

Army Lists.

The Annual Register.

Bibaud, Maximilien.—Le Panthéon Canadien. Montréal, 1891.

Bourinot, Sir George.—Lord Elgin, "The Makers of Canada." Toronto, 1903.

Bradley, A. G.—Lord Dorchester, "The Makers of Canada." Toronto, 1907.

Burke's Peerage. 1906.

Calnek, W. A.—History of the County of Annapolis. Edited and completed by A. W. Savary. Toronto, 1897.

Canniff, Wm.—History of the Settlements of Upper Canada. Toronto, 1869.

Canniff, Wm.—History of the Province of Ontario (Upper Canada). Toronto, 1872. (Ceci n'est qu'une seconde édition de l'ouvrage précédent).

Christie, Robert.—A history of the late province of Lower Canada. 6 vols. Québec, 1848-1866.

Collins, J. E.—Canada under the Administration of Lord Lorne. Toronto, 1884.

De Brett's Peerages. 1863, 1908.

Dent, John Charles.—The Canadian Portrait Gallery. 4 vols. Toronto, 1880-81.

Dent, John Charles.—The Last Forty Years: Canada since the Union of 1841, 2 vols. Toronto, 1881.

The Dictionary of National Biography.

Doughty, A. G.—The Siege of Quebec. 6 vols. Québec, 1901.

Doutre et Lareau.—Histoire générale du Droit Canadien. Montréal, 1877.

Edgar, Lady.—General Brock, "The Makers of Canada." Toronto, 1904.

Fraser, Alexander.—A History of Ontario. 2 vols. Toronto, 1907.

Garneau, F. X.—Histoire du Canada, 4e. ed. 4 vols. Montréal, 1882.

The Gentlemen's Magazine.

Kaye, John William.—The Life and Correspondence of Charles, Lord Metcalfe. Londres, 1858.

Kingsford, William.—The History of Canada. 10 vols. Toronto, 1887-1898.

Lyall, Sir Alfred, P.C.—The Life of the Marquis of Dufferin and Ava. 2 vols. Londres, 1905.

Leggo, William.—The History of the Administration of the Right Honorable Frederick Temple, Earl of Dufferin. Montréal, 1878.

MacMullen, John.—The History of Canada.... Brockville, 1868.

Morgan, Henry J.—Bibliotheca Canadensis. Ottawa, 1867.

Morgan, Henry J.—Men and Women of the time; a handbook of Canadian Biography. Toronto, 1898.

Morgan, Henry J.—Sketches of celebrated Canadians. Québec, 1862.

McIlwraith, Jean N.—Sir Frederick Haldimand, "The Makers of Canada." Toronto, 1904.

The Parliamentary Companion.

Read, D. B.—Life and Time of Governor Simcoe. Toronto, 1890.

Read, D. B.—Life and Times of Sir Isaac Brock. 2 vols. Toronto, 1894.

Reid, Stuart J.—Life and Letters of the first Earl of Durham, 1792-1840. Londres, 1906.

Robertson, J. Ross.—Robertson's Landmarks of Toronto. 2 vols. Toronto, 1894, 1896.

Robertson, J. Ross.—The History of Freemasonry in Canada. 2 vols. Toronto, 1899.

Roy, J. Edmond.—Histoire de la seigneurie de Lauzon. 5 vols. Lévis, 1897-1904.

Scadding, Rev. H. H.—Toronto of Old. Toronto, 1878.

Scott, Duncan Campbell.—John Graves Simcoe, "The Makers of Canada." Toronto, 1905.

Scrope, C. Poulett.—Memoirs of the Right Honourable Charles, Lord Sydenham. Londres, 1843.

Shortt, Adam.—Lord Sydenham, "The Makers of Canada." Toronto, 1908.

Simcoe's Military Journal. New-York, 1844.

Simcoe's Diary of his Journey from Humber Bay to Matchedash Bay, 1793. "Transactions of the Canadian Institute," Toronto, 1890.

Smith, William.—History of Canada. 2 vols. Québec, 1815.

Some Account of the Public Life of the Late Lieutenant General Sir George Prevost, Bart. Particularly of his service in the Canadas; including a Reply to the Strictures of his Military character, contained in an article in the Quarterly Review for October, 1822. Londres, 1823.

Stewart, George.—Canada under the Administration of the Earl of Dufferin. Toronto, 1878.

Sulte, Benjamin.—Histoire des Canadiens-français. 8 vols. Montréal, 1882.

Taylor, Fennings.—Biography of Sir William Fenwick Williams, in "Portraits of British Americans," part II, Montréal, 1865.

Taylor, Fennings.—Biography of Lord Monck, in "Portraits of British Americans," part I, Montréal, 1885.

Taylor, Fennings.—Biography of Sir John Michel, in "Portraits of British Americans," part VIII, Montréal, 1865.

Taylor, James P.—Cardinal facts of Canadian History. Toronto, 1899.

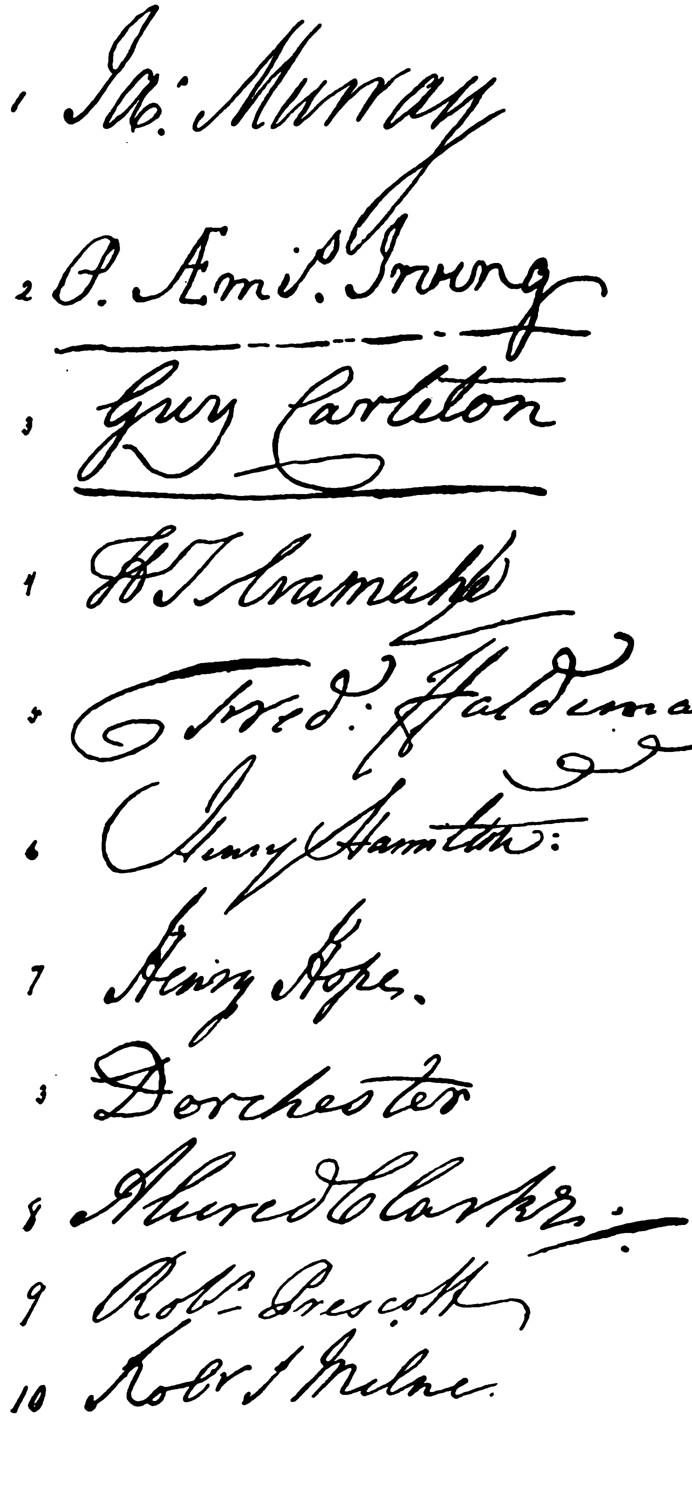
Tupper, Ferdinand Brock.—Family Records; containing Memoirs of Major General Sir Isaac Brock, K.B., Lieutenant E. W. Tupper, R.N., and Colonel William De Vic Tupper, with notices of Major General Tupper and Lieutenant C. Tupper, R.N. To which are added The Life of Te-cum-seh, a Memoir of Colonel Havilland LeMesurier, etc. Guernesey, 1835.

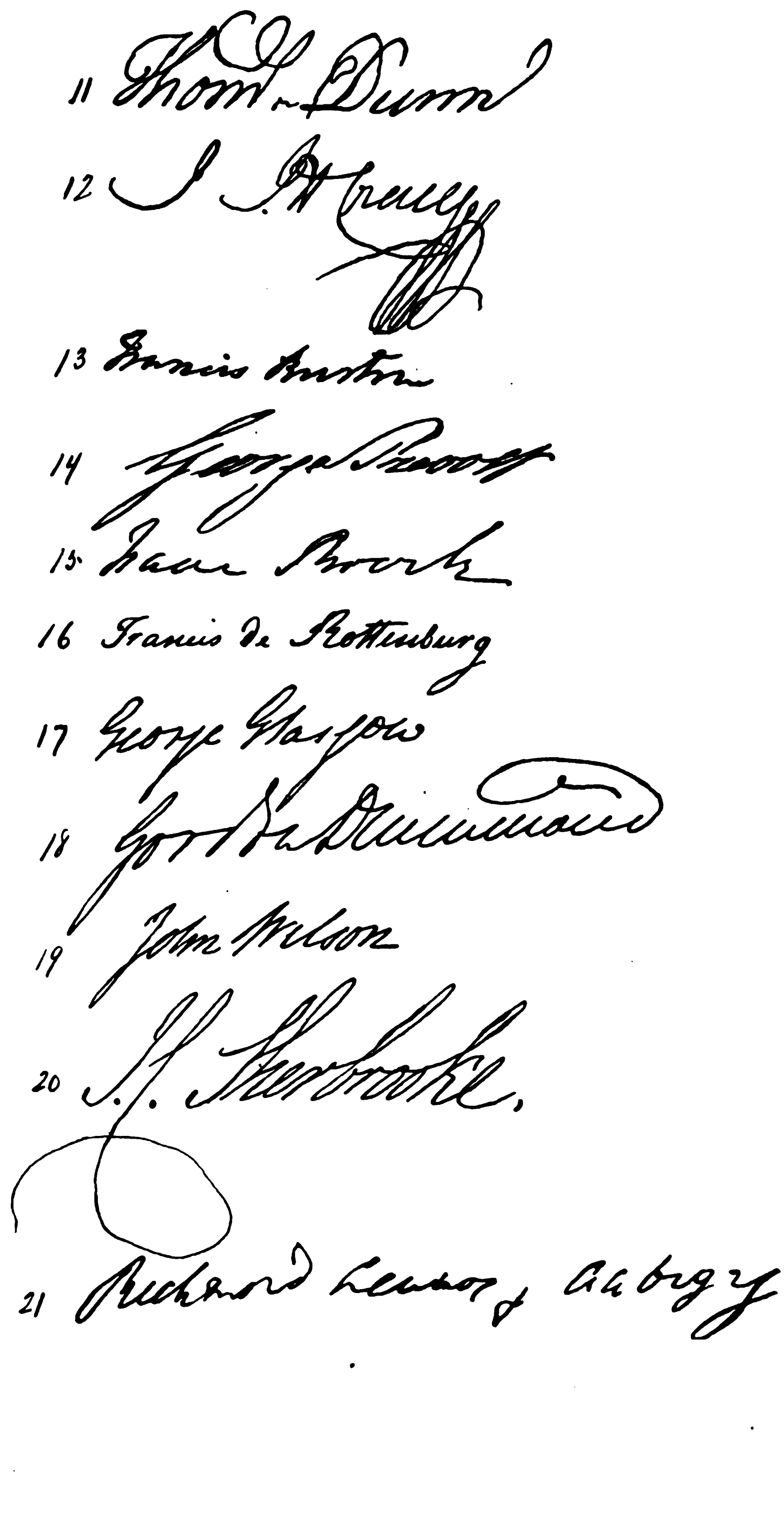
Turcotte, Louis P.—Le Canada sous l'Union. 2 vols. Québec, 1882.

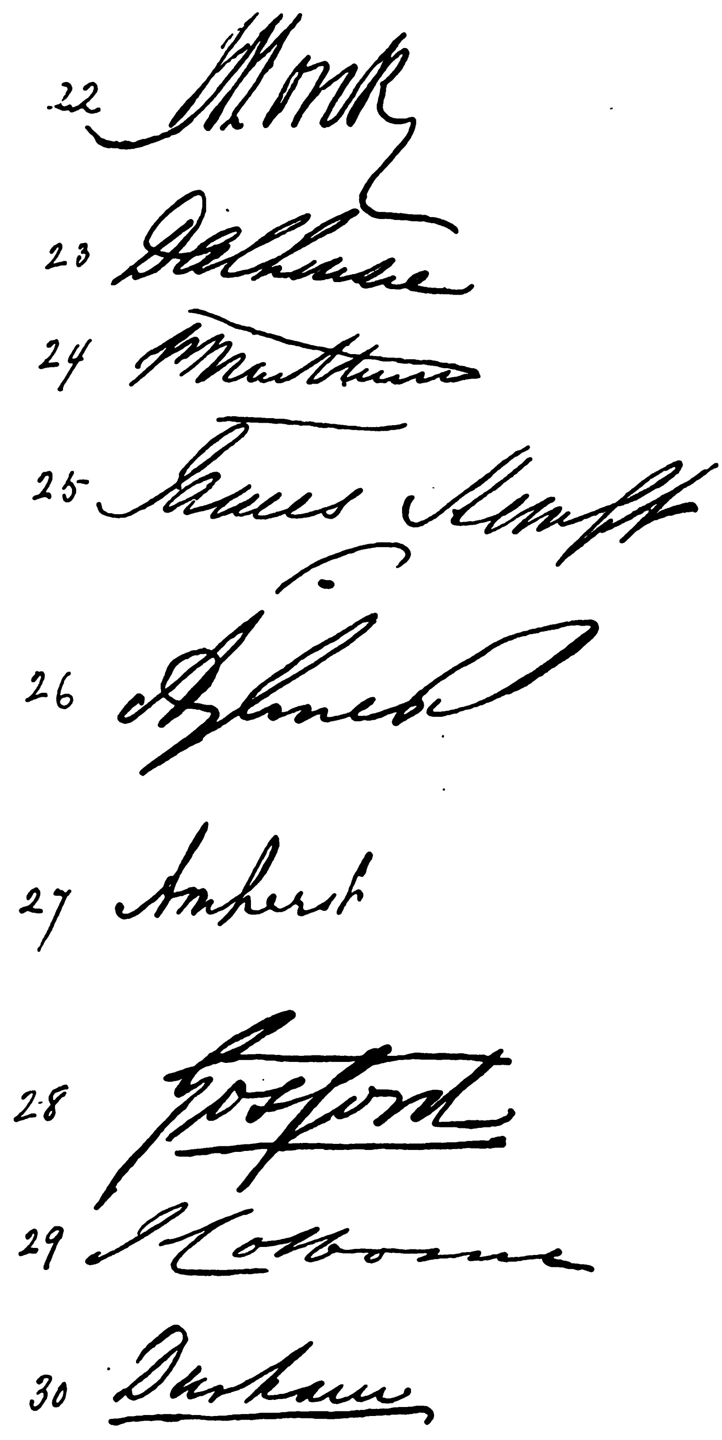
Les Ursulines de Québec, depuis leur établissement jusqu'à nos jours. 4 vols. Québec, 1864-1866.

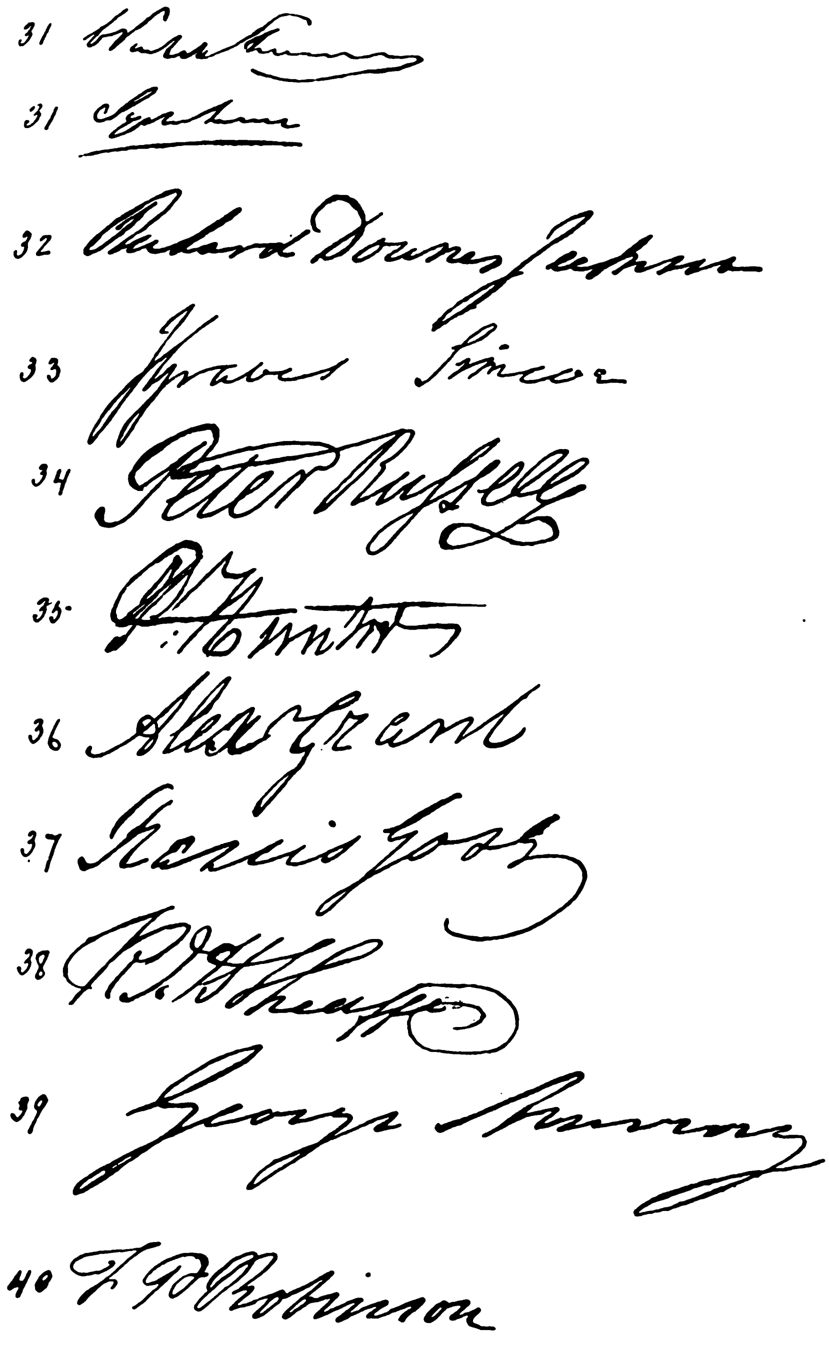
Who's Who.

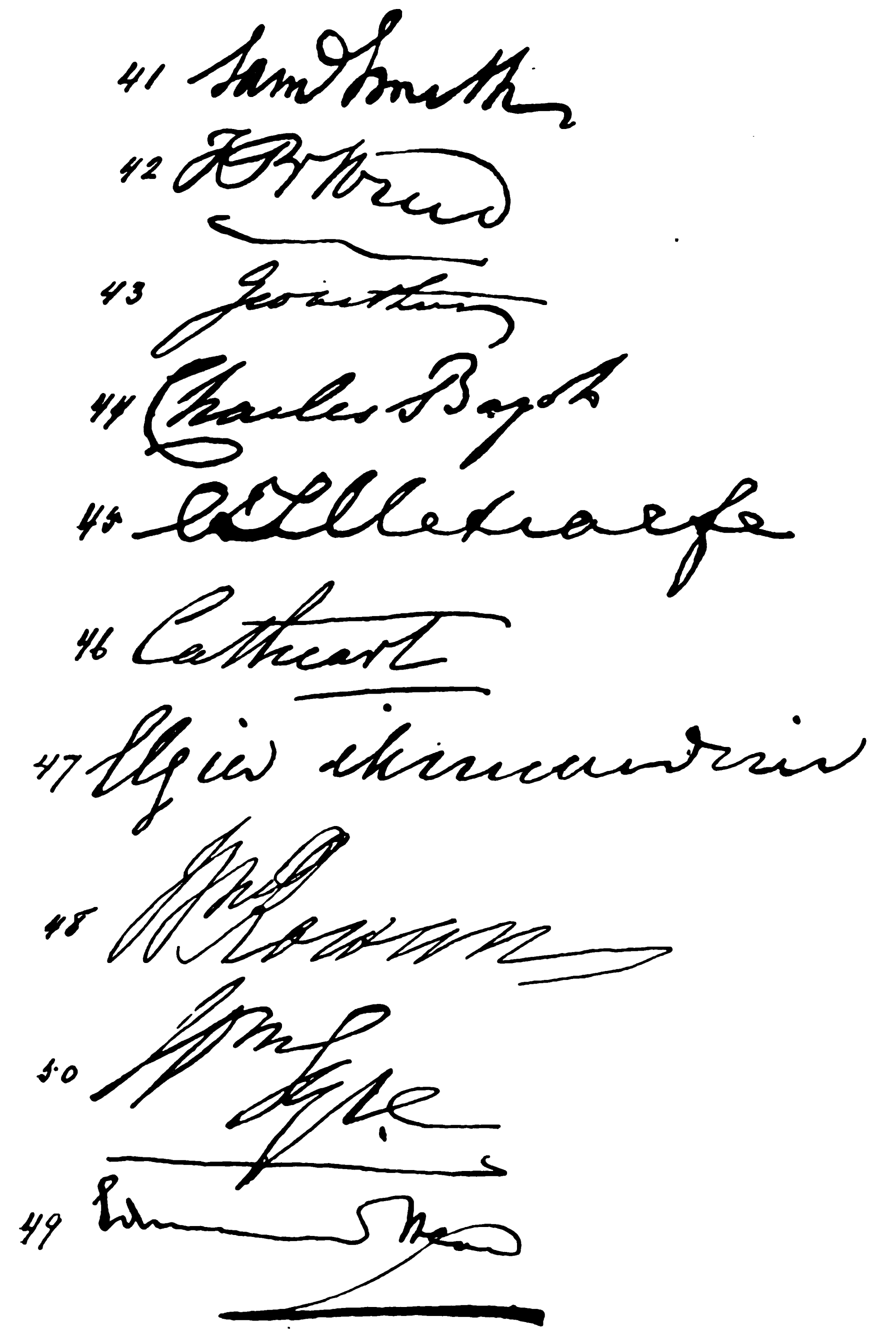
Wrong, George M.—The Earl of Elgin. Londres, 1905.

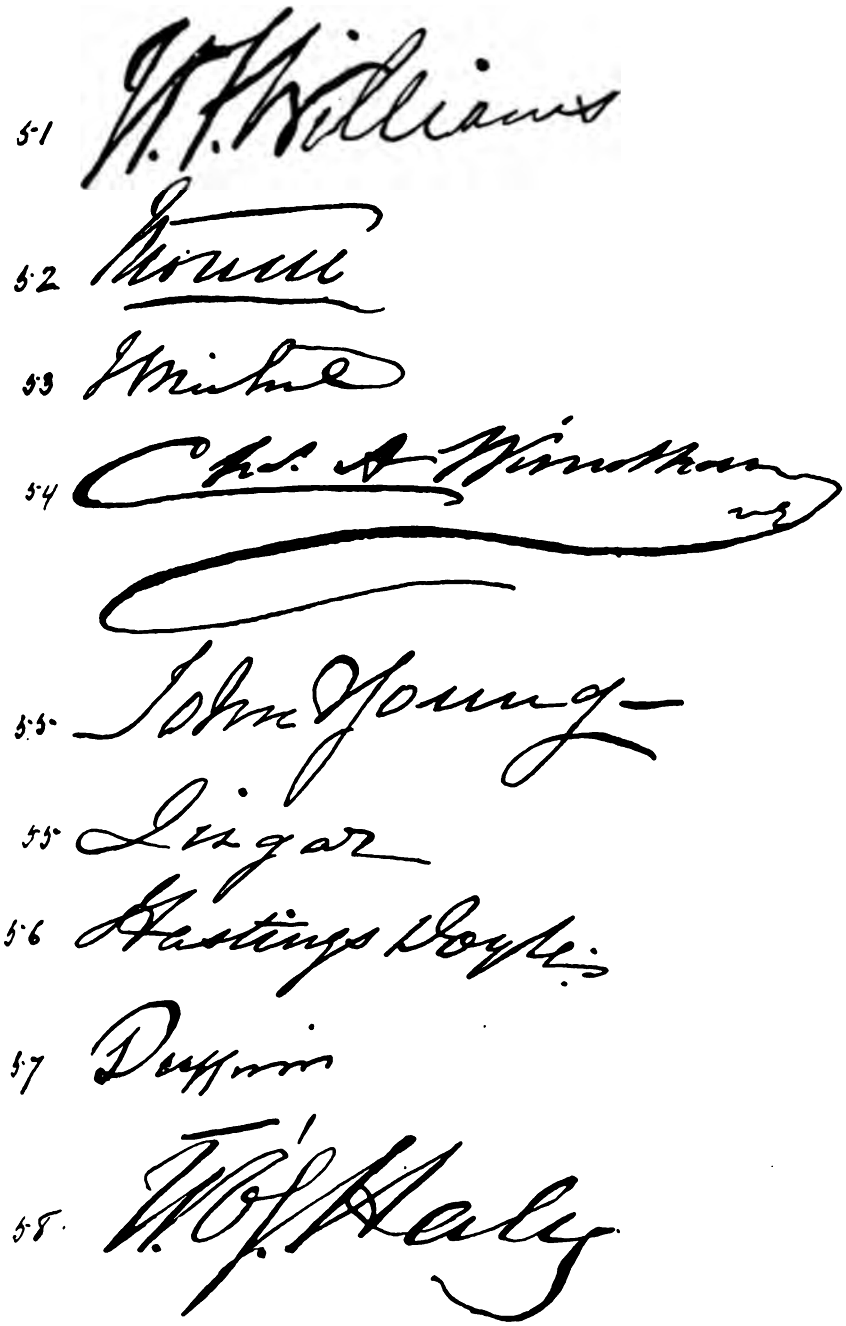

1 Ja: Murray
2 P. Emi. Irving
3 Guy Carleton
4 H T Cramahé
5 Fred: Haldimand
6 Henry Hamilton:
7 Henry Hope.
3 Dorchester
8 Alured Clarke.
9 Robt. Prescott
10 Robt. S. Milnes.

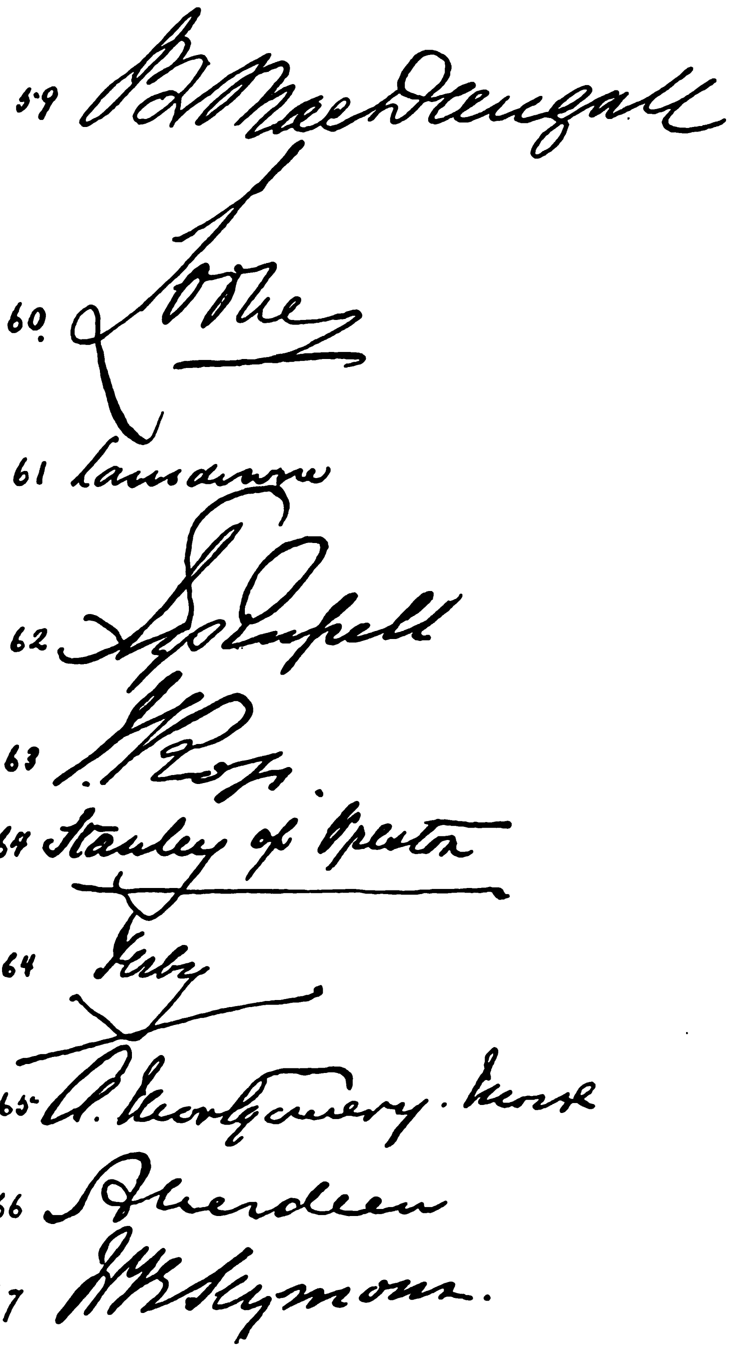

11 Thomas Dunn
12 J. H. Craig
13 Francis Burton
14 George Prevost
15 Isaac Brock
16 Francis de Rottenburg
17 George Glasgow
18 Gordon Drummond
19 John Wilson
20 J. C. Sherbrooke
21 Richmond Lennox & Aubigny

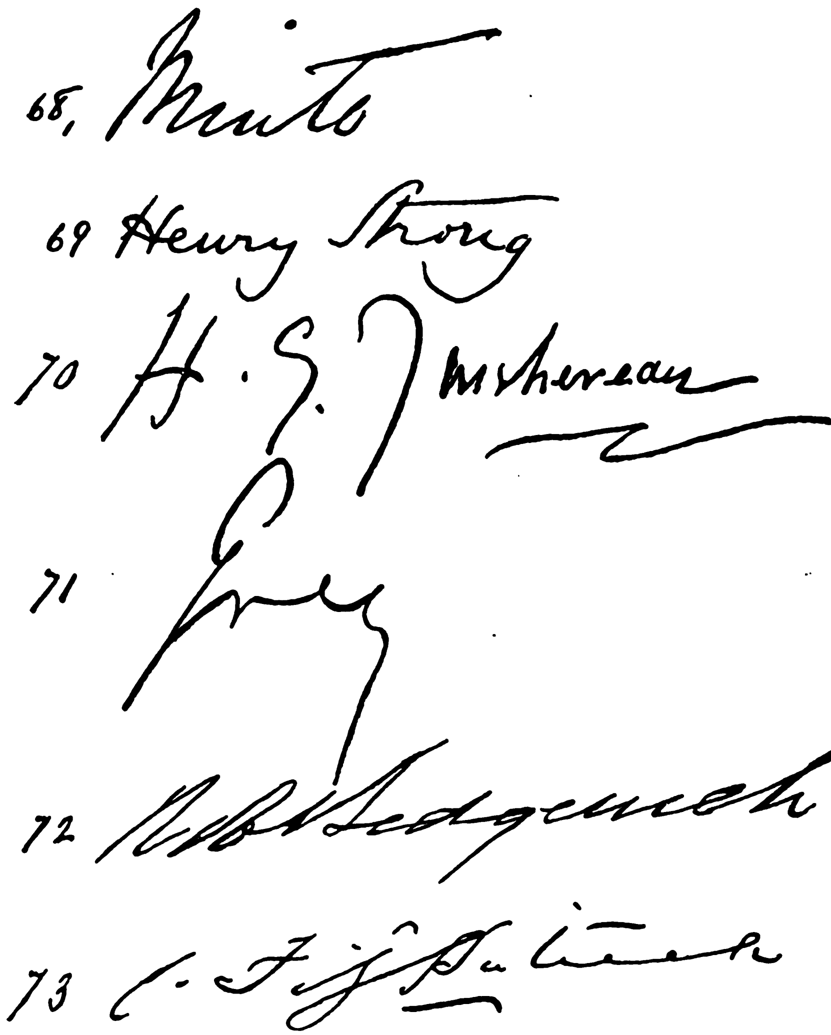

22
23
24
25
26
27
28
29
30


31
31
32
33
34 Peter Russell
35
36 Alex Grant
37
38
39
40 Robinson








68. Minto
69 Henry Strong
70
71 Grey
72
73

V.—*Des Acadiens déportés à Boston, en 1755.*—(*Un épisode du Grand Dérangement*).

Par M. LE SÉNATEUR PASCAL POIRIER.

(Lu en mai 1908.)

PREMIÈRE PARTIE.

Déportation; exil.

Many a weary year had passed since the burning of Grand-Pré,
When on the falling tide the freighted vessels departed,
Bearing a nation, with all its household gods, into exile,
Exile without an end, and without example in story.
Far asunder, on separate coasts, the Acadians landed....
Friendless, homeless, hopeless, they wandered from city to city....
Asked of the earth but a grave, and no longer a friend nor a fireside.

LONGFELLOW.—*Evangeline.*

Bien des années de douleur s'étaient succédé, depuis qu'à la lueur de Grand-Pré incendié, des vaisseaux, bondés d'êtres humains, étaient partis avec la marée, emportant tout entières en exil, la nation et la patrie acadiennes. Exil sans fin et d'une pitié sans égale dans l'histoire. Jetés sur des rives lointaines, et séparés les uns des autres, on les vit errer de ville en ville, sans amis, sans demeures, sans espérance humaine, résignés, et ne demandant rien à la terre qu'un tombeau.

LONGFELLOW.—*Evangeline.*

Le drame douloureux du Grand Dérangement s'était terminé dans les pleurs des Acadiens et le ricanement des soldats anglais.

De son poste de Pigiguit, aujourd'hui Windsor, où il gardait plus de mille prisonniers attendant d'être expédiés, le capitaine Murray écrivait au colonel Winslow, stationné à Grand-Pré: " Vous savez que nos soldats les haïssent, et que s'ils peuvent trouver un prétexte pour les tuer, ils le feront.".... " Pour moi, j'ai hâte de voir ces pauvres diables embarqués, et, alors, je me paierai le plaisir d'aller vous voir et de boire avec vous à leur bon voyage."

Et comme l'embarquement traînait en longueur, il ne trouvait dans les scènes de désolation qu'il avait sous les yeux qu'un motif à se divertir. " Aussitôt que j'aurai expédié ces *rascals,* écrivait-il de nouveau à son ami, j'irai me reposer avec vous et nous amuser."

Tout ce qu'on a dit des misères et des souffrances des Acadiens, au jour du Grand Dérangement; tout ce que la tradition en a rapporté; tout ce que Longfellow, poète divin, en a tiré de notes plaintives et désespérées sur son luth immortel, n'en égale pas la lamentable réalité. Ce drame ne peut s'écrire qu'avec des larmes.

Cependant, si cruel que fut l'embarquement, la suite, l'exil, fut plus douloureux encore.

Pour les déportés du Massachusetts, ce fut une agonie de plus de dix ans, sans trêve ni répit; agonie des hommes réduits à la mendicité et obligés de subir, sans ouvrir la bouche, pour eux et leur famille, les affronts, le mépris, les enlèvements, les rapts, tous les outrages, toutes les injustices, toutes les infamies; agonie des femmes à la merci de maîtres prévenus, jusqu'au fanatisme religieux, contre tout ce qui portait le nom de catholique et de français; agonie des enfants qu'on arrachait aux bras de leurs parents pour se les distribuer; agonie de l'âme des pères et des mères, en voyant ces mêmes enfants devenir des Anglais, des protestants.

Tout les avait abandonnés; le roi de France les laissait persécuter, en dépit de la protection que leur garantissait le traité d'Utrecht; la terre les maudissait, et le ciel restait sourd à leurs gémissements.

C'était un peuple de douleur.

C'est un vendredi, 5 de septembre 1755, à trois heures de l'après-midi, que les Acadiens du Bassin-des-Mines et de Pigiguit furent convoqués dans leurs églises, pour entendre la lecture d'un prétendu message du roi d'Angleterre et de l'Acadie, Georges II. Ce message, auquel le roi et ses ministres étaient tout à fait étrangers, n'était qu'un guet-apens du gouverneur Lawrence.

Quoique la paix existât alors entre l'Angleterre et la France, les Acadiens furent cernés et enveloppés par les soldats anglais dans les murs de leurs églises, et là, désarmés et impuissants, ils s'entendirent déclarer prisonniers de guerre; et Winslow et Murray, au nom de Sa Majesté britannique, leur annoncèrent que leurs biens étaient confisqués et qu'ils allaient être dispersés dans les colonies anglaises.

Le 10 septembre commença l'embarquement, celui des adultes, les pères de familles et les jeunes gens, à bord de cinq transports ancrés en face du village de Grand-Pré; et, le 8 d'octobre suivant, il se termina par celui des vieillards, des malades, des femmes et des enfants. Jours à jamais lamentables!

Ce n'est que le 27 octobre que le convoi, quatorze vaisseaux chargés au Bassin-des-Mines et dix à Beaubassin, partit, avec ses cargaisons humaines, pour l'éternel exil.

Le nombre des Acadiens qui furent dispersés, depuis Boston jusqu'à la Caroline du Sud, dans les plantations anglaises, nullement préparées et mal disposées à les recevoir, et, par les autorités régionales, distribués, ensuite, dans les villes et les villages, s'éleva à six mille environ. Il y en eut quinze cents autres, au moins, à qui il ne fut pas permis de débarquer.

Les premiers qui arrivèrent à Boston appartenaient au convoi destiné aux "plantations" du Sud, la Virginie et les deux Carolines.

Une tempête formidable s'était abattue sur eux, à leur sortie de la baie d'Annapolis, et six vaisseaux parmi les plus malmenés avaient dû faire relâche, à Boston, pour se mettre à l'abri et réparer leurs avaries, pendant que les autres poursuivaient leur route.

La chambre des Représentants du Massachusetts, qui était en session, à Boston, chargea, le 5 novembre, une commission spéciale d'aller examiner cette cargaison de papistes exécrés.

Les six transports, de simples goëlettes, jaugeaient en tout 485 tonneaux, et portaient 1,077 personnes.

Le rapport de la commission, lu devant la Chambre, disait entre autres choses: les vaisseaux ont en général trop de monde; les provisions ne sont pas suffisantes pour le voyage qu'ils ont à faire, surtout à cette saison de l'année; l'eau est très mauvaise.

Sur le *Dolphin,* transport de quatre-vingt-dix tonneaux, où il y avait 227 personnes entassées, quarante étaient couchées sur le pont, malades; ils en avaient compté autant sur le pont du *Davis,* vaisseau de même tonnage.

La Commission ne recommanda pas qu'il leur fut porté secours, et la Chambre des Représentants ne leur en procura aucun.

Il se trouvait, à ce moment-là, à Boston, un membre du Conseil du gouverneur de Halifax, nommé Benjamin Green. Il eut la curiosité d'aller voir cet étrange chargement qui arrivait de son pays. Le spectacle de tant de malheureux, des femmes pour la plupart, mourant sur le pont des vaisseaux, le toucha. Il eut pitié, et, allant trouver les membres de la Législature, il offrit de dédommager les armateurs de ce qu'ils pourraient perdre sur le prix du passage jusqu'à destination, s'ils voulaient alléger les vaisseaux du surplus de leur fret humain, lequel était fixé réglementairement à deux passagers par tonneau, et si la ville ou la province consentait à en prendre soin. Le bon Samaritain n'eut pas agi d'autre façon.

L'offre de Green fut acceptée, et une cinquantaine de ces moribonds furent mis à terre, pendant que les transports, la tempête calmée et les avaries réparées, reprenaient la mer.

Ainsi le premier acte officiel de la Législature du Massachusetts, se rapportant aux exilés de 1755, fut un acte d'humanité. Prenons-en note. De semblables procédés se feront rares dans la suite.

Dans la répartition qui fut faite des exilés entre les différentes provinces anglaises d'Amérique, le Massachusetts eut sa large part.

Les cargaisons qui lui étaient destinées arrivèrent à Boston les unes après les autres. La première à décharger fut, croyons-nous, le *Seaflower,* goëlette de quatre-vingt-un tonneaux, appartenant à un caboteur du Maine, le colonel Nathaniel Downell, laquelle s'étant rendue, durant le mois de septembre, à Grand-Pré, pour affaires de commerce, fut réquisitionnée par Lawrence pour le transport des Acadiens. Ce vaisseau, comme la plupart des autres, d'ailleurs, n'était nullement propre au service des passagers. Murray, qui avait hâte de quitter Pigiguid, comme nous l'avons vu, pour aller s'amuser avec Winslow, y avait entassé, pêle-mêle, deux cent six personnes, malgré l'ordre de ne charger les transports que dans la proportion de deux personnes par tonneau, ce qui était déjà trop.

Les autorités de Boston hésitèrent longtemps à laisser débarquer sur le sol puritain des catholiques romains qui leur étaient odieux, et qui leur arrivaient dénués de tout.

Pendant ce temps-là, les Acadiens mouraient de faim dans la cale et sur le pont du *Seaflower;* et il était défendu au capitaine d'en laisser descendre un seul à terre, et à tous de leur porter secours.

Un certain Thomas Hutchinson, qui les visita, a laissé de leurs souffrances un récit navrant. Malgré la consigne sévère, il résolut d'en sauver quelques-uns. A ses risques et périls, il fit descendre et loger chez lui une veuve du nom de Benoit, avec ses quatre fils et un petit-fils, qu'il avait trouvée mourant de misère (*hardships*), après quinze jours de maladie, sans personne pour lui donner aucun soin.

Afin d'empêcher que tous ces malheureux ne périssent de privations et de froid, les chambres nommèrent, à la fin, un comité chargé de s'enquérir des faits et de trouver quelque moyen de leur venir immédiatement en aide.

La recommandation du comité fut de les placer temporairement à Boston et dans les villes environnantes; de les nourrir et de les loger, sauf à se faire rembourser, plus tard, par le gouvernement de la Nouvelle-Ecosse, ce qu'ils auraient coûté à la province.

En conséquence, le gouverneur fut requis par les deux Chambres de notifier Lawrence que la province du Massachusetts prenait à sa charge les Français de la Nouvelle-Ecosse qu'il lui avait envoyés, mais à condition qu'elle serait par lui remboursée de tous les frais encourus et à encourir. Le message ajoutait: " Nous vous donnons avis que si vous nous envoyez d'autres déportés de même provenance, ils n'auront pas la permission de débarquer, à moins que le gouvernement de la Nouvelle-Ecosse ne s'engage expressément à rembourser à cette province les dépenses qu'ils pourront occasionner."

Au *Seaflower* à peine déchargé vint s'ajouter le *Swallow*, capitaine William Hayes, parti, le 13 décembre, du Bassin-des-Mines, avec un chargement de deux cent trente-six âmes.

Rassuré du côté des frais par le message qu'il venait d'envoyer à Lawrence, le gouvernement n'hésita pas à laisser le nouveau contingent joindre à terre les premiers arrivés, et, le 23 décembre, il autorisa par un Acte spécial, "les Cours des Sessions Générales de la paix et les juges de paix des différents comtés et les commissaires des pauvres et les *selectmen* des différentes villes où ils avaient été répartis, de les employer, de les mettre en service (*to bind them out*) ou de leur prêter assistance de la même manière que la loi leur eut donné autorité de le faire, s'ils avaient été des habitants du Massachusetts." Les frais à encourir, jusqu'au 10 du mois d'avril suivant, seraient remboursés par la province.

Ces dispositions, sur le papier, paraissent assez humaines. En vérité, c'était, comme nous l'allons voir, livrer ces pauvres gens à la cupidité et aux sévices des maîtres, le plus souvent des bourreaux, qui leur étaient donnés. Ce *bind them out* était une mise en servage, faisant d'eux des ilotes.

A quelques jours de là, le 26, un troisième bâtiment de transport jetait l'ancre dans la rade de Boston.

Avant de laisser les nouveaux arrivés descendre à terre, les Chambres voulurent connaître les intentions de Lawrence à leur égard et quelles dispositions il avait prises touchant les frais de leur entretien. A cette fin, ils mandèrent à la barre de la Législature le capitaine Livingstone et les armateurs Apthorp et Hancock. Ceux-ci déclarèrent qu'ils ne portaient aucun message du gouverneur Lawrence, ni de son Conseil; que leurs seules instructions étaient de délivrer les prisonniers, "qui étaient devenus un danger pour la Nouvelle-Ecosse," entre les mains des autorités de Boston. Les Acadiens étaient dirigés sur Boston pour y être déchargés, comme on jette au large un lest encombrant dont il faut se débarrasser. Non seulement Lawrence n'avait pas pourvu à leurs frais d'entretien, à Boston, mais ne leur avait donné de vivres que juste ce qu'il leur fallait pour se rendre à destination.

En effet, entassés dans le navire, les nouveaux arrivés, en attendant qu'on décidât de leur sort, périssaient de froid et de faim.

Ce que voyant, les Chambres nommèrent d'urgence un comité pour en prendre soin, temporairement, en attendant une réponse de Lawrence et des instructions du général Shirley, auquel elles avaient fait également écrire. Ce comité avait le pouvoir de les distribuer, comme l'avaient été les deux cargaisons précédentes, dans les différentes villes de la province; mais, disait l'Acte de la Législature, "cette distribution ne doit pas être entendue comme leur conférant droit de citoyen dans les villes où ils seront envoyés."

Entre le 26 décembre et le 16 février, deux autres navires chargés de déportés vinrent mouiller dans la rade de Boston et demander à débarquer leur cargaison humaine, le *Race Horse,* capitaine Banks, venant de Grand-Pré, avec cent vingt, et le *Helena,* d'Annapolis-Royal, avec trois cent vingt-trois, prisonniers. Personne, ni Lawrence ni Shirley, ne garantissait à la province le remboursement de ce qu'ils allaient coûter. Les Chambres, néanmoins, se décidèrent à ne pas les laisser périr, quoiqu'il leur répugnât souverainement, comme elles l'écrivaient au gouverneur Shirley, d'admettre dans leurs villes, au contact de leurs enfants, ces papistes, " dont la grossière bigoterie catholique était notoire, et dont la loyauté à Sa Majesté britannique leur était suspecte."

En conséquence, et dans la certitude d'être, quoique tardivement, peut-être, remboursés des avances qu'ils pourraient faire, les autorités de Boston ordonnèrent que les derniers arrivés seraient reçus et traités de la même manière que leurs devanciers, c'est-à-dire, distribués dans les diverses municipalités de la province.

A la date du 16 février 1756, le nombre des Acadiens internés dans la province du Massachusetts s'élevait à plus d'un millier d'âmes.

Mais la mer n'était pas seule à jeter ses épaves humaines sur les falaises du Massachusetts. Il en sortait aussi des bois; il en surgissait de partout, pauvres malheureux partis à la recherche, qui d'un père, qui d'une mère, qui d'un enfant, qui d'une épouse, qui d'une fiancée. C'étaient des spectres en haillons et affamés errant, lamentables, dans la nuit.

Quand ils étaient à bout de forces et de courage; quand leurs pieds meurtris ne pouvaient plus les porter; que le froid de l'hiver avait glacé leurs membres amaigris, et le désespoir brisé les ressorts de leur âme, ces mères désespérées, ces orphelins, ces malades, ces vieillards, ces hommes forts vaincus par la faim et la douleur, tombaient d'inanition dans les granges et les hangars qu'on leur avait donnés pour refuges, quelquefois sur le sol gelé, ou dans la neige, et mouraient en invoquant la Mère des Douleurs, leur Patronne, et en bénissant Dieu crucifié. Aucune parole de malédiction ne sortit jamais de leur bouche.

Dans les commencements, la prévention des Bostonais contre les "*French Neutrals*" fut poussée au point qu'on leur attribua tous les crimes et méfaits dont les auteurs restaient inconnus, ou que l'on voulait soustraire à la justice. Comme on les croyait capables de tout, ils étaient, sans preuve aucune, accusés de tout, et punis selon toutes les rigueurs de la loi. A Charlestown, où il y avait une poudrière, les autorités municipales adressèrent une pétition au gouverneur pour en éloigner les trente et un Acadiens qui y avaient été remisés, de crainte, disaient-ils, qu'ils ne fissent sauter la ville. Pris de peur, la chambre des Représentants, le Conseil et le gouverneur se concertèrent pour les faire transférer, une partie à Leicester et les autres à Spencer, attendu que, disait l'ordre de la Cour, " leur séjour à Charlestown met en danger la sûreté de toute la province."

A partir de ce moment, les Acadiens furent constamment tenus éloignés de Boston pour des raisons de transes et de paniques de même nature. Ceux qui avaient été, à leur débarquement, envoyés dans les villes maritimes furent, pour la plupart, relégués, peu de temps après, à l'intérieur de la province: il y allait, alléguait-on, de la sûreté de la flotte marchande de la Nouvelle-Angleterre!

Tout ceci autorisait les mesures d'extrême rigueur et les pires traitements.

Cependant il devint bientôt impossible de fermer plus longtemps les yeux à l'évidence des faits.

Ces papistes acadiens qu'on s'était figurés mauvais et dangereux, étaient, à n'en pas douter, des hommes pacifiques; ces idolâtres paraissaient vivre dans la crainte et selon les commandements du Seigneur; ceux qu'on avait crus des assassins n'étaient jamais pris commettant aucun acte de violence; on les avait représentés comme des débauchés, et ils vivaient chastement; comme des voleurs, et ils se laissaient mourir de faim plutôt que de rien dérober.

Il est à remarquer que les Romains se trompèrent de la même façon à l'endroit des premiers chrétiens.

Tant d'infortune imméritée, joint à tant de courage et à une si grande paix de l'âme, finit par frapper les Puritains de la Nouvelle-Angleterre.

Une réaction lente et presque honteuse se fit, pendant un certain temps, en faveur des Acadiens.

On leur offrit de les sauver, s'ils convenaient qu'ils étaient sujets du roi d'Angleterre. Les anciens virent un piège là-dessous, et prirent peur. Ils craignirent qu'après leur nationalité on leur demandât d'abandonner leur foi. Se déclarer anglais, dans la province du Massachusetts, c'était presque, à leurs yeux, se déclarer protestants. Et la foi catholique, l'espérance finale du ciel, était tout ce qui leur restait au monde. Tout perdre, mais non pas la Foi. Ils refusèrent en termes reconnaissants; donnant pour raison que le roi de France ne consentirait jamais à signer un traité de paix avec le roi d'Angleterre, sans stipuler qu'ils fussent réintégrés dans leur patrie et que leurs biens leur fussent rendus.

La chambre des Représentants, réunie en session, le 18 mars (1756), et ayant à décider du sort d'un certain nombre de nouveaux arrivés, autorisa les commissaires des pauvres à fournir des instruments aratoires et des outils aux hommes, des rouets et des métiers à tisser aux femmes, le tout n'excédant pas le prix de quarante schellings pour chaque personne; et aussi à trouver des maisons pour tous ceux qui, maintenant qu'on leur en fournissait le moyen, entreprendraient de subvenir aux besoins de leurs familles.

Des maisons pour se retirer, avec des lits, plus tard, pour se coucher, au lieu de baraquements, de hangars et de granges qu'ils avaient eus pour passer l'hiver! Et la liberté d'exercer des métiers humains pour gagner leur vie et subvenir aux besoins de leurs familles, au lieu d'être à la charité et de mourir de faim! Le ciel venait donc enfin à leur secours; le bon Dieu avait donc enfin entendu leurs gémissements!

Un autre arrêté, pris le même jour, autorisait les municipalités à nourrir convenablement les pauvres et les malades aux frais de la province, ce qui, apparemment, n'avait guère été fait jusque là. C'était un pan du ciel qui s'ouvrait devant eux.

Tant de libéralités octroyées à des Français, à des catholiques, donnèrent aux princes des *clergymen,* aux scribes et aux pharisiens de Boston, c'est-à-dire à la classe bien pensante et aux honnêtes gens de la ville puritaine, de sérieuses appréhensions. Leurs représentants versaient décidément dans un libéralisme dangereux. Il y avait parmi eux de la libre pensée irréligieuse. L'Eglise et l'Etat allaient se trouver dans un danger imminent, à cause des mesures d'humanité prises vis-à-vis de chrétiens qui ne priaient pas dans leurs temples réformés. Sans compter que ces papistes pouvaient faire concurrence à leurs ouvriers, et un tort énorme à leurs pêcheurs de Gloucester, étant meilleurs marins qu'eux. Cela ne se pouvait pas tolérer.

Sous la pression exercée sur eux par la cupidité et la religion, les membres de la Chambre des Représentants et du Conseil capitulèrent devant l'opinion, et, au commencement du mois d'avril, remirent en vigueur, en la remaniant de façon à la rendre plus sévère, une loi passée sous le règne de Marie et de Guillaume d'Orange dite « à l'effet de prévenir tout danger de la part des Français résidant dans la province," et qu'ils intitulèrent: "Acte pour empêcher les ci-devant habitants de la Nouvelle-Ecosse et autres Français, sujets du roi de France, de circuler dans la province, sans être munis d'un passe-port, et pour les empêcher aussi d'être employés aux pêcheries et sur les vaisseaux faisant le cabotage."

C'était le commencement de la persécution.

Sans provocation aucune, sans aucun manquement de leur part, les Acadiens allaient être traités semblablement aux 2,500 nègres qui étaient, La pétition suivante, datée antérieurement à l'acte que nous venons de lire, et que nous reproduisons dans toute sa simplicité, sans en changer une lettre, ne le montre que trop clairement.

" A Son Excellence, le Gouverneur-Général de la province du Massachusetts, Nouvelle-Angleterre, et aux honorables messieurs membres du Conseil.

" Nous avons pris la liberté de vous présenté cette requete, comme nous somme en chagrin par raport à nos enfans. La perte que nous avons souffers de nos habitation et même icy et nos séparations les zun des autres est rien à compareé à cell que nous trouvons à présent, que de prendre nos enfants par force devant nos yeaux. La nature mesme ne peut souffrir cela. Si il estait en notre pouvoir davoir notre chois, nous choisirerions de rendre nos corps et nos âmes que d'être separré d'eux. Cest pour quoy nous vous prions en grâce et à vos honeurs que vous ayié la bonté d'apaiser cette cruaultez.

" Nous ne refusons aucunement de travailler pour entretiendre nos enfants....

" Vous priants en grâce que d'avoir la bonté d'avoir egart a notre requeste, ainsy faisent vous obligeré votre humble et très obéissant serviteurs:

JEAN LANDRY,
de Chelmsford.
CLAUDE BENNOIS,
d'Oxford.
CLAUDE LEBLANC,
CHARLES DAIGLE,
PIERRE LEBLANC,
de Concord.
AUGUSTE LEBLANC,
de Worcester.
JACQUES HEBERT,
JOSEPH VINCENT,
d'Andover.
ANTOINE HEBERT,
de Waltham."

Ces chrétiens, ces martyrs, offraient leur vie, offraient leurs âmes et leurs corps, pour sauver leurs enfants. A quel désespoir en étaient-ils réduits! Il ne s'est pas vu, depuis le temps de Notre Seigneur, une aussi grande désolation que la nôtre, disait un de ces Acadiens au gouverneur.

Ces actes inhumains n'étaient pas isolés, mais se pratiquaient déjà, comme le montre cette pétition, dans presque toutes les localités où se trouvait un groupe d'Acadiens.

Cependant l'œuvre de la déportation se poursuivait à la Nouvelle-Ecosse, au Nouveau-Brunswick, au Cap-Breton et à l'île Saint-Jean (aujourd'hui du Prince-Edouard) avec une recrudescence qui ressemblait à de la frénésie. Le vol—distribuer aux colons anglais les fermes des Acadiens avec leurs riches prairies, et se partager entre soi leur bétail et leurs chevaux—avait été l'un des mobiles de Lawrence et de ses conseillers intimes.

Maintenant, la peur d'être désavoué en Angleterre et de se voir appelé à rendre compte, avait saisi le gouverneur, et son âme en était devenue plus cruelle encore.

Au lieu de jeter les trente deniers, prix du sang et du désespoir de tout un peuple, dans les ruines encore fumantes des églises qu'il avait brûlées et d'en finir avec une existence qui, désormais, ne pouvait être pour lui que celle de Hérode après le massacre des enfants de Juda, il s'appliquait avec un acharnement redoublé à pourchasser sur mer et à traquer dans les bois ceux des Acadiens qui lui avaient échappé, donnant au *Board of Trade* et aux gouverneurs des colonies, pour justification de son zèle, qu'il y allait de la sûreté de la Nouvelle-Ecosse et des autres possessions anglaises d'Amérique, maintenant surtout que la guerre était déclarée entre la France et l'Angleterre, qu'ils fussent jusqu'au dernier dispersés bien loin de leur traitreuse patrie. Et ceci lui donnait, en même temps, raison, le justifiait d'avoir détruit cette race dangereuse, d'avoir fait ce qu'il avait fait, et le rangeait parmi les hommes d'Etat les plus clairvoyants de la Grande-Bretagne. Si les débris de ce peuple étaient encore tant à redouter, que serait-ce s'il était encore en possession de tous ses moyens de nuire? Il avait donc agi dans les intérêts du royaume en donnant, comme il l'avait fait, d'urgence et sans attendre l'autorisation de la Cour, l'ordre de les déporter en bloc et de confisquer leurs biens.

Poursuivre à outrance l'œuvre de leur anéantissement complet était désormais la pensée unique de sa politique.

En fouillant tous les coins et recoins de la Nouvelle-Ecosse, il découvrit un petit groupe qui avait été passé inaperçu dans la battue générale, l'établissement de Pobomcoup, aujourd'hui Pubnico, à l'extrémité sud de la péninsule.

Pobomcoup, confondu généralement avec le Cap-Sable, datait du commencement de la colonie. La seigneurie relevait principalement de la famille des d'Entremont de Saint-Etienne de Latour, de bonne et authentique noblesse française, possédant ses terres sous le titre de baronnie, avec haute, moyenne et basse justice, et jouissant de tous autres droits et privilèges seigneuriaux.

Ces grands seigneurs vivaient de pêche et de commerce maritime, à côté de leurs tenanciers, en tout deux cents âmes environ.

Leurs échanges se faisaient principalement avec Boston, où ils étaient honorablement et favorablement connus. A cause de leur éloignement des autres établissements français, de leur haute situation personnelle et de l'estime où ils étaient tenus par les Anglais, tant d'Annapolis que de la Nouvelle-Angleterre, personne jusque là, n'avait songé à les molester. Eux-mêmes se croyaient à l'abri de toute entreprise. Ils avaient selon toute apparence, prêté au roi d'Angleterre le serment d'allégeance sans restriction, que l'on avait requis d'eux; s'étaient conduits en loyaux sujets anglais durant l'invasion française de 1744, et tenaient de la main du gouverneur Mascarene un certificat officiel de civisme anglais. A toutes fins ils étaient en règle avec leur souverain, aussi bien qu'avec les autorités de Halifax.

Lawrence, son œuvre de destruction terminée du côté de la baie Française, tourna son attention vers le petit établissement du Cap-Sable. Au colonel Prebble, qui s'en retournait à Boston avec son régiment de volontaires, il remit, le 9 avril 1756, l'ordre militaire qui suit:

" Il vous est par les présentes enjoint d'aller débarquer vos troupes au Cap-Sable, d'y saisir tous les habitants que vous pourrez et de les emmener avec vous à Boston. Quoiqu'il arrive, vous détruirez et incendierez les maisons des dits habitants, et enleverez leurs mobiliers, effets et troupeaux de toutes sortes, que vous distribuerez à vos soldats pour les récompenser de ce service. Tout ce que vous ne pourrez pas emporter vous le détruirez."

Prebble et ses officiers s'acquittèrent de leur besogne à la satisfaction de Lawrence. Etant tombés sur l'établissement de Pobomcoup pendant que la plupart des habitants se trouvaient au large, ils entassèrent dans leurs vaisseaux tout ce qu'ils y purent loger de butin, détruisirent le reste et incendièrent les maisons, jusqu'à quatre lieues du port. Entre autres exploits, ils contraignirent Joseph d'Entremont de les conduire où demeuraient ses enfants, et là, en présence de leur père, ils scalpèrent l'un d'eux, à la manière des sauvages. Prebble, cependant, ne put faire que soixante et douze prisonniers; les autres habitants lui échappèrent, ou, plutôt, il leur échappa; car, la première alerte passée, ceux qui n'avaient pas été pris s'armèrent et, tombant sur les soldats anglais qui retournaient à leurs vaisseaux avec leur butin et leurs prisonniers, en tuèrent un certain nombre.

A Boston, où ils furent emmenés, ils se trouvèrent, la plupart, en pays de connaissance, plusieurs, au milieu d'anciens amis. Qu'allait-on faire de ces prisonniers encombrants?

Les laisser libres, leur accorder les droits du citoyen, comme le proposaient timidement des caboteurs et des capitaines dont ils avaient sauvé, aux uns leurs vaisseaux, aux autres la vie, en les arrachant, les premiers aux récifs du Cap-Sable, les seconds au tomahawk des sauvages, ils ne le pouvaient guère, à cause des autres déportés, et surtout par égard pour Lawrence, qui avait écrit privément au gouverneur Shirley de les expédier à la Caroline du Nord, dans le cas où il ne saurait qu'en faire, ou qu'il lui surviendrait à cause d'eux quelques difficultés, "*in case unforeseen difficulties should arise.*"

A la suite de délibérations assez orageuses, il fut décidé qu'ils seraient en effet expédiés à la Caroline du Nord. Thomas Hancock et compagnie, les armateurs que nous connaissons, furent chargés de ce soin. Ceux-ci eurent vite fait de trouver un vaisseau, l'une des goëlettes dans lesquelles ils avaient transporté les exilés de Grand-Pré, pour les y entasser.

Quand les soixante et douze prisonniers de Prebble montèrent à bord, et qu'ils virent dans quelle embarcation infecte on prétendait les emmener là-bas, au bout du monde, ils entrèrent en révolte et, malgré Hancock, l'équipage et les gardes, s'emparèrent des chaloupes et descendirent à terre. Ils avaient vécu toute leur vie à la manière des êtres humains; ils mourraient, s'il le fallait, mais comme des hommes, comme des Français savent le faire. C'était leur dernier mot.

Les autorités, à qui Hancock alla rapporter l'incident et demander main-forte pour embarquer et maintenir les récalcitrants, ou la résiliation de son contrat, demeurèrent fort perplexes. Elles prirent quatorze jours pour délibérer, laissant, durant ce temps-là, les prisonniers à sa charge. Ceux-ci profitèrent du répit pour présenter au gouverneur un mémoire dans lequel, après lui avoir raconté tout l'odieux de l'acte de piraterie dont ils étaient les victimes, ils concluaient en insistant pour que l'ordre du gouverneur Lawrence à Prebble de les déporter à Boston, et non pas à la Caroline du Nord, fut exécuté à la lettre, ou qu'on les ramenât dans leur seigneurie de Pobomcoup.

Les quatorze jours écoulés, aucune résolution n'ayant encore été prise, Hancock, soit qu'il fut réellement touché du sort des d'Entremont, soit qu'il ne se souciât guère de transporter au loin des passagers aussi peu commodes, écrivit au gouverneur qu'il se tenait toujours prêt à remplir les conditions de son contrat, mais que, peut-être, valait-il mieux "que le gouvernement daignât avoir compassion de ces malheureux, ayant égard à leur situation, et leur permît de demeurer dans la province, ainsi qu'ils le demandaient dans leur pétition."

C'est à ce dernier parti que le gouverneur s'arrêta.

Ils furent, par l'ordre des deux chambres, distribués par petits groupes, à Plymouth, à Gloucester et dans les villes maritimes situées entre ces deux endroits.

Entre temps, pour parer à de nouveaux ennuis de même nature, le gouvernement passa d'urgence une loi qui défendait à tout capitaine de vaisseau " d'avoir la présomption de débarquer aucun Français-Neutre sur le territoire du Massachusetts."

L'injustifiable agression dont ils avaient été l'objet avait exaspéré les Acadiens demeurés au Cap-Sable et, avec eux, leurs fidèles amis les Micmacs. De son côté Lawrence s'ingénia à les molester par tous les moyens en son pouvoir; mais comme les miliciens de la Nouvelle-Angleterre, leur engagement terminé, s'en étaient retournés dans leurs plantations, il ne parvenait pas à déloger les Acadiens. Un détachement, qu'il envoya, en 1758, pour se saisir d'eux et terminer l'œuvre de Prebble, dut se contenter de pillages et d'incendies, les habitants, avertis par les sauvages, s'étant réfugiés dans la forêt, où ses sicaires n'osèrent pas les relancer. Mais l'existence intolérable qui leur était faite et la terreur que leur inspirait Lawrence, leur firent tourner les regards du côté de Boston, dans l'espoir d'en obtenir quelque protection. Shirley, longtemps gouverneur de la baie du Massachusetts, avait exercé, en sa qualité de commandant en chef des troupes anglaises en Amérique, une autorité considérable dans toutes les plantations et même à Halifax. Croyant que son successeur au gouvernement du Massachusetts, Thomas Pownall, jouissait des mêmes prérogatives, ils lui adressèrent, à l'automne de 1758, une pétition, où ils le conjuraient de les prendre sous sa protection et d'obtenir qu'on leur permît de demeurer au Cap-Sable et de vivre en paix dans leur seigneurie. Ils lui promettaient, en retour, de l'aimer et de l'honorer jusqu'à leur dernier soupir, et, en même temps, de faire " de bon cœur tout ce qu'on exigerait d'eux, en autant qu'il le leur serait possible; de payer un tribut annuel à la province du Massachusetts, et de porter même, s'ils en étaient requis, les armes contre le roi de France." Ils ajoutaient que si, toutefois, permission leur était refusée de résider au Cap-Sable, on daignât les recevoir au Massachusetts, où ils s'engageaient à vivre la vie des autres prisonniers; car tout leur était préférable aux Antilles françaises, dont le climat était mortel, et où Lawrence voulait les déporter. " S'il faut que nous partions d'ici, disaient-ils en terminant, nous le ferons pour obéir à Votre Eminence; mais ce sera comme si nous abandonnions la vie."

Pownall était un homme aux vues larges et humaines. Le 4 décembre, lendemain du jour où Joseph Landry lui remit ce placet, il convoqua les membres de son Conseil pour prendre leur avis; mais non pas avant d'avoir préalablement obtenu du général Amherst l'assurance qu'il ferait, s'il y avait lieu, transporter la petite colonie du Cap-Sable à Boston, aux frais de la Couronne.

Le Conseil refusa d'acquiescer à la prière de la pétition, quoique appuyée par le gouverneur; mais ordonna d'en faire tenir une copie au gouverneur Lawrence.

Pownall, en transmettant cet arrêté à Lawrence, l'accompagne de cette observation: "Le cas de ces pauvres gens du Cap-Sable est assurément lamentable et digne de tout l'adoucissement qu'il est possible d'y apporter. Si la politique permet de leur venir de quelque façon que ce soit en aide, l'humanité le réclame à hauts cris."

Lawrence avait fait litière de tout sentiment d'humanité; ce qu'il lui fallait, c'était ses victimes. Au printemps de 1759, celles-ci, épuisées par les rigueurs d'un long hiver, décimées par la maladie, sans abri, couvertes de haillons, toute espérance humaine envolée, envoyèrent un messager lui annoncer qu'elles se rendaient à discrétion, s'en remettant à sa merci. Le gouverneur les envoya quérir dans des pontons armés, qui ramenèrent à Halifax cent cinquante-deux hommes, femmes et enfants. Il les constitua prisonniers sur l'île George, où ils demeurèrent jusqu'à l'automne, lorsque tous, jusqu'au dernier, furent transportés en Angleterre. Une lettre de Lawrence les y avait précédés, accompagnée du procès-verbal du Conseil tenu le 16 juillet, où ils étaient représentés, et dans la lettre et dans le procès-verbal, comme des brigands de la pire espèce et les plus dangereux ennemis du royaume. Cela leur valut d'être internés, à leur arrivée en Angleterre. Et cependant, ils avaient été des sujets anglais fidèles et irréprochables, jusqu'à la descente de Prebble dans leur village.

La situation des Acadiens de Boston, après l'arrivée des soixante et douze prisonniers de Prebble, avait semblé devoir s'améliorer. Les deux courants d'opinion que nous avons vus se former dans la bonne ville puritaine se divisèrent encore une fois: d'un côté, le peuple, compatissant de sa nature, penchait vers la clémence humaine; de l'autre, les préposés à la religion, *clergymen* et pharisiens, prêchaient qu'il fallait pour honorer Dieu en finir avec la secte idolâtre des papistes.

On put croire un instant, mais un instant seulement, que les conseils d'humanité et de charité chrétienne prévaudraient auprès des autorités civiles. Cette illusion se produisit durant le cours du mois de mai, coïncidant avec le passage, à Boston, du colonel, devenu le général, Winslow.

Cet officier, autrefois si dur envers les Acadiens, avait présidé, à Grand-Pré, à leur embarquement à bord des transports de sa nation. Il les avait vus, après qu'ils furent tombés dans le guet-apens et eurent été mis dans l'impossibilité de faire aucune résistance, défiler vers les navires ancrés dans le port, les hommes, mornes et silencieux, les enfants chantant un cantique à la Vierge, pendant que les femmes, leurs mères, leurs filles, leurs sœurs, leurs fiancées, leurs épouses, se tenaient agenouillées le long de la route de douleur, pleurant toutes les larmes de leurs yeux, et ce spectacle avait fait sur son cœur de soldat loyal une impression profonde. Il les retrouvait, maintenant, dans son propre pays, dans sa ville natale, les victimes toujours innocentes et toujours résignées de la persécution, réduits à la dernière condition de misère et d'ignominie, outragés, flagellés publiquement, et son âme s'ouvrait à la compassion. S'il y restait des préjugés, la haine en était disparue, pour faire place à un sentiment de pitié, presque de sympathie. Tout porte à croire qu'il s'interposa, à Boston, en faveur des exilés. En tous cas, il se brouilla tout à fait avec Lawrence, dont la cruauté le révoltait.

La loi du 20 avril avait frappé de stupeur les Acadiens. Dans leur détresse ils s'adressèrent à la Législature. Comme le moment était propice, leur cri fut entendu, et les membres de la Chambre des Représentants chargèrent un comité spécial de s'enquérir des faits et de proposer des adoucissements.

Dans son rapport, le comité recommanda, entre autres choses, qu'il leur fut procuré des logements, afin de permettre aux membres de chaque famille de vivre en commun, ce qui n'avait pas encore été fait, quoique l'ordre en eut été donné auparavant, et " qu'ils fussent traités avec bonté et humanité."

Il est vrai qu'il ne fut tenu aucun compte de ces deux dernières recommandations; mais le gouvernement ne laissa pas que de prescrire aux commissaires des pauvres et aux *selectmen* de ne plus mettre, " jusqu'à nouvel ordre de la Cour," les enfants mineurs en servage; d'essayer de leur trouver à tous de l'ouvrage, et, lorsque, malgré leur bonne volonté de travailler pour gagner leur vie, les Acadiens ne pourraient pas le faire, pour cause de maladie ou autrement, de ne pas les laisser mourir de faim, et de porter contre la province le compte de ce qu'ils leur auraient avancé.

En même temps, ne recevant aucune réponse satisfaisante, ni de Lawrence, ni du gouverneur Shirley, la Législature s'adressait directement à Londres pour le remboursement de ce que les prisonniers avaient, jusque là, coûté au Massachusetts. C'était, pour les pauvres exilés, du répit avec une lueur d'espoir dans le lointain.

Il fallait bien peu de chose pour faire changer le baromètre, à Boston, quand il s'agissait des *Neutrals*. Une mauvaise lettre de Lawrence y suffisait toujours. Cette fois-ci ce fut un incident d'une nature tout à fait imprévue qui fit éclater l'orage et prévaloir l'opinion du parti des persécuteurs.

Dans le premier convoi des déportés, parti de Grand-Pré, ainsi que nous l'avons vu, le 27 octobre de l'année précédente, quatre cents Acadiens avaient été dirigés sur Savannah, en Georgie, où ils étaient arrivés au commencement du mois de décembre. Comme il leur avait été dit, lors de leur embarquement, à Beaubassin, que leur déportation n'était que temporaire, et que, lorsque la paix serait assurée entre la France et l'Angleterre, ils pourraient venir reprendre possession de leurs biens, ils résolurent, à tout événement, de remonter par petites étapes vers le nord, et de se rapprocher de l'Acadie, afin d'être prêts à réintégrer leurs biens aux premières nouvelles favorables.

Le gouverneur de la Georgie, qui ne demandait pas mieux que de les voir s'en aller, leur donna des passe-ports et leur facilita, en même temps, le moyen de se construire des embarcations dans lesquelles ils pourraient emmener avec eux leurs familles.

Il en partit au delà de trois çents, au mois de mars, sur la flotille qu'ils s'étaient construite durant l'hiver.

Longeant les côtes de la Georgie, des deux Carolines, de la Virginie, du Maryland, du Delaware, du New-Jersey, du Rhode-Island, l'avant-garde, une cinquantaine de personnes, peut-être davantage, parvint, sans donner l'éveil, jusqu'à Saint-Jean, au Nouveau-Brunswick. Apprenant leur retour, Lawrence les fit appréhender de nouveau et lancer, pour la deuxième fois, en exil. En même temps il donnait l'alarme de tous côtés, et requérait les gouverneurs de la Nouvelle-Angleterre d'arrêter les autres au passage.

C'est ainsi qu'un parti de soixante et dix-huit Acadiens se virent barrer le chemin sur les côtes de New-York; eurent leurs embarcations saisies et leurs passe-ports confisqués, par l'ordre du lieutenant-gouverneur Charles Hardy, et furent, ensuite, dispersés " dans les parties les plus reculées de la province," tandis que leurs enfants étaient brutalement distribués parmi les familles anglaises—moyen sûr, écrivait cyniquement le gouverneur de New-York aux Lords du Commerce, à Londres, " d'en faire de bon sujets britanniques."

Le reste de la caravane navale, quatre-vingt-dix-neuf personnes, embarquées sur sept chaloupes, furent pris, le 25 juin, au sud de Boston, à Sandwich, petit port, où ils s'étaient arrêtés, comme cela leur arrivait souvent, pour se procurer de l'eau et quelques provisions.

Munis de passe-ports en règle et se croyant à l'abri de tout coup de main, ils s'étaient attardés, à Sandwich, plus longtemps qu'ils n'avaient coutume de le faire ailleurs, afin de permettre à cinq d'entre eux de chercher leurs femmes, dont ils avaient été séparés lors de l'embarquement, et qui se trouvaient quelque part parmi les détenus du Massachusetts.

A l'exemple de son collègue de New-York, le gouverneur Phips, contre le droit des gens, leur enleva leurs passe-ports et tous leurs papiers; fit confisquer leurs embarcations, puis, après avoir rendu compte à Lawrence de son exploit, les fit disperser, chairs vivantes que l'on arrachait à des corps vivants, et dont on se partageait les lambeaux: vingt à Dartmouth, cinq à Rochester, six à Dighton, cinq à Raynham, six à Norton, huit à Attleborough, huit à Freetown, douze à Taunton, cinq à Easton, douze à Rehoboth et sept à Swanzey.

Un souffle mauvais passa sur le Massachusetts, à ce moment-là, produisant dans les âmes puritaines l'effet que la vue et l'odeur du sang produisent chez les fauves. Après que les Acadiens de Sandwich eurent été dispersés dans la colonie, on fit une razzia dans la ville même de Boston, à la suite d'un arrêté qui décrétait d'en chasser tous les *Neutrals*. Un premier coup de filet en amena quatre-vingt-quatre, qui furent répartis, le 25 août: dix à Cambridge, cinq à Walpole, cinq à Topsfield, cinq à Middletown, cinq à Westfield, cinq à Sherburn, cinq à Littletown, cinq à Bedford, quatre à Tewsbury, huit à Brookfield, six à Southborough, six à Grafton, quatre à Bellingham, quatre à Acton, trois à Dunstable et quatre à Westboro.

En même temps, ceux qui avaient été internés dans les villes maritimes, les d'Entremont entre autres, furent, à la suite de requêtes pressantes adressées au gouvernement, relégués à l'intérieur de la province. C'est ainsi que quarante-neuf Acadiens détenus à Charlestown et à Marblehead (Salem) furent distribués: six à Natick, six à Medway, quatre à Holliston, quatre à Bellington, trois à Southborough, deux à Dunstable, quatre à Walpole, six à Dudley, quatre à Dracut, cinq à Shelburne et cinq à Nedfield.

Et il y en avait d'autres à Andover, à Amesbury, à Abington, à Beverley, à Bolton, à Barnstable, à Bellerica, à Boxford, à Boston, à Bratford, à Braintree, à Bridgewater, à Brooklyn, à Capean, à Concord, à Charleston, à Coolidges, à Chelmsford, à Dorchester, à Deuxborough, à Deedham, à Darkmouth, à Danforth, à Falmouth, à Framington, à Groton, à Gallisbury, à Halifax, à Hanover, à Hingman, à Haverhill, à Hopkertown, à Ipswick, à Kingston, à Lancaster, à Lincoln, à Lynn, à Lexington, à Leicester, à Marlborough, à Middleborough, à Mendon, à Marblehead, à Marshfield, à Milton, à Manchester, à Medfield, à Medford, à Mistick, à Malden, à Methuen, à Newton, à Newbury, à Nantucket, à Needham, à Oxford, à Pembrooke, à Plymston, à Plymouth, à Reading, à Roxbury, à Rowley, à Stoughton, à Sandwitch, à Salisbury, à Stoneham, à Sudbury, à Scituate, à Shrewsbury, à Sturbridge, à Sutton, à Salem, à Stow, à Spencer, à Uxbridge, à Wenham, à Waltham, à Wilmington, à Woburn, à Weymouth, à Watertown, à Weston, à Worcester, à Waldan, à Wrentham, à Westford, et ailleurs.

Qu'on se représente la situation de ces malheureux et de ces malheureuses au milieu d'une population prévenue, ameutée contre eux; dont ils ne comprenaient pas la langue; qui les haïssait à cause de leur nationalité, et qui, comme font d'ailleurs, sans exception aucune, les fanatiques de toutes les religions, croyaient glorifier Dieu en accablant leurs frères de duretés, de calomnies, de mépris et d'injustices.

D'où provenait ce changement dans les dispositions des Bostonais vis-à-vis de leurs prisonniers? De la guerre, sans doute, qui venait d'être déclarée (7 mai) entre l'Angleterre et la France, et dont les coups étaient portés par des bandes de Canadiens et de Sauvages jusqu'aux portes même de leurs villes; mais surtout et principalement de Lawrence, le sinistre gouverneur de la Nouvelle-Ecosse. La tentative de retour faite par les exilés de la Georgie l'avait frappé d'épouvantement. Il se sentait perdu, lui et ses complices, si les motifs secrets de la déportation des Acadiens venaient à être connus en Angleterre. Il fallait donc à tout prix, non pas seulement les empêcher de retourner à la Nouvelle-Ecosse, mais les faire disparaître de la face de la terre. Aussi, munis de lettres et de messages enflammés, ses émissaires parvinrent-ils à rallumer dans les âmes puritaines le feu de la persécution que les larmes des proscrits commençaient à éteindre.

On dit que les démons trouvent une certaine quantité de joie à torturer ceux qui tombent dans la géhenne. L'acharnement que mettait Lawrence à poursuivre, sans trève ni merci, partout, à la Nouvelle-Ecosse, au Canada, dans les colonies anglaises et jusqu'en Angleterre, ceux qu'il avait exilés et dont il avait confisqué les biens, a quelque chose qui, visiblement, n'est pas humain. Il se repaît de sa haine comme d'une jouissance d'enfer. Vivant, on s'aperçoit qu'il goûte à la joie des damnés.

Sa qualité de gouverneur de la Nouvelle-Ecosse donnait du poids aux calomnies qu'il répandait. N'avait-il pas été témoin des complots et des crimes qu'il imputait à ses victimes? Comment ne pas le croire sur parole? Qui pouvait, d'ailleurs, le contredire?

Le message suivant du gouverneur Shirley au lieutenant-gouverneur et aux deux Chambres de la province du Massachusetts, montre la nature de ses calomnieuses accusations et le mal qu'elles faisaient aux Acadiens.

"Le message que je vous adresse est accompagné d'une lettre que j'ai reçue du gouverneur Lawrence, laquelle a trait au retour des habitants français de la Nouvelle-Ecosse récemment dispersés dans les colonies anglaises. Cette lettre montre si clairement les effets pernicieux qui suivraient leur rapatriement que je n'ai pas besoin d'y rien ajouter. Je vous dirai seulement qu'en Angleterre, où je suis à la veille de retourner, je m'efforcerai, avec toute l'énergie dont je suis capable, de représenter sous de telles couleurs aux ministres de Sa Majesté tout ce que vous aurez fait pour empêcher la calamité de leur retour à la Nouvelle-Ecosse, qu'ils vous en sauront gré."

Ce message est daté du 16 août 1756.

Le 31 du même mois le Conseil et la Législature adoptaient, et le gouverneur sanctionnait, un Acte plus révoltant encore que celui du mois d'avril précédent, reproduit plus haut.

Ce n'était plus seulement par l'amende et l'emprisonnement que seraient châtiés, désormais, pour une première offense, ceux et celles qui seraient trouvés, sans passe-ports, en dehors de la ville ou du district où ils avaient été internés, mais par le supplice du bloc (*in the stocks*); pour une seconde offense, ils seraient fouettés publiquement, le corps nu jusqu'à la ceinture, hommes et femmes, filles et garçons, et ramenés dans leur enclos, "aux frais du délinquant."

Et il n'était pas nécessaire d'être magistrat pour les arrêter, tout citoyen de condition libre le pouvait faire.

Le jour suivant, ordre était donné d'incarcérer (*to arrest*) tout Acadien qui tenterait de s'en retourner à la Nouvelle-Ecosse; et le lieutenant-gouverneur était autorisé à écrire aux gouverneurs des provinces du sud, leur recommandant de garder tous les déportés qui se trouvaient dans les limites de leur jurisdiction. Ceci encore c'était pour plaire à Lawrence, qui avait écrit à Shirley: "Je conjure Votre Excellence de faire usage de tous les moyens possibles pour empêcher un projet aussi pernicieux (leur retour à la Nouvelle-Ecosse) en détruisant les embarcations qu'ils peuvent s'être construites, et d'arrêter au passage tous ceux qui tenteront de traverser votre province pour s'en revenir ici, soit par terre, soit par eau.... Je ne donnerais pas, continue-t-il, tous ces ennuis à Votre Excellence, si je ne savais pas d'une façon absolument certaine (*if I were not perfectly well assured*) que le retour de ce peuple à la Nouvelle-Ecosse peut être fatal aux intérêts de Sa Majesté dans ce pays."

Tout cela est incroyable, et tout cela est strictement la vérité. Je n'ai pas puisé aux sources françaises; c'est à Boston même, dans les procès-verbaux de la Législature et dans les archives que je me suis principalement documenté. Et j'y ai longtemps cherché la justification de tant de rigueurs et n'en ai trouvé aucune. Rien n'est allégué contre les Acadiens. Les tribunaux ne relèvent rien contre eux, ni les cours des juges de paix, ni les dossiers de la police. Dans les innombrables villes et municipalités où ils furent détenus, il n'apparaît pas qu'aucun d'entre·

eux ait jamais commis aucun acte quelconque d'insubordination ou de violence; qu'ils aient jamais dérobé quoi que ce soit; qu'ils aient en aucune circonstance manqué aux lois de la plus sévère moralité; qu'ils se soient pris de querelle entre eux ou avec leurs oppresseurs; qu'aucun ait jamais été surpris en état d'ébriété; ni même, et ceci était le plus clair de la religion de leurs hôtes, qu'ils aient, en aucun temps, failli à l'observation rigoureuse du saint jour du Seigneur.

Les commissaires des pauvres et les *selectmen* ne portent aucune plainte spécifique contre eux, et ceci est frappant. Nul citoyen ne se prétend molesté, ni injurié, ni lésé, par aucun d'eux. Les municipalités s'adressent parfois à la Législature pour s'en débarrasser, mais c'est à cause de ce que leur coûtent les pauvres et les malades; si elles les accusent devant les autorités, c'est de crimes qu'ils pourraient commettre, comme, par exemple, de faire sauter les villes dans lesquelles se trouvent des magasins militaires, mais jamais des crimes qu'ils ont de fait commis.

Par contre, allez fouiller les archives de Boston, et vous y trouverez des centaines de pétitions de ces malheureux implorant du gouverneur et de la législature secours et protection contre leurs bourreaux.

C'est Charles et Nicolas Breau et leurs sœurs, de la ville de Hanover, qui, après avoir travaillé longtemps à de lourds travaux, chez John Bailey, pour vivre et faire vivre leurs vieux parents, n'ont pas reçu un seul sou de salaire, et sont là mourant de faim tous ensemble; c'est Claude Bourgeois, de Boston, à qui dix ou douze hommes sont venus enlever ses deux filles, âgées, l'une de vingt-cinq et l'autre de dix-huit ans; c'est Augustin Hébert, de Watertown, qu'on a assommé ainsi que sa femme, parce qu'ils avaient essayé d'empêcher le rapt de leur enfant; c'est Béloni Melanson, de Lancaster, qui demande justice contre un nommé Richardson, qui lui a presque tué son fils mis en service chez lui; c'est la veuve Thibodeau, dont le mari vient de mourir, que les *selectmen* envoient à droite et à gauche avec sa famille d'enfants en bas âge et auxquels la ville accorde douze sous par semaine pour vivre; c'est Paul Clermont et Charles Mius d'Entremont qui se sont engagés à travailler chez Nathaniel Ray Thomas, de Marshfield, pour leur habillement, une habitation pour eux et six femmes et leur nourriture à tous. Le terme de leur contrat est à la veille d'expirer, et Thomas refuse absolument de les vêtir et même de les nourir.

Il arrive parfois que les requêtes des Acadiens sont appuyées par des Anglais: c'est lorsque les intérêts de ces derniers se trouvent de quelque façon en cause.

Ainsi Joseph Michel, autrefois favorablement connu de la garnison anglaise d'Annapolis, et qui maintenant demeure, avec sa famille, à

Marshfield, dans le comté de Plymouth, avait placé son fils François, âgé de vingt-trois ans, au service d'un nommé Caleb Tildon, à un salaire nominal. Les *selectmen* de la ville de Marshfield, John Little et Seth Bryant, "l'ont violemment, contre sa volonté et celle de son père, enlevé de chez Tildon, qui voulait le garder, pour le mettre chez Anthony Windslow." Les mêmes *selectmen* se sont saisis d'un autre de ses garçons, Paul, âgé de quinze ans, et l'ont, de force, malgré les larmes de sa mère, traîné chez Nathaniel Clift pour en faire, contre son gré, un matelot. Il prie le gouverneur et les chambres de déclarer nuls les contrats faits par les *selectmen*, et que ses enfants lui soient rendus, garantissant qu'ils ne seront à charge à personne.

Cette requête est accompagnée d'une déclaration de David Thomas qui en corrobore la teneur, et d'une autre, assermentée, un *affidavit*, de Caleb Tilton, qui certifie que les faits allégués sont vrais et qu'il a même offert ses biens en caution pour l'entretien de la famille Michel, pourvu qu'on lui laissât son fils.

Le lecteur est curieux de savoir ce que va faire la Cour d'un cas aussi clairement prouvé, où il y va de la mauvaise conduite flagrante de deux employés publics.

Sur la recommandation du comité spécial auquel toute l'affaire a été renvoyée, elle en remet l'examen au prochain terme, c'est-à-dire aux calendes grecques.

Cependant elle reconnaît en principe "que c'est de la part des *selectmen* agir à l'encontre de l'intention de la Législature que de disposer des enfants des Français de la Nouvelle-Ecosse contre une somme d'argent ou toute autre valeur, excepté lorsque c'est dans l'intérêt de ces derniers. (comme dans le cas présent, sans doute), et que chaque fois que des mineurs désirent et peuvent se subvenir à eux-mêmes, ou que leurs parents ou des amis offrent de se charger d'eux, ils ne devraient pas être enlevés à leur famille contre leur gré; et que les *selectmen* devraient, en autant que cela se peut, consulter les parents et les mineurs eux-mêmes sur le choix des maîtres à leur donner."

Des instructions aussi molles et aussi imprécises laissèrent comme auparavant le sort des Acadiens absolument à l'arbitraire des *selectmen* et de leurs amis.

Le lecteur n'a pas oublié le geste si humain de Thomas Hutchinson, qui, à l'arrivée des premiers convois d'exilés à Boston, fit descendre du vaisseau où, en compagnie d'une cinquantaine d'autres malheureux, elle périssait de froid et de faim, une pauvre veuve malade, du nom de Benoit, avec sa famille d'enfants en bas âge. Ce Thomas Hutchinson était l'un des citoyens les plus considérables de Boston, ayant été successivement président de la Chambre des Représentants, membre du Conseil, juge en chef, lieutenant-gouverneur, et gouverneur en titre du Massachusetts. Il occupa ce dernier poste jusqu'aux commencements de la révolution américaine en 1756. Il était membre du Conseil.

Au commencement de septembre de l'année 1756, il adresse au gouverneur Shirley une pétition touchante, dans laquelle il raconte l'état de profonde misère où s'était trouvée cette pauvre veuve à son arrivée à Boston; comment, en dépit de la consigne, il la fit descendre à terre et placer dans une de ses maisons. Malgré tous les soins qu'il lui fit donner, elle mourut au bout de quelques jours; mais, l'ayant fait venir, elle lui demanda, quelques instants avant d'expirer, "au nom de leur Sauveur commun à tous deux, de prendre sous sa protection ses deux garçons, ses deux filles et son petit-fils."

Il a, depuis le trépas de l'aïeule, veillé sur ces orphelins, comme il le lui a promis, devant Dieu, sur son lit de mort. Mais voici qu'on lui apprend que le shérif de Boston a reçu l'ordre de les emmener loin de la ville, et ces enfants sont dans le désespoir.

Tout ce qu'il demande dans sa pétition c'est qu'il soit permis à ces orphelins de demeurer près de lui, à Boston; ou, s'il faut absolument qu'ils partent, qu'ils ne soient pas envoyés plus loin que Cambridge, mais placés là, dans une famille Robichau, qu'il indique, et que lui, Hutchinson, se chargera d'eux et donnera pour eux un cautionnement à la ville.

Accueillie favorablement par le Conseil, cette requête est purement et simplement rejetée (*dismissed*) par la Chambre des Représentants.

Le Conseil refuse d'obtempérer, et ordonne au grand shérif du comté de laisser ces enfants chez Hutchinson, jusqu'au mardi de la semaine suivante.

La Chambre des Représentants casse cet arrêté.

A la fin, après avoir cinq fois fait la navette d'une chambre à l'autre, cette question d'Etat est résolue de la manière suivante: les cinq enfants ne seront pas envoyés, comme ils le devaient être, aux extrémités de la province, mais pourront continuer d'être l'objet des soins de leur protecteur, pourvu que celui-ci se porte garant de leur bonne conduite, et ne leur permette pas de s'approcher plus près d'un mille de Boston!

Quelquefois les villes s'adressent elles-mêmes à la Législature, lorsqu'il s'agit de cas graves, comme le suivant, par exemple: une famille composée du grand-père, de la grand'mère et de cinq enfants en bas âge, a été placée, les enfants à Oxford et les vieux parents à Cambridge. Ceux-ci, contre toute raison, sont venus rejoindre leurs petits-fils. Ni les uns ni les autres n'étant en état de travailler pour gagner leur vie, ils ont été trimballés d'une maison à une autre, et personne n'a voulu en prendre soin. Ils sont maintenant à Newton, sans pain et sans vêtements, à la veille de mourir tous ensemble—*about ready to perish*. D'autres miséreux se sont joints à eux, dans la chétive demeure qui leur a été attribuée, des femmes pour la plupart, dont l'une est à la veille d'accoucher, et deux hommes, dont l'un est bien malade et dans le délire, depuis trois semaines. Personne ne veut leur faire la charité, et leur présence est un fardeau insupportable à la ville. Henry Gibbs, le pétitionnaire, demande, au nom de la municipalité, que cette famille soit envoyée ailleurs.

Ils ne manquent pas à l'occasion d'esprit, ces descendants des Pèlerins anglais, surtout d'esprit de bon aloi.

Jean Labordore déclare dans une pétition au gouverneur, et se fait fort de prouver par plusieurs témoins demeurant à Salem, qu'il a, autrefois, en Acadie, à différentes reprises, sauvé la vie à des Anglais, notamment à tout un équipage de Bostonais, en allant, malgré les menaces des sauvages et au péril de sa vie, les prévenir que les Micmacs se préparaient à les surprendre pour les massacrer; ce qui lui valut de la part de ces derniers une décharge de fusil dans le corps, dont il garde encore plusieurs plombs, et l'obligea de quitter l'endroit, Maliguêche, (aujourd'hui Lunemburg), où il avait sa maison et des terres. On ne lui tient aucun compte de tout cela, maintenant, et il en a le cœur brisé.

"Durant les dix dernières semaines, on ne lui a donné en tout pour subsister, à lui et à sa famille composée de sept personnes, qu'un quartier d'agneau, et, tous les jours, une pinte de lait. On lui a refusé jusqu'à un attelage pour charroyer du bois de chauffage qu'il avait coupé lui-même. Ils sont là, tous ensemble, en plein hiver, sans vivres et sans feu, dans une maison qui n'a ni porte ni toit. Quand il pleut, ils sont obligés de changer leur lit de place pour trouver un abri, et ils n'ont rien pour se protéger contre la neige fondante. Lorsqu'il est allé se plaindre au *selectman* de ce que le plancher de sa maison était inondé et que tout y flottait, celui-ci, en ricanant, lui a répondu que ce qu'il avait de mieux à faire c'était de se construire un canot et de naviguer dans sa maison."

Tout ce qu'il demande c'est la permission de quitter cette ville de malheur, Wilmington, et de se retirer ailleurs.

Les d'Entremont sont parmi ceux qui portent le plus souvent leurs plaintes aux pieds du lieutenant-gouverneur. Eux aussi rappellent, mais discrètement, les services qu'ils ont rendus aux Bostonais, pendant qu'ils résidaient au Cap-Sable.

Charles Amand Mius et Paul Clermont d'Entremont s'étaient engagés par écrit à travailler pour Ray Thomas. Celui-ci a gardé les deux originaux du contrat et ne veut pas donner aux pétitionnaires la copie à laquelle ils ont droit; il les menace même de les faire jeter en prison, s'ils persistent à la lui demander; mais il refuse, en même temps, de les décharger de leurs obligations. François Mius, sa femme et leurs dix enfants, meurent de misère et de privations à Tewsbury, et les autorités ne veulent rien faire pour les secourir. Laurent Mius, père de dix enfants, et son frère se sont engagés à travailler pour les commissaires des pauvres de Metheun. Après deux mois d'ouvrage, tout ce qu'ils ont pu retirer de salaire a été trois verges de vieux coton, deux livres de morue sèche et une livre de saindoux pour l'un, et quelque chose d'équipollent pour l'autre. Quand ce dernier est allé demander son paiement, il a été jeté dehors violemment, frappé avec une pelle à feu et presque assommé. Il crache le sang maintenant, et ne peut plus rien faire. Il est arrivé pis encore à l'un de ses jeunes frères qui, après avoir travaillé sept mois sans recevoir de gages, s'en revint chez son père. Son employeur l'y suivit, lui enleva presque tous ses vêtements et jura au père qu'il lui fendrait la tête, s'il levait un doigt pour défendre son enfant. Je passe les pétitions des autres.

Celle de Joseph d'Entremont, père du jeune homme auquel Prebble, comme nous l'avons vu plus haut, enleva la chevelure, à Pobomcoup, après avoir pillé ses biens et brûlé sa maison, mérite que le préambule en soit cité en entier, parce qu'il se retrouve en substance dans la plupart des placets des déportés du Cap-Sable.

"A Son Honneur le Lieutenant-Gouverneur et aux honorables membres du Conseil de Sa Majesté:

"Vos suppliants demeuraient au passage de Baccareau, au Cap-Sable, localité fort éloignée et tout à fait séparée des autres établissements de l'Acadie, où ils se livraient exclusivement à la pêche et tiraient de la mer leurs moyens de subsistance. Leur genre de vie les mettait fréquemment en communication avec les pêcheurs anglais, qu'ils eurent souvent l'occasion de secourir; ils étaient en excellents termes d'amitié avec eux et avec tous ceux de votre nation, sauvant les naufragés, portant secours à ceux qui se trouvaient dans la détresse, fournissant des vivres et prêtant assistance à ceux qui en avaient besoin, et accueillant toujours avec la plus cordiale hospitalité tous ceux d'entre eux qui prenaient refuge dans leur port: toutes choses que vos pêcheurs peuvent abondamment corroborer."

Il termine en demandant tout simplement de n'être pas déporté à la Caroline du Nord, avec Jacques Amirault, comme ils en sont l'un et l'autre menacés.

La pétition de Charles Mius d'Entremont, écrite de sa main, en français et en anglais, d'une large écriture ronde, sera la dernière que je citerai.

"Marsfield, 5 janvier 1757.

"A Son Excellence, etc...

"C'est avec un très grand regret que je prends la liberté d'importuner Votre Excellence. Nous sommes, moi et ma famille (composée de dix personnes), pour le présent réduits à la dernière extrémité... L'on ne veut pas nous fournir ni de provisions ni de bois et nous sommes presque tout nus. L'on ne veut pas, non plus, nous fournir de travail... Nous mourons, moi et ma famille... J'avais apporté avec moi, cette automne, du Cap-Sable, un baril de bœuf avec six boisseaux de sel, que M. Lamson nous a retirés... Pour le présent nous n'avons ni bois, ni vivres, et l'on ne veut pas me permettre d'en aller chercher au bois sur mon épaule pour me chauffer. Je suis ainsi réduit à la mendicité pour faire subsister ma famille.

"Charles Mius et toute sa famille."

Pour toute réponse on lui permit de passer dans une autre ville, à la condition qu'il fournît un cautionnement de deux cents louis comme garantie de bonne conduite.

Ces hauts seigneurs, ces barons d'authentique lignée, amis séculaires et éprouvés des pêcheurs et des marchands de Boston, qui, durant les guerres et pendant la paix, ont sauvé la vie à plusieurs de leurs géoliers, rappellent, mais avec quelle dignité! les services rendus dans leur pays, pour qu'on ait maintenant quelque pitié d'eux et de leurs enfants.

Le nombre des cas d'injustice, de cruauté, de violence, de rapine, de vols, d'outrages de tous genres, dont se plaignent les Acadiens détenus dans les villes et les villages du Massachusetts est à peine croyable. Et encore n'avons-nous probablement pas les doléances des plus malheureux, les veuves, qui n'osaient pas se plaindre, les orphelins et les illettrés, qui ne le pouvaient pas.

Hutchinson, celui que nous connaissons et qui a écrit une histoire du Massachusetts, confesse qu'il lui a été impossible de lire en entier toutes les pétitions adressées par les Acadiens aux gouverneurs: les larmes l'en ont empêché!...

Ces malheureux s'adressent aux gouverneurs, parce qu'ils sont hors la loi; parce que les tribunaux ordinaires de la province ne leur accordent aucune protection.

Il est juste de reconnaître que les membres du Conseil et ceux de la chambre des Représentants allégèrent assez souvent, et autant peut-être qu'ils le pouvaient faire, sans trop compromettre leur ré-élection, les souffrances des prisonniers; qu'ils redressèrent même, quelquefois, leurs griefs.

Il y a une autre pétition que je citerai, parce qu'elle a une portée historique.

Des historiens ont prétendu, et d'autres prétendent encore, que la "neutralité" des Acadiens était toute au profit de la France; qu'ils n'étaient, à la Nouvelle-Ecosse, que des ennemis déguisés de l'Angleterre, prêts à prendre les armes contre elle au premier moment favorable, en dépit de leur serment de fidélité.

La pétition de Louis Robichaud nous montre le contraire. Il demeurait à Annapolis-Royal, avant d'être déporté à Boston, et de là traîné à Cambridge. Il demande à la Législature d'être ramené à Boston, et, parmi les considérants de sa pétition, il allègue le fait qu'il a empêché, en 1744, Port-Royal d'être surpris par les Français et de tomber entre leurs mains, en donnant avis à la garnison de l'approche de Duvivier et de son détachement. Il déclare que le fait est notoire et parfaitement connu de ceux de leurs soldats qui se trouvaient alors en garnison, à Annapolis-Royal. Ces derniers attesteront, en outre, qu'en punition de cet acte de loyauté à l'Angleterre, il a été, lui et sa famille, fait prisonnier par les Français, qui incendièrent sa maison, pillèrent son mobilier et tuèrent ses animaux. Daignez, ajoute-t-il, m'accorder ma prière, comme faveur spéciale et personnelle. Ce ne sera pas un précédent.

Accordé au Conseil; refusé à la chambre des Représentants.

On a aussi prétendu que la crainte qu'avaient les Acadiens d'être appelés à prendre les armes contre leurs frères du Canada et de la France, s'ils prêtaient au roi d'Angleterre un serment de fidélité sans réserve, était vaine et chimérique; que les autorités anglaises n'auraient jamais commis la barbarie de les appeler à des combats fratricides.

Il est malaisé de dire, aujourd'hui, ce qu'aurait fait les gouverneurs de Halifax des Acadiens de la Nouvelle-Ecosse en état de porter les armes, durant la guerre que les Anglo-Américains eurent à soutenir, de 1756 à 1759, contre les milices canadiennes et les soldats de France, s'ils avaient prêté au roi d'Angleterre un serment d'allégeance absolu.

Voici, en tous cas, ce que les deux chambres de la Législature du Massachusetts n'hésitèrent pas à faire des Acadiens déportés dans leur province. Le 25 août 1757, elles passèrent une résolution déclarant "qu'il était désirable que Son Excellence le Gouverneur-Général, commandant en chef de la flotte anglaise, enrôlât de force (*impress*), pour le service de Sa Majesté, dans l'escadre commandée par le sous-amiral Holburn, tels et autant des sujets français de Sa Majesté, récemment transportés de la Nouvelle-Ecosse dans cette province, qu'il le jugerait bon; et qu'ils fussent embarqués de force sur ceux d'entre les vaisseaux de l'escadre qui étaient prêts à les recevoir."

L'une des plus vives douleurs des Acadiens, la plus profonde assurément, fut la privation des sacrements. Ils vivaient et mouraient à la manière des hérétiques, sans absolution, sans pain eucharistique, sans extrême-onction. Nul prêtre ne venait à leur chevet apporter les paroles de vie éternelle; et leurs corps étaient confondus avec ceux des protestants dans des cimetières qui n'avaient pas été bénis. Ils avaient perdu leur patrie, et le ciel devant eux se dérobait. "La pensée de mourir sans confession, nous dit Hutchinson, historien protestant contemporain, les tourmentait plus que tous les châtiments corporels qu'on eut pu leur infliger." Pourtant l'exil dont ils subissaient les rigueurs, ils l'eussent évité en prêtant au roi d'Angleterre le serment de fidélité sans restriction, l'ordinaire serment d'allégeance prêté par tout le monde, aujourd'hui, que les gouverneurs de la Nouvelle-Ecosse requéraient d'eux. Mais les missionnaires, et plus particulièrement l'abbé Le Loutre, grand vicaire de l'évêque de Québec, les en avaient dissuadés dans les intérêts de leur âme. C'est pour leur religion, en somme, plus encore que pour le roi de France, que ces hommes simples et droits souffraient la persécution. C'était pour sauvegarder, comme ils le croyaient, leur foi, qu'ils avaient, jusqu'à la fin, devant les avertissements réitérés, devant les menaces des gouverneurs de la Nouvelle-Ecosse, refusé de devenir les sujets d'un roi hérétique; et voici qu'à cause de ce refus, ils ont perdu leurs biens, leur patrie, leur liberté; que le ministère de leurs prêtres leur est rigoureusement refusé; qu'ils vivent et meurent sans les secours de la religion, et que les enfants d'un grand nombre d'entre eux vont devenir des protestants.

Des prêtres parmi eux! C'est ce que les Puritains n'auraient jamais su tolérer. Le bruit s'étant répandu qu'il s'en était introduit un, subrepticement, les recherches les plus minutieuses furent immédiatement instituées pour découvrir et châtier, selon toutes les rigueurs des lois britanniques, ce suppôt de l'antéchrist. Quand ils se furent assurés de la fausseté de la rumeur, et eurent acquis la conviction que les Acadiens ne nourrissaient d'ailleurs aucun complot séditieux, ils leur permirent de s'assembler en commun, le dimanche, dans les hangars et les granges qui leur servaient de demeures, pour prier Dieu à leur manière. Tels les premiers chrétiens dans les catacombes. Et, cependant, nous dit encore Hutchinson, "les Puritains avaient, alors, un plus large esprit de tolérance religieuse que n'avaient eu leurs pères." A preuve, c'est qu'ils permettaient aux Acadiens de faire leurs prières, en famille, à leur manière, *in their own way*. "Mais, ajoute-t-il, le peuple n'eut jamais consenti à l'exercice public du culte par un prêtre. Une loi toujours en vigueur, interdisait, sous peine de mort, à tout prêtre catholique de franchir les frontières de la province."

L'abbé Casgrain et, avant lui, Thomas Akins, ont écrit que l'abbé Desenclaves, d'abord missionnaire du Port-Royal, puis, du Cap-Sable, à l'époque de la descente de Prebble, avait été emmené prisonnier à Boston, où il était resté deux ans, jusqu'en 1759. Ceci est manifestement une erreur.

Un incident dont le Massachusetts a été le théâtre, mérite d'être rapporté ici, parce qu'il a bien pu avoir inspiré à Longfellow, sinon l'idée première, du moins la trame de son immortel poème L'*Evangeline*. Parmi les déportés se trouvait un jeune homme, Etienne Hébert, qui fut, comme bien d'autres infortunés, séparé de sa famille et de ceux qu'il aimait. Conduit d'abord à Philadelphie, Hébert s'y fit remarquer à cause de son intelligence, de sa force et de sa superbe stature, par un officier, qui le pris pour son ordonnance. Or, en même temps que lui, trois frères, et une brune jeune fille, Josephte Babin, à laquelle il venait justement de se fiancer, avaient été emportés dans la tourmente, mais sur des vaisseaux différents. La pensée de ses frères, et surtout de Josephte, hantait ses nuits et le rendait infiniment malheureux. Il résolut de les retrouver ou de mourir à la peine. S'esquivant, une nuit, Dieu sait comment, il entra dans la forêt et, après des peines inimaginables, parvint jusqu'au Canada, dont il visita les établissements nouvellement fondés par les Acadiens. Les siens ne s'y trouvaient pas. Las de la vie, le jeune amoureux se remit à leur recherche, comme Gabriel Lajeunesse se mettra à la recherche d'Evangeline. Sous des déguisements divers, il parcourut, à travers mille dangers, la plupart des villes de la Nouvelle-Angleterre, et se rendit jusqu'au Maryland. Dans le cours de ses pérégrinations, il eut la joie de retrouver successivement ses trois frères, dont l'un à Worcester, dans le Massachusetts, et la consolation de les conduire à Saint-Grégoire, au Canada, où ils s'établirent.

Il désespérait de jamais revoir sa douce fiancée, quand on lui annonça, un jour, qu'une jeune fille portant le même nom qu'elle, avait été emmenée à Québec, où elle vivait avec l'une de ses sœurs. Chaussant ses raquettes, il prit aussitôt le chemin de la vieille capitale, et là, plus heureux que Gabriel Lajeunesse, il retrouva sa Josephte, sa fiancée, libre et n'ayant jamais, de son côté, désespéré de le revoir.

SECONDE PARTIE.

Captivité; délivrance.

> **Men whose lives glided on like rivers that water the woodlands;**
> **Darkened by shadows of earth, but reflecting an image of heaven.**
>
> LONGFELLOW.—*Evangeline.*

> **Des hommes dont la vie s'écoulait pareille aux ondes de ces rivières qui courent sous la forêt, assombries par les ombres de la terre, mais reflétant l'image du ciel.**
>
> LONGFELLOW.—*Evangeline.*

Nous voyons partout les injustices et les persécutions prendre fin, comme toute autre chose humaine. Non pas, quand ce sont les Acadiens qui souffrent.

A Rome, sous Néron, sous Dioclétien, quand on appréhendait un Nazaréen, on le livrait aux bêtes de l'amphithéâtre ou à la hache du licteur, et tout était dit: c'était la fin.

Il eut été plus avantageux aux Acadiens de vivre sous Néron que sous Lawrence; en tous cas, prisonniers sous un proconsul romain, leur sort n'eut guère été différent de ce qu'il fut dans les colonies de la Nouvelle-Angleterre, durant leur captivité.

On se haïssait moins, on se voulait moins de mal, entre païens et chrétiens, d'un côté, il y a dix-huit cents ans, qu'entre chrétiens et chrétiens, qu'entre protestants et catholiques, des deux côtés, sous le bon vieux régime des rois " très chrétiens " de France et " défenseurs de la foi " d'Angleterre.

A Boston, où les lois défendaient le meurtre religieux, à l'encontre de ce qui se pratiquait, naguère encore, en la plupart des royaumes de l'Europe, on s'appliqua à garder les prisonniers acadiens le plus longtemps que l'on pût, quand on se fut aperçu qu'il y avait des bénéfices à retirer de leur travail à peine rémunéré et du partage de leurs enfants. C'était un filon que la Providence donnait aux Puritains à exploiter, six jours de la semaine, en récompense de leur observance du jour dominical. Aussi ne permirent-ils jamais aux Acadiens de prendre des terres, d'exercer de métiers, de fonder aucun établissement, ni même de faire la pêche à leur profit personnel.

Les esclaves, à Rome, pouvaient acquérir un pécule, racheter leur liberté, être affranchis; à Boston, les Acadiens étaient propriétaires de leurs instruments et outils de travail et de leurs effets mobiliers, mais ne pouvaient pas aspirer à devenir citoyens. Les Romains vendaient les enfants des prisonniers tombés en esclavage; les Bostonais se les distribuaient gratuitement entre eux.

Il y avait aussi cette différence que les Romains ne faisaient de prisonniers qu'en temps de guerre, tandis que les Acadiens avaient été saisis et déportés en temps de paix. Un guet-apens comme celui auquel Lawrence eut recours, en 1755, pour s'emparer d'un peuple libre, sujets d'une puissance rivale, eut répugné à la fierté romaine. L'armée eût protesté pour dégager son honneur militaire; la magistrature fût intervenue, au nom de la justice et du droit des gens; le sénat les eût laissés libres de partir et, au besoin, le leur eut ordonné.

Il y avait cette autre différence, en faveur des païens, qu'une loi romaine (Cod. III, tit. XXXVIII, § II.) ordonnait, dans tous les cas de vente et de partage d'une propriété, que l'intégrité de la famille fût respectée et que les esclaves qui étaient époux et épouse, père et mère, frère et sœur, ne fussent point séparés; dans une multitude de cas, les liens sacrés de la famille furent inhumainement brisés en Acadie.

Précipités par la fatalité des événements dans une situation anormale, dont le roi de France ne s'inquiétait guère, disons, ne pouvait guère les tirer, et d'où le gouvernement britannique, d'accord avec celui des plantations de la Nouvelle-Angleterre, ne voulait pas les laisser sortir, les prisonniers du Massachusetts virent leur captivité s'éterniser. Nouveaux Sisyphes, quoi qu'ils fissent pour regagner leur liberté, le rocher retombait toujours sur eux.

Louisbourg, l'imprenable forteresse, était une deuxième fois tombée, en 1758, entraînant dans sa chute le Cap-Breton, l'île Saint-Jean et le Nouveau-Brunswick. Ce furent autant de champs nouveaux ouverts à la persécution, dont souffrirent ceux des Acadiens qui avaient échappé, trois ans auparavant, à Lawrence et à ses sbires, en passant de la Nouvelle-Ecosse sur le territoire français.

Il se fit, après la chute de Louisbourg, un second assaut de déportation plus cruel, plus meurtrier, plus implacable encore que le premier, et moins justifiable, parce que, cette fois-ci, les sujets français que l'on dépouillait de leurs biens, que l'on enlevait de leurs habitations et que l'on exilait, avaient été trouvés vivant régulièrement en territoire français, ou en litige, et n'avaient jamais, sauf quelques-uns, durant leur séjour à la Nouvelle-Ecosse, ni depuis, pris les armes contre l'Angleterre.

Le traité de Paris (1763), qui suivit de quatre ans la prise de Québec, ne laissa au roi Très-Chrétien, de toute la Nouvelle-France d'Amérique, que deux îlots: Saint-Pierre et Miquelon; et tout rentra dans l'ordre, parce que tout avait cédé aux armes victorieuses de la Grande-Bretagne.

En attendant la proclamation du traité de paix entre les deux couronnes, Murray, gouverneur anglais de Québec, permit aux Canadiens de retourner à leurs champs sans être molestés.

Durant le même temps, dans toute l'étendue de l'Amérique du Nord et jusqu'en Angleterre, les Acadiens continuaient d'être au ban de l'humanité. Ceux de Boston étaient toujours parqués dans les limites qui leur avaient été assignées en 1756; ceux d'Angleterre et de Halifax étaient gardés dans les prisons de l'Etat, où ils périssaient, décimés par le chagrin, la misère et les maladies; et ceux du Canada étaient exclus des garanties et immunités réservées dans les traités en faveur des autres hommes.

L'article 39 de la capitulation de Montréal, soumis à la signature d'Amherst, stipule qu'aucun Français résidant au Canada, ou sur les frontières, ne sera déporté en Angleterre ni dans les colonies anglaises. Le général anglais écrit en marge: "Accordé, excepté à l'égard des Acadiens."

Vaudreuil propose, à l'article 55, que "les officiers de milice, les miliciens et les Acadiens qui sont prisonniers à la Nouvelle-Angleterre soient renvoyés sur leurs terres."—"Accordé, à la réserve des Acadiens."

Il n'y a pas dans toute l'Amérique du nord un coin de terre, une pierre, où ces infortunés puissent reposer la tête.

A la Nouvelle-Ecosse et dans les autres provinces maritimes, non plus, la cessation des hostilités entre la France et l'Angleterre, pas plus que le fait qu'ils étaient réduits à la dernière misère et dans l'impossibilité absolue de nuire en aucune façon au gouvernement et aux colons anglais, ne donna de répit aux pauvres Acadiens.

Lawrence était mort, le 19 octobre 1760, à la fleur de l'âge, comme Néron; mais il avait été remplacé par Belcher, doyen de son Conseil et juge en chef de la province, celui-là même qui, le 28 juillet 1755, avait prononcé contre les Acadiens l'inique sentence de mort. Ils n'avaient changé que de bourreau; la persécution demeurait la même, aussi intense, aussi implacable.

Belcher avait été, dès le commencement, le conseiller intime, le complice de Lawrence. Ensemble ils avaient cherché, ensemble ils avaient trouvé un prétexte plausible, presque une bonne raison, pour déporter les Acadiens: savoir leur refus de modifier le serment prêté par eux à la couronne britannique, en 1726 et en 1730, lequel les exemptait de porter les armes contre les Français et les Sauvages, et d'en prendre un qui fût sans restriction aucune.

En dehors du prétexte plausible, de la raison presque bonne, il y avait le mobile: s'emparer de leurs biens.

"Une autre raison de leur faire évacuer l'Acadie, c'est qu'en partant ils nous faliciteront les approvisionnements et nous laisseront une grande quantité de terres toutes prêtes à la culture," *a large quantity of land ready for immediate cultivation,* écrivait Lawrence lui-même, le 18 octobre 1755, aux Lords du Commerce, avec un grand air de candeur et d'innocence.

Rien qu'en troupeaux, les Acadiens de la Nouvelle-Ecosse possédaient bien 50,000 têtes de bétail, Haliburton dit 60,000, sans compter les brebis, les chevaux, les cochons, la volaille, etc., toutes choses propres aux approvisionnements de la garnison de Halifax, aux fournitures de l'armée, au commissariat de la marine, et susceptibles, par conséquent, d'être converties en beaux louis sterling.

Les Acadiens déportés aux extrémités du monde, la nécessité s'imposait de ne pas laisser périr leurs biens, d'en disposer, au contraire, dans le plus bref délai, et de trouver des occupants pour leurs terres et leurs prairies.

La disposition des biens immobiliers n'allait pas sans quelque inconvénient, à cause de la nécessité qu'il y avait, aux termes de la loi, d'enregistrer, au greffe de Halifax, les noms des nouveaux propriétaires —des *grantees*—et de l'accomplissement d'autres formalités nécessaires pour constituer un titre de propriété parfait. Lawrence se contenta d'une partie du bétail et des chevaux, dont il y a lieu de croire qu'il partagea le produit avec Belcher et les plus intimes de ses complices, réservant les terres et les prairies pour les autres membres de son Conseil et quelques amis influents ou dangereux. Ces derniers, en participant à ses spoliations, en deviendraient, par le fait même, les défenseurs obligés.

Le plus difficile était de cacher la chose aux yeux de tous, d'en couvrir et d'en faire disparaître les traces.

Grâce à la guerre de Sept Ans, terminée en Amérique, mais se poursuivant toujours en Europe, Lawrence y réussit longtemps, sans se donner trop de mal. Il était tout puissant à Halifax et influent à Londres. Mais il y avait des appétits mal rassasiés dans son entourage, et partant des mécontents. L'éveil fut donné par quelqu'un qui le dénonça auprès des Lords du Commerce, l'accusant de détournements au préjudice de l'Etat. La Cour s'apprêtait à lui demander ses comptes, comme fit, quelques années plus tard, le ministre du roi de France à l'intendant Bigot et à ses complices, quand la mort l'arracha soudainement à la justice humaine. Peut-être fut-il parvenu à se disculper; car il ne paraît pas qu'il ait laissé de biens considérables à Halifax. La haine, plus encore que la cupidité, semble avoir rongé le fond de son âme. L'histoire lui doit cette justice.

Pour les spoliateurs, quels qu'ils fussent, la paix était plus à redouter que la guerre. La paix pouvait ramener à la Nouvelle-Ecosse les Acadiens déportés dans les plantations de la Nouvelle-Angleterre et ailleurs; et ceux-ci, l'amitié rétablie entre les deux couronnes, auraient été fondés en droit à réclamer leurs biens immobiliers et à se faire rendre compte de leurs biens mobiliers. Que la diplomatie française appuyât leurs justes revendications, et les spoliateurs étaient perdus.

Il importait donc plus que jamais de purger le pays d'Acadiens, jusqu'au dernier; de les éloigner le plus loin qu'il fut possible, mais, avant tout, d'empêcher leur retour. C'est à quoi Belcher s'appliqua avec autant d'acharnement—il n'était guère possible d'en apporter davantage—qu'en avait mis Lawrence. La calomnie, toujours bonne à exploiter contre eux, ne suffisait plus, désormais, toute seule; il importait de l'appuyer par des faits, et de persuader aux autorités d'Angleterre et aux gouverneurs des colonies que réellement il y avait danger pour le royaume d'en laisser un seul en Acadie. Ce n'était pas la haine, maintenant, comme pour Lawrence, qui poussait les voleurs, c'était la peur, plus cruelle que la haine.

Un fait ressortait clairement des derniers événements, c'est qu'il y avait des mécontents en la demeure, et, apparemment, parmi les membres mêmes du Conseil, puisqu'il y avait eu dénonciation aux Lords du Commerce, avec détails compromettants à l'appui. Il s'agissait donc, tout d'abord, d'acheter le silence des dénonciateurs. A cette fin, les Conseillers furent, à quelque temps de là, en 1764, autorisés à s'octroyer eux-mêmes, à se partager entre eux une large partie des terres abandonnées par les Acadiens, les meilleures, et gardées jusque là en réserve. Ils s'en attribuèrent chacun vingt mille arpents, ce qui n'était peut-être pas exagéré pour des personnes en appétit mises à même de se servir à volonté. Belcher et les amis influents ne furent pas oubliés. Lord Egmond reçut pour sa part cent mille arpents de terre et forêts, et un certain Alexandre McNutt, pour lui et ses associés, un million six cent mille. Tous ces bénéficiaires, receleurs ou complices, feraient, quand il en serait nécessaire, l'office de la charité en couvrant une multitude d'iniquités.

Entre temps, le général Amherst avait mandé au gouverneur de la Nouvelle-Ecosse de mettre fin à la déportation des Acadiens.

Sûr de chacun des membres de son Conseil, Belcher, le 20 février 1761, leur fit passer, en réponse au message du général, un arrêté déclarant "qu'ils étaient unanimement d'avis qu'aucun ordre du roi, ni aucune loi de la province ne devait permettre aux Acadiens-Français de demeurer à la Nouvelle-Ecosse." Ils priaient, en terminant, le gouverneur de faire parvenir cet arrêté à qui de droit.

A quatre reprises différentes Belcher fait adopter par son Conseil des résolutions demandant au général Amherst l'autorisation de déporter ce qu'il restait d'Acadiens dans les provinces, et quatre fois il essuie un refus.

De guerre lasse, et désespérant de gagner le général, il se tourne du côté de l'Angleterre. Les Lords du Commerce, auxquels il adresse d'abord ses réquisitoires et ses factums calomnieux, déclarent que leur sentiment est "qu'il n'est ni nécessaire ni politique d'expulser ce qu'il reste d'Acadiens, vu que, si l'on employait à leur égard des procédés raisonnables, ils pourraient tous devenir des membres utiles à la société et servir les intérêts de la colonie." Toutefois, il se récusent et renvoient le gouverneur au Secrétaire d'Etat.

Auprès du secrétaire d'Etat, Lord Egremont, Belcher n'eut pas plus de succès. C'est en vain qu'il réédite la vieille histoire invraisemblable et maintenant usée, que "les Acadiens n'attendent que le moment propice pour soulever les Sauvages, et, aidés par les Français, fondre sur les établissements anglais"; Lord Egremont lui répond par une fin de non recevoir.

Affolé par le spectre qu'évoquait la présence des Acadiens demeurés au pays, et déterminé d'en finir à tout prix, Belcher se résout à tenter le coup dangereux qui avait réussi à Lawrence, en 1755: agir comme d'urgence, sans l'autorisation des autorités supérieures, et plaider, ensuite, le fait accompli.

A cette fin, il se fait présenter, le 8 juillet 1762, par les Chambres, une adresse où il est dit "que les Acadiens essayeront toujours, tant qu'ils seront à la Nouvelle-Ecosse, de reprendre, par tous les moyens possibles, possession de leurs terres; qu'ils sont capables de tous les méfaits; que, confinés comme ils sont, dans les baraques de Halifax, ils demeurent une lourde charge aux Anglais, etc." La conclusion de l'adresse est "qu'ils doivent être déportés en dehors de la province."

Le 23 juillet, Belcher provoque une nouvelle adresse, en venant se plaindre au Conseil de l'insolence—voir la fable du *Loup* et de l'*Agneau*—des Acadiens; du danger qu'ils font courir à la province, et de l'esprit de trahison qu'ils entretiennent parmi les Sauvages. Le Conseil y répond aussitôt, comme cela était entendu, en lui recommandant de déporter à Boston ce qu'il restait d'Acadiens dans la province, et de les y laisser à la charge du gouverneur Bernard, jusqu'à ce que Son Excellence, Sir Jeffrey Amherst, décide de leur sort."

Il se fait donner le même avis, adresser la même prière, par son Conseil, le 26 du même mois. C'est une grossière comédie; c'est Néron consultant ses histrions sur la nécessité d'incendier Rome. Le dernier réquisitoire qu'il se fait présenter semble écrit tout entier de sa main. Ce sont les "insolences," les "dangers," les "incitations" que nous avons déjà vus, assaisonnés de nouveaux griefs: l'insécurité de la Nouvelle-Ecosse tant qu'il restera un Acadien à Halifax; les inconvénients de nourir et de garder en prison tant d'ennemis implacables; le danger qu'ils ne dévastent la province avec les armes et les munitions qu'ils tiennent mystérieusement cachés dans des endroits secrets; l'effet déprimant que produit dans les âmes des sujets de Sa Majesté l'imminence de tant de calamités, *the great uneasiness and distress to the minds of His Majesty's subjects,* etc. "Pour toutes ces raisons le Conseil est d'avis qu'à cause de ce danger imminent il est absolument nécessaire de déporter ces Acadiens de la province"; d'autant plus que si Halifax était attaqué, "ils pourraient bien profiter de l'occasion pour mettre le feu à la ville et se joindre à l'ennemi." Il n'y a pas un moment à perdre; il faut, dans l'intérêt du salut public, que le gouverneur se saisisse d'eux au plus tôt et les déporte à Boston, le port anglais le plus rapproché de la Nouvelle-Ecosse.

Mais, à leur arrivée à Boston, seront-ils mis au large ou gardés prisonniers? Belcher, qui tremble toujours que ses victimes ne reviennent, consulte derechef son Conseil sur ce point important, et la lugubre comédie recommence. Après avoir exhumé toute la correspondance échangée entre Belcher, Amherst et le ministère des Colonies, à Londres, depuis le commencement de l'année 1761, c'est-à-dire depuis l'arrivée de Belcher au gouvernement de la Nouvelle-Ecosse, la sereine assemblée "tomba unanimement d'accord que les dits Acadiens, à leur arrivée à Boston, devraient être détenus prisonniers jusqu'à ce que le général Amherst disposât d'eux selon son bon plaisir."

Cette opinion, dictée d'avance au Conseil, était à peine formulée, que Belcher, se sentant désormais suffisamment à couvert, fit avancer les cinq transports qu'il tenait prêts et ordonna d'y embarquer tous les Acadiens qu'il trouva sous sa main, quinze cents environ, et de les transporter à Boston.

En même temps il écrivait à Lord Egremont et aux Lords du Commerce, en Angleterre, et au général Amherst, à New-York, les lettres les plus lâchement diffamatoires sur le compte de ceux qu'il bannissait de leur pays. Au général Amherst il recommandait de "les séparer les uns des autres le plus qu'il pourrait, afin qu'ils fussent dans l'impossibilité de nuire et de retourner en Acadie." Si, cependant, on croyait désirable d'en diriger quelques-uns du côté du Haut-Canada, où le général Murray consentait à les recevoir, il n'y voyait aucun inconvénient, "pourvu qu'ils fussent dispersés au milieu d'une population beaucoup plus nombreuse, qui les maintiendrait dans la terreur."

La législature du Massachusetts refusa net au capitaine Brooks, commandant du convoi, de laisser descendre son monde. Ni les sollicitations de Hancock, le représentant du gouvernement de la Nouvelle-Ecosse à Boston, ni le message du gouverneur Bernard recommandant qu'ils fussent reçus temporairement, ni une lettre de même teneur du général Amherst, ne purent lui faire changer de résolution. Elle ne consentit même pas qu'il leur fût vendu de provisions autrement que pour argent comptant. Les Acadiens n'en avaient pas, et Hancock ne voulut pas en avancer, ni engager le crédit de son gouvernement.

Après trois longues semaines d'attente, les provisions étant toutes épuisées, sauf ce qu'il fallait pour les équipages, les cinq vaisseaux reprirent la mer.

Qu'allaient devenir tous ces malheureux, ces hommes poussés au désespoir, ces femmes brisées par les privations et la douleur, ces enfants?

Il restait toujours la ressource d'en faire ce qu'avait fait Boscowan, d'accord avec Lawrence, en 1758, de ceux de l'île Saint-Jean: les abandonner en pleine mer sur des vaisseaux prêts à couler. Qui, de Halifax ou de Boston, pourrait entendre les gémissements de ceux qui périssaient, au milieu de l'océan, dans les tourments de la soif et de la faim? Qui les verrait s'enfoncer lentement sous les flots et disparaître?

La tradition acadienne est muette au sujet des sinistres monstrueux, froidement préparés par Belcher, et, avant lui, par Lawrence, et remis, le plus souvent, pour exécution à l'amiral Boscowan, parce que aucun d'entre les sinistrés n'a survécu pour en faire le récit. Les Acadiens des îles Saint-Pierre et Miquelon seuls parlent encore des "pontons" anglais comme d'un souvenir d'enfer. Toutes traces, toutes mentions de ces hécatombes ont disparu des archives publiques. Une lettre de l'honorable Brook Watson, au révérend docteur Brook, à la date de 1791, mentionne bien environ treize cents Acadiens comme ayant péri dans la traversée d'Amérique en Europe; mais cela n'éveille aucun soupçon de l'horrible vérité. Pas plus, d'ailleurs, que la statistique, qui compte les vaisseaux, au départ, et n'en trouve plus le nombre, à l'arrivée.

Mais, comme disent les Anglais, *murder will out*. Le drame suivant, raconté par le capitaine Piles, maître du navire *Achilles*, dans le dessein évident de montrer un missionnaire catholique en peu glorieuse posture, est un de ces accidents révélateurs, assez fréquents à l'audition des causes criminelles, qui mettent au jour les crimes cachés et font, quoique tardivement, découvrir les coupables.

Le récit, en tous cas, porte tous les caractères de véracité. Le voici dans son intégrité.

Le capitaine Nichols, dit-il, maître d'un transport venant de Yarmouth, fut réquisitionné par le gouvernement de la Nouvelle-Ecosse pour transporter de l'île Saint-Jean environ trois cents Français-Neutres avec leurs familles. Avant de prendre la mer, il attira l'attention de l'agent du gouvernement sur la mauvaise condition de son vaisseau, qui était absolument hors d'état de se rendre en France, à cette saison de l'année.

" En dépit de ses protestations, on le contraignit à prendre les proscrits à son bord et à mettre à la voile.

" Arrivé à cent lieues des îles Sorlingues, le vaisseau faisait eau à tel point que, malgré tous les efforts de l'équipage, il devint impossible de l'empêcher de sombrer."

Voyant qu'ils allaient tous périr, le capitaine Nichols fit venir le missionnaire et lui dit qu'il restait un moyen, un seul, de sauver la vie à un petit nombre d'entre eux, parmi lesquels serait le missionnaire lui-même, c'était de faire consentir les Français à abandonner à l'équipage les chaloupes de sauvetage qu'ils avaient à bord.

L'équipage épuisé était, à ce moment-là, à la merci des Acadiens réfugiés sur le pont. Ceux-ci, qui avaient sans doute, durant la traversée, essuyé les outrages et les mauvais traitements ordinaires, tenaient maintenant dans leurs mains le sort de leurs mortels ennemis.

Continuant son récit, Nichols nous dit que " le prêtre harangua, durant une demi-heure, les Français rangés sur le pont et leur donna l'absolution. Alors, d'un sentiment commun, ils consentirent à laisser le capitaine, l'équipage et le prêtre se sauver dans les chaloupes, et à périr, eux, tous ensemble, dans le navire abandonné.

" Un seul, parmi les Français, descendit dans la chaloupe de sauvetage. Mais, entendant sa femme lui dire: Vous allez donc laisser votre femme et vos enfants périr sans vous? il fut touché de remords, et remonta sur le navire partager le sort des autres."

Pendant que les embarcations s'éloignaient avec l'équipage, le missionnaire, les vivres et ce qu'il restait d'eau potable, le navire s'engloutit sous les yeux mêmes des fuyards. Ceux-ci, après avoir couru les plus grands dangers, atteignirent sains et saufs les côtes de l'Angleterre.

Le nom du missionnaire mis ici en vedette est, croyons-nous, Biscarat.

Le capitaine Piles nous rapporte que " la raison donnée par le prêtre aux siens pour les abandonner, c'était l'espérance qu'il avait de sauver les âmes de ces hérétiques et de les ramener à Dieu avec lui."

Biscarat périt de quelque façon, en Angleterre, sans avoir revu la France.

Il s'agit ici d'un capitaine dont la main fut forcée, et qui n'était pas de complicité avec l'autorité. Quand il y avait collusion, les choses se passaient plus militairement; et les treize cents naufragés dont parle Brook Watson n'eurent pas l'occasion de faire volontairement un acte égalant en simplicité ce que le martyrologe romain nous montre de plus sublimement grand.

Enfin fut signé, le 10 février 1763, le traité de Paris, qui confirmait l'Angleterre dans ses possessions américaines et rétablissait la paix universelle. Terreneuve, la Nouvelle-Ecosse, le Nouveau-Brunswick, l'île Saint-Jean, et le Canada illimité, étaient devenus définitivement provinces anglaises, et les sujets catholiques du roi Très Chrétien de France avaient été cédés corps et biens au roi protestant d'Angleterre.

Pour les Canadiens-Français rien ne fut, on peut dire, changé, excepté le pouvoir souverain. Ils restaient dans leur pays et leur pays leur restait. Seulement l'Angleterre l'ouvrait aux colons du monde entier. Du monde entier, oui, à l'exception des Acadiens.

A ceux-ci, les pionniers de l'Evangile et de la colonisation dans la Nouvelle-France d'Amérique, il fut fait défense d'entrer dans le nouvel empire colonial. La porte de leur propre pays, l'Acadie, fut ouverte à tout le monde, eux exceptés. Ils restaient toujours en dehors de l'humanité. Le droit des gens leur était toujours dénié. On ne relevait rien contre eux et leurs juges les condamnaient toujours. Ils étaient Abel, et portaient dans tout le vaste univers la marque de Caïn.

La paix signée, ceux du Massachusetts demandèrent à passer en France, ils en furent empêchés; à s'établir au Nouveau-Brunswick, on leur en refusa la permission; à se retirer aux Antilles, il leur en fut fait défense; à rentrer au Canada et à la Nouvelle-Ecosse, on ne leur en donna pas le moyen.

En France ce fut le roi Louis XV lui-même qui, durant les négociations antérieures à la signature du traité de Paris, ayant appris par le duc de Nivernois, son ambassadeur auprès du roi Georges, que les prisons d'Angleterre regorgeaient d'Acadiens, et qu'un grand nombre était également détenu dans les " Plantations " de la Nouvelle-Angleterre d'Amérique, les réclama comme ses " fidèles sujets," et leur fit dire qu'il les enverrait chercher dans ses vaisseaux.

Ceux de Liverpool—il y en avait aussi un grand nombre d'internés à Southampton, à Penryn et à Bristol—furent les premiers à apprendre l'heureuse nouvelle. Ils pensèrent mourir de joie en entendant parler de délivrance. " Après quelque temps, nous dit M. de la Rochette, chargé de leur transmettre le message royal, les larmes succédèrent aux premières acclamations. Plusieurs semblaient entièrement hors d'eux-mêmes; ils battaient des mains; les levaient au ciel; se frappaient contre les murailles et ne cessaient de sangloter. Nul ne pourrait décrire tous les transports auxquels ces honnêtes gens s'abondonnèrent. Ils passèrent la nuit à bénir le roi et à se féliciter du bonheur dont ils allaient jouir."

Le roi promettait de délivrer tous les Acadiens retenus prisonniers en quelque lieu que ce fût. Ceux d'Angleterre songèrent à leurs frères d'Amérique et trouvèrent moyen, au commencement de l'été suivant, lorsque le traité eut été définitivement signé, de leur faire parvenir la grande nouvelle.

Ils leur recommandaient en même temps de faire connaître en sous-main au duc de Nivernois le nombre de ceux qui voudraient rentrer en France et les divers lieux de leur détention, afin que le roi put les envoyer prendre sur ses vaisseaux.

Ce message fut d'abord communiqué aux Acadiens de Baltimore, de Philadelphie, de New-York, de New-Haven et de Boston. Ces derniers le firent tenir à ceux de la Nouvelle-Ecosse. Finalement, cela était inévitable, il arriva à la connaissance des autorités anglaises.

Comme la paix était alors signée entre les deux couronnes, et qu'il y était dit que le roi de France réclamait les Acadiens comme ses " très fidèles sujets," il ne se trouvait rien dans tout cela que de régulier; on n'y pouvait relever aucun acte, ni aucune intention de trahison: le procédé était correct.

A la nouvelle que le roi de France les allait envoyer quérir sur ses vaisseaux, les prisonniers du Massachusetts étaient entrés dans le délire d'une joie pareille à celle que nous avons vue éclater chez ceux de Liverpool. Sans se soucier de passe-ports, ils sortirent, fous de joie, de leurs enclos maudits et s'assemblèrent, hommes, femmes et enfants, tous libres, à Boston et dans les autres villes maritimes, attendant les vaisseaux de France.

Les vaisseaux n'arrivèrent pas, ni aucune nouvelle, ni aucun message du " roi bien-aimé ", Louis XV.

En justice pour celui-ci, il faut dire que toute l'affaire avait été conduite par le duc de Nivernois, son ambassadeur plénipotentiaire à Londres, durant les préliminaires de la paix de Paris; que Sa Majesté n'en avait probablement pas eu de connaissance personnelle, absorbée qu'Elle était par les hauts devoirs d'Etat et par les soins à donner à sa dernière maîtresse, glorieusement régnante. D'ailleurs, eût-Elle voulu envoyer chercher " ses fidèles sujets " qu'Elle en eut été empêchée. A Montague Wilmot, successeur de Belcher au gouvernement de la Nouvelle-Ecosse, que cette rumeur avait extraordinairement alarmé, Lord Halifax écrivit, le 26 novembre 1763, au nom du roi d'Angleterre, que des représentations énergiques venaient d'être faites à la cour du roi de France au sujet des entreprises clandestines du duc de Nivernois; que le cabinet de Londres prendrait les moyens de les faire avorter, et que, de son côté, le gouvernement de la Nouvelle-Ecosse devait ne pas perdre de vue ceux qui conduisaient ces négociations ténébreuses et empêcher qu'aucun Acadien ne sortit furtivement de la colonie.

Les autorités de Boston, aussi alarmées que celles de Halifax, députèrent Jasper Mauduit après de Lord Grenville, à Londres, pour lui faire des représentations. Le noble Lord leur fit dire de n'avoir crainte; " que rien de tout cela ne se pouvait faire, étant contraire aux lois qui régissaient la navigation; qu'il était interdit au roi de France d'envoyer aucun vaisseau dans les colonies anglaises."

Elles n'en demandèrent pas moins à voir la liste de ceux qui voulaient passer en France. Il s'en trouva, à la date du 24 août 1763, onze cent dix-neuf, appartenant à cent soixante et dix-huit familles. C'était probablement tous ceux du Massachusetts capables de prendre la mer.

Aussitôt de nouvelles complications surgirent. Puisque le roi de France réclamait les Acadiens en les désignant comme "ses sujets," ils avaient donc été, depuis huit ans, des prisonniers de guerre à Boston. *Business is business.* On établit le compte à payer, basé sur les déboursés de toutes sortes : il s'éleva à la somme de neuf mille cinq cent soixante et trois louis sterling, neuf schellings et dix pences. Pourquoi ne pas faire verser d'abord cet honnête denier dans le trésor de la province? On verrait ensuite à laisser partir les prisonniers, s'il y avait lieu.

On trouva ceci, encore: S'ils partent, nous perdrons le bénéfice de leurs services.

En troisième lieu, on découvrit soudainement qu'ils " étaient susceptibles de devenir des sujets anglais utiles."

Plusieurs autres raisons également bonnes furent trouvées pour les garder. En tous cas, il était nécessaire, avant de rien arrêter définitivement, de référer le cas au ministre des Affaires Etrangères, à Londres, et rien ne serait fait avant d'avoir une réponse de la métropole et surtout avant d'être remboursé.

Louis XV ne paya point la rançon demandée. Il restait à peine dans ses coffres royaux ce qu'il fallait d'argent pour offrir à la haulte et puissante Damoiselle Du Barry quelque cadeau digne de Sa Majesté Très-Chrétienne, et fournir aux grands de son royaume de quoi soutenir, dans un luxe oriental, la dignité du trône et de l'autel.

Ces " fidèles sujets " qui souffraient la persécution dans les prisons du Nouveau-Monde, pour la France et la Religion, qu'était-ce après tout aux yeux du roi, de ses courtisans et de leurs maîtresses? Des gens du peuple, des roturiers, de la canaille, comme il y en avait vingt millions en France.

Le résultat final fut que les Acadiens du Massachusetts ne purent pas partir, et qu'ils se virent ramenés de force dans les villes qui leur servaient de prisons.

Ils avaient aperçu la terre de promission et avaient pensé en mourir de bonheur; et voici que l'enfer se refermait sur eux.

Cette rançon de neuf mille cinq cent soixante et trois louis sterling, près d'un quart de million de francs, de la valeur d'un million de francs de nos jours, exigée tout à coup pour le rachat de sujets, britanniques, si telle était la qualité des Acadiens, français, s'ils l'étaient encore après la prestation de leur serment de fidélité, et après qu'un acte de la Législature les eut déclarés compétents à s'enrôler sur la flotte du roi Georges, mérite, à part de l'étrange figure qu'elle projette ici, d'être examinée un instant. C'est quelque chose comme l'examen des comptes que Pharaon aurait présentés à Moïse pour frais de nourriture, logement et prisons des Hébreux, quand ceux-ci voulurent se retirer de l'Egypte, après la construction de la grande pyramide.

De quoi ces neuf mille cinq cent soixante et trois louis sterling étaient-ils faits? Lawrence avait remboursé à la province ce qu'il lui en avait coûté pour faire arrêter ceux des Acadiens qui s'en étaient revenus de la Virginie; au moins avait-il promis de demander à son Conseil de Halifax de le faire, et il était tout puissant chez lui.

De son côté, le gouvernement de Boston était toujours en instance auprès du *Board of Trade* de Londres pour se faire indemniser de toutes les avances faites aux Acadiens, depuis leur première arrivée, en 1755. Ces instances remontaient au 7 février 1756, jour où les Chambres passèrent une résolution à l'adresse du gouverneur Shirley, disant: "Nous n'ignorons pas que le gouvernement du Massachusetts n'a nullement contribué aux frais nécessités pour le recrutement, parmi nous, des soldats qui ont été envoyés à la Nouvelle-Ecosse; mais nous devons faire remarquer à Votre Excellence que tous les Français-Neutres qui ont été remis à notre charge sont arrivés ici dépourvus de tout. Comme leur déportation a été faite pour la sûreté de la Nouvelle-Ecosse, c'est à l'Angleterre à en porter les frais."

A la date où nous sommes arrivés, elles avaient, à Londres, Jasper Mauduit, qui continuait de presser leurs réclamations, et elles n'eurent de cesse que la Trésorerie royale ne leur eut remboursé jusqu'au dernier sou. La somme d'argent exigée du roi de France était, par conséquent, surérogatoire.

J'ai eu la curiosité, bien légitime pour un chroniqueur, de parcourir les comptes et les factures qui furent présentés au gouvernement du Massachusetts par les *selectmen*, les commissaires des pauvres et les diverses municipalités. Ils m'ont paru exagérés. Les loyers coûtaient chers et les drogues se vendaient dans les grands prix.

Voici, pris dans le tas, le mémoire de ce que coûta Jean Mius d'Entremont à John Low, jeune, de la ville de Gloucester, pour son entretien et celui de sa famille, du mois de juin au mois de septembre, 1756.

7 juin 1756. Doit:

	Louis.	Schilling.	Pence.
Pour 31 livres du meilleur porc	5	8	6
" 28 livres de pain.	0	2	10
" 11 livres de veau	0	17	3
" 20½ livres de porc	3	1	6
" ½ boisseau de pois	1	10	0
" 1 boisseau de blé-d'inde (maïs)	1	5	0
" 31 livres de porc	4	13	0
" 1 boisseau de blé-d'inde	1	17	6
" 42 livres de porc	7	7	0
" 1 gallon de mélasse	0	18	9
" 1 boisseau de blé-d'inde	1	5	0
" 37 livres de morue.	1	13	9
" 14 livres de porc	2	9	0
" 1 boisseau de blé-d'inde	1	5	0
" 35 livres de porc	5	5	0
" 4 livres de sucre	1	0	0
" ½ boisseau de pois	1	2	6
" 1 gallon de mélasse	0	18	9
" l'avoir hébergé trois jours, lui et sa famille.	3	15	0
Etc., etc.	.	. .	. .
Total	£84	3	7
Réduit au cours légal	£11	5	5½

(Signé) JOHN LOW, Jr.

22 septembre 1756.

Aucun de ces comptes n'est vérifié, je veux dire accompagné des pièces justificatives, des reçus ordinaires fournis en pareil cas, et que les Anglais, gens d'affaires, appellent *vouchers*. Toutes les factures sont à peu près dans la même note.

A ces prix-là, la veuve Thibodeau, à qui on accordait douze sous par semaine, pour son entretien et celui de ses cinq enfants, n'avaient pas de quoi vivre dans l'abondance.

Vers le même temps, 1763, un nommé Jacques Robin, Jersiais protestant, établi à Londres, fit offrir aux Acadiens de Boston et de l'Acadie de les établir sur des terres que le roi d'Angleterre consentait à lui céder le long de la rivière Miramichi, où ils pourraient se livrer à l'agriculture et à la pêche. Il leur garantissait le libre exercice de leur religion; un missionnaire catholique approuvé par les autorités de l'Eglise romaine, et toutes les provisions et autres objets de première nécessité dont ils auraient besoin. Ce Jacques Robin était, à ce qu'il semble, l'ancêtre des Robin dont nous voyons aujourd'hui les établissements de pêche à l'île Madame et à la Baie-des-Chaleurs.

L'idée de ce projet de colonisation paraît lui avoir été fournie par l'abbé Manach, ancien missionnaire en Acadie, qui, pour avoir bû à la santé du Prétendant, et, au dire du gouverneur Wilmot, fait œuvre de sédition parmi les Sauvages, avait été appréhendé et emmené prisonnier en Angleterre.

Les mêmes raisons pour garder les Acadiens du Massachusetts valaient toujours: la nécessité de toucher préalablement la rançon de neuf mille cinq cent soixante et trois livres sterling, et l'importance "de ne pas perdre le bénéfice de leurs services." A ces deux raisons d'ordre majeur vinrent s'ajouter les protestations d'énergumène du gouverneur de la Nouvelle-Ecosse, adressées simultanément à Londres et à Boston, contre le projet de laisser les Acadiens s'établir si près de leur ancien pays, où ils ne manqueraient pas, aussitôt arrivés, d'entrer en communication secrète avec la France; d'ourdir de noirs complots contre l'empire britannique; d'ameuter les sauvages; "de s'accaparer du commerce des pelleteries;" bref, de faire courir à la colonie tout entière les plus grands dangers.

Cette fois-ci, encore, ils ne partirent pas.

Leur situation, à la suite de tout ces événements, ne s'était pas améliorée. Qu'on en juge par le message suivant de Fra Bernard, gouverneur du Massachusetts, communiqué à la Chambre des Représentants, le 18 janvier 1764.

La petite vérole sévissait alors à Boston, et les Acadiens, quoiqu'ils n'en eussent pas été atteints, avaient été séquestrés, et personne ne pourvoyait à leur subsistance. Ils périssaient de froid et de faim.

"Le cas de ce peuple, disait le message, est en vérité lamentable. Aucun d'entre eux n'a encore attrappé la petite vérole, et ils n'ont que leur travail de chaque jour pour vivre. S'ils ne peuvent pas aller chercher de l'ouvrage dans la ville, ils mourront de faim; s'ils y vont, ils prendront la maladie. Comme ils sont entassés dans de tout petits logements et dépourvus du nécessaire, il faut qu'ils trouvent quelque moyen de ne pas périr misérablement. Je me suis abouché à ce sujet avec les *selectmen*, qui, à leur tour, ont consulté les commissaires des pauvres. Les uns et les autres prétendent qu'ils ne peuvent rien faire pour leur venir en aide. Je me trouve, en conséquence, dans la nécessité de m'adresser à vous pour sauver la vie à ces gens. Donnez-leur de quoi manger, et, de mon côté, je mettrai les casernes, *barracks of the Castle*, à leur disposition. Quand ils y auront demeuré assez longtemps pour montrer qu'ils n'ont pas été infectés par la maladie, ils pourront alors être admis dans d'autre villes et y trouver de l'ouvrage, ce qu'il leur serait impossible maintenant de faire."

La Chambre des Représentants et le Conseil consentirent à ce que le gouverneur les internât dans les casernes et leur votèrent de quoi " subsister " jusqu'au quinze du mois suivant, c'est-à-dire trois semaines.

Mais comme un certain nombre de ceux qui se trouvaient dans les villes du littoral de la mer avaient profité des derniers événements pour s'enfuir à Saint-Pierre et Miquelon et au Canada, sur des bateaux de pêche et autres voiliers, le gouvernement fit défendre, par proclamation royale, à tout capitaine, maître et patron de vaisseau de prendre aucun Acadien à son bord. C'était remettre en vigueur une loi passée sept ans auparavant, et que le traité de paix entre la France et l'Angleterre avait, depuis près d'un an, fait tomber en désuétude.

Cette proclamation tombait bien mal pour les pauvres prisonniers, comme nous allons le voir.

Dans l'été de la même année, savoir le 26 juin 1764, neuf ans après le Grand Dérangement, cinq ans après la prise de Québec et un an après le traité de Paris, le comte d'Estaing, lieutenant-général et gouverneur pour le roi de France aux Antilles, fit savoir, par proclamation, aux Acadiens de la Nouvelle-Angleterre que ceux d'entre eux, hommes, femmes et enfants, qui seraient désireux de se retirer sur l'île Saint-Domingue, n'avaient qu'à en donner avis à John Hanson, marchand de New-York; que celui-ci fournirait tout ce qui leur serait nécessaire, provisions, vivres et prix du passage, pour s'y rendre, et que là ils seraient bien traités par le gouvernement français, qui leur donnerait des terres et de quoi subsister durant les premiers mois.

Les Acadiens se cramponnèrent à cette nouvelle planche de salut, comme font ceux qui se noient, à une épave. Soixante et six pères de familles, représentant quatre cent six personnes, signèrent, pour eux-mêmes et pour leurs frères, une requête au gouverneur et aux Chambres de Boston, qu'ils présentèrent, le 1er décembre (1764), sollicitant un passeport général pour tous ceux d'entre eux qui voudraient aller aux Antilles françaises.

Certains que leur prière serait exaucée, et déterminés de redevenir des hommes libres, un grand nombre quittèrent, comme ils l'avaient fait une fois déjà, les villes et les villages où ils avaient été si longtemps enfermés, et se rendirent tout de suite à Boston, attendant l'heure de prendre la mer. Afin de se procurer pour eux-mêmes et leurs familles

les choses de première nécessité, ils vendirent le peu qu'ils possédaient, quelques objets mobiliers et leurs outils de travail.

Le premier acte des autorités municipales de Boston fut de les interner dans un entrepôt à sucre, sur la pointe du Moulin-à-Vent, où ils furent gardés à vue, sans qu'il leur fut permis de faire parvenir aucune communication à John Hanson.

Ne recevant pas de réponse à la première pétition qu'ils avaient adressée au gouverneur, les prisonniers lui en remirent, le 1er janvier 1765, une seconde, où je relève les passages suivants, touchants dans leur naïve simplicité.

"Nous vous souhaitons, commencent-ils par dire, une bonne et heureuse année, avec toutes sortes de prospérités, et aussi que vous nous accordiez un passeport pour les colonies françaises, où nous désirons beaucoup aller.

"Votre Excellence a connaissance de l'offre qui nous est faite. Cela fait neuf ans que nous vivons ici dans l'attente d'être rendus à nos compatriotes, et votre silence semble vouloir fermer la porte qui nous est ouverte. Nous avions toujours cru qu'en temps de paix, dans tous les pays du monde, la porte des prisons s'ouvrait aux prisonniers. Permettez-nous de trouver étrange notre détention ici.

"On nous répète que nous jouissons de la liberté de pratiquer notre religion; cela nous semble contraire aux faits; car, en nous détenant ici malgré nous, vous nous mettez dans l'impossibilité de l'exercer. C'est de la dureté envers nous. Vous nous faites une situation bien dure, nous mettant dans l'impossibilité de rien faire pour améliorer notre condition.

"Excellence, si vous n'avez pas bientôt compassion de nous, nous allons tous périr de froid et de faim.

"Depuis (un mois) que nous vous avons présenté notre première requête, nous avons reçu quatre-vingt-quatorze livres de mouton, deux charges de bois, deux boisseaux de pois, cinq boisseaux de pommes de terre et de navets, pour soixante et douze bouches que nous sommes ici... Cela est bien dur, Monsieur.

"Veuillez donc avoir compassion de nous, pour le temps qui nous reste à demeurer ici.

Signé: Jean Trahant, Costin Thibodot, Jean Hébaire, Charles Landry, Allexis Braux."

Cette fois encore la permission de partir leur fut refusée. Le gouverneur Fra Bernard, dans un message au Conseil, donne les raisons de son refus: "C'est qu'il a toujours considéré les Acadiens comme des sujets anglais," et qu'il ne peut pas les laisser s'en aller sans l'autorisation du Ministre.

Ils sont tour à tour sujets anglais, ou sujets français, selon les chances qu'on a de les mieux exploiter: français pour être rançonnés comme prisonniers de guerre; anglais pour se faire enrôler de force sur la flotte du roi.

Cependant les Chambres nommèrent encore une fois un comité pour s'enquérir de leur situation exacte et mettre une fin finale à leurs plaintes éternelles.

Sur leur situation, le rapport fut que beaucoup de ces pauvres Acadiens étaient très malades, et que les autres s'affaissaient de jour en jour, ce qui était dû, soupçonnaient-ils (*as we apprehend*) au fait qu'ils avaient été trop longtemps sans prendre de nourriture. "Ceux qui le peuvent veulent bien travailler; mais la dureté du temps est telle qu'ils ne peuvent pas trouver assez d'ouvrage pour vivre et encore moins faire vivre leur famille."

Pour remède à leurs maux et surtout aux ennuis du gouvernement, le comité propose que les *selectmen* des différentes villes où ils ont été originairement répartis les reprennent à leur charge et s'arrangent avec eux "du mieux qu'ils pourront;" mais qu'il ne leur soit pas permis de sortir de la province, pas plus qu'à d'autres des leurs d'y rentrer.

Ce recommencement de persécution parut odieux au gouverneur; car Bernard, comme Pilate quand il fit flageller Jésus, parce qu'il ne trouvait aucun mal en lui, cherchait, à sa manière, à les sauver.

S'il s'était prononcé contre leur départ pour les Antilles, c'est qu'il considérait que ce voyage leur serait fatal, comme il l'avait été à ceux de Philadelphie qui avaient été envoyés, l'année précédente, au Cap-Français; c'était pour les sauver qu'il agissait ainsi, comme l'explique la suite de son message à la Chambre: "Leur cas, disait-il, est vraiment digne de pitié. S'ils vont à Hispaniola, ils courrent au devant d'une mort certaine. Peu échapperont aux effets du climat mortel de cette île. C'est plus pour des motifs d'humanité que par considération politique que je m'oppose à ce que le reste d'entre eux entreprenne ce fatal voyage. Ce n'est pas tant pour en faire des sujets anglais que pour les empêcher de périr, que j'en use ainsi envers eux."

Il termine son message en demandant au Conseil de leur donner quelque coin de terre dans la province pour qu'ils s'y établissent et perdent l'envie d'émigrer aux Antilles françaises, où la mort les attend. Les établir, c'est, selon lui, régler toute la difficulté.

Ce message est daté du 24 janvier.

Un comité fut, encore une fois, institué pour s'enquérir des faits.

Dans son rapport nous le voyons se prononcer contre l'idée d'offrir aux Acadiens des terres pour s'y établir, quoiqu'il y en eut en abondance, n'attendant que des colons. Cependant il reconnait que "dans l'état où se trouvent les détenus, ils sont dans un danger immédiat de périr, s'ils ne sont pas secourus," et termine en recommandant qu'on leur alloue des vivres pour deux mois, jusqu'au printemps.

La Chambre des Représentants, à qui ce rapport fut soumis, y souscrivit en partie. Comme les Acadiens mouraient littéralement de faim et qu'ils étaient dans l'impossibilité absolue de se procurer des vivres, ne possédant plus ni outils ni rien, elle eut la largesse de leur voter des rations pour quatre jours! Sa générosité ne s'arrêta pas là. Ayant décrété qu'ils seraient encore une fois séquestrés dans leurs anciennes limites, elle fit, aux frais de la province, enterrer les morts et transporter en voiture, jusqu'à la porte de leur prison, ceux et celles qui ne pouvaient plus marcher! Quoiqu'ils fussent sortis de leurs geôles sans le passeport exigé par la loi, étant en veine de magnanimité, elle ne les fit pas mettre au bloc, et ne les condamna pas, comme ils en étaient passibles, à être fouettés publiquement, hommes et femmes, garçons et filles, le buste nu jusqu'à la ceinture. Ils furent purement et simplement reconstitués prisonniers.

Et c'est ainsi qu'en l'an de grâce 1765, on traitait, à Boston, en pleine paix, des sujets anglais... ou français, quand c'était des Acadiens.

A partir de ce jour la situation de ces malheureux fut plus lamentable encore qu'auparavant. Jusque là, c'était le purgatoire avec l'espérance finale du ciel; désormais ce fut l'enfer, l'enfer du Dante, refermé sur eux, et scellé.

Allaient-ils donc tous périr, de plus de douze cents qu'ils avaient été dans le Massachusetts? Mourir de faim, de froid, sous les coups, ces pères et ces mères profondément chrétiens s'en seraient consolés; car, après tout, ce n'était qu'abandonner une vie mortelle et misérable. Mais vivre et mourir sans le secours des sacrements consolateurs de l'Eglise; mais voir leurs enfants, ceux qu'on leur ravissait, élevés dans une religion dont les membres étaient aussi inhumains, pour devenir à leur tour des Puritains, cette pensée leur était intolérable.

Cependant, le gouverneur Fra Bernard cherchait toujours le moyen de les sauver, et il ne s'en présentait aucun.

Douze mois s'écoulent, durant lesquels on n'entend plus parler des prisonniers du Massachusetts, désormais oubliés de l'univers entier. Même Thomas Hutchinson, l'homme charitable et juste, leur ami, que nous connaissons, ne peut rien faire pour eux dans le court espace de temps où il remplit les fonctions de lieutenant-gouverneur. De son côté, la Législature ne prend plus même la peine de répondre, quand ils s'adressent à elle pour quelque nécessité urgente.

Il leur arrivait, toutefois, des nouvelles du dehors, de temps en temps; et ils trouvaient moyen de communiquer entre eux et de se concerter.

C'est ainsi qu'ils apprirent, au commencement de 1766, que le gouverneur Murray avait, l'année précédente, par proclamation royale, ouvert le Canada aux immigrants d'Angleterre et à tous ceux des colonies anglaises qui désireraient s'y établir. Cent arpents de terre seraient accordés aux chefs, et cinquante à chaque enfant, de toute famille, qui en ferait la demande, gratuitement, les deux premières années, et, ensuite, moyennant une redevance annuelle de deux schellings.

Disait la proclamation: "Ceux qui voudront s'établir dans le bas de la province, comme sur la baye de Gaspé, la baye des Chaleurs et places adjointes, auront (en outre) l'avantage de la pêche."

Les prisonniers décidèrent de tenter un suprême effort de ce côté-là.

En conséquence, huit d'entre eux, Jean Trahan, Alexandre Breau, René Landry, Isaac Gourdeaux, Augustin Leblanc, Isidore Gourdeaux, Jean Hébert et Joseph Manzerol, remirent, le 8 février 1766, une pétition au gouverneur, le priant, au nom des Acadiens de Boston, de les faire transporter par mer, eux et leurs familles, au Canada, avec des provisions pour un an, vu qu'ils étaient sans ressources. Ils le priaient en même temps, d'écrire au gouverneur Murray pour lui demander de les recevoir et de leur donner des terres.

Le gouverneur Bernard communiqua cette pétition aux Chambres, l'accompagnant d'un message au cours duquel il disait: "J'ai toujours eu, depuis que je suis gouverneur de cette province, beaucoup de compassion pour ce peuple. Comme vous le savez tous ce sont les dures nécessités de la guerre plutôt qu'aucune faute imputable à eux qui les ont arrachés à une situation où ils vivaient dans l'aisance, dans l'abondance même, pour les plonger dans la pauvreté et le servage, d'où ils n'ont aucun moyen de sortir. A plusieurs reprises j'ai cherché à améliorer leur sort et à faire d'eux d'utiles sujets de la Grande-Bretagne; mais j'ai chaque fois failli à la tâche.

"Voici que vous avez l'occasion de faire, sans qu'il vous en coûte beaucoup, qu'ils ne soient plus à charge à la province ni à eux-mêmes, et deviennent, au contraire, une source de richesses et de force pour l'Empire, en Amérique. Il est bien certain que s'ils avaient des terres, sans lesquelles aucun cultivateur ne peut vivre, ils se tireraient d'affaire. J'espère donc qu'ils pourront profiter de l'offre du gouverneur Murray; donnez-leur en le moyen, et vous ferez un acte d'utilité publique en même temps que de charité."

Pour réponse, la Chambre des Représentants, sur la recommandation de toute la cour, ordonna que ceux des Acadiens qui étaient venus à

Boston présenter la pétition, s'en retournassent immédiatement dans les villes et villages qui leur avait été assignés, et, s'ils refusaient, que les vivres leur fussent coupés.

Ils avaient le choix : retourner prendre leurs chaînes, ou mourir, à Boston, de faim.

C'en était trop. Le gouverneur et le conseil refusèrent de ratifier cette dernière infamie. Ils étaient écœurés.

Il s'en suivit un *dead-lock* entre la Chambre des Représentants et le Conseil. A la fin, ce fut la Chambre qui céda, et, le 20 février 1766, elle autorisa le lieutenant-gouverneur " à écrire à Murray pour l'informer que les Acadiens étaient prêts à passer au Canada, s'il consentait à les recevoir."

Vingt louis sterling furent votés pour envoyer porter le message par deux Acadiens, le lieutenant-gouverneur ne se souciant apparemment pas de confier à des Bostonais cette délicate mission.

Voici la réponse du gouverneur Murray, telle que rapportée par l'un des deux envoyés :

" Monsieur, j'ai reçu, il y a déjà quelque temps, votre lettre du 25 février à propos des Acadiens de votre province. Je suis d'avis qu'il est de l'intérêt de l'empire britannique en général et du Canada en particulier, que ce peuple s'établisse ici sur le même pied que les nouveaux sujets Canadiens de Sa Majesté ; par conséquent, je n'hésite pas à les recevoir. Mais comme ils ont autrefois refusé de prendre le serment d'allégeance et d'apostasie (*abjuration*) et comme par leur requête à moi adressée ils semblent s'attendre à être maintenus aux frais du gouvernement, jusqu'à ce qu'ils puissent se suffire à eux-mêmes, je crois nécessaire de vous communiquer ma réponse à leur pétition, vous priant de la leur passer, afin que personne ne puisse plaider ignorance. Ceci pour prévenir toute rancœur et tout reproche de côté et d'autre."

Cette réponse montre combien il s'en fallut de peu que Murray ne leur refusât l'entrée du Canada. Quelqu'un les avait évidemment desservis auprès de lui. Ce quelqu'un-là, disons-le sans hésiter, c'était Wilmot, digne successeur de Lawrence et de Belcher. Ce trio de gouverneurs avait passé par des transes mortelles en apprenant, quelques années auparavant, que Murray était disposé à laisser les déportés de la Nouvelle-Ecosse s'établir sur les côtes de la Gaspésie. Pour l'en détourner, ils lui avaient écrit, les uns après les autres, pis que pendre des Acadiens. Les établir dans le fond du Haut-Canada, passe encore ; mais dans le golfe, à portée de leurs anciens établissements, jamais ! Leurs cris avaient retenti jusqu'en Angleterre. " Je suis d'avis, écrivait Wilmot au Lord de Halifax, que l'établissement d'une colonie d'Acadiens, soit dans les provinces maritimes, soit sur le long du fleuve Saint-

Laurent, exposerait le pays aux plus fâcheuses conséquences. Ce sont des français fanatiques, des papistes irréductibles.... Qu'on les disperse plutôt, par petits groupes, et préférablement à tout autre endroit, aux Antilles françaises."

Murray, et c'était là l'essentiel, leur ouvrait les portes du Canada; il y avait sous le soleil un coin de terre où il leur serait permis de vivre et de mourir en hommes libres. Mais on les prévenait qu'aucune assistance ne leur serait donnée. Comment, avec cette perspective, entreprendre le long voyage, sans ressources, dénués de tout et exténués par des années de privations et de souffrances?

Ils se jettent aux pieds du gouverneur et des membres du Conseil, et les conjurent d'avoir compassion au moins des veuves chargées d'enfants, des vieillards, des malades; de leur procurer à tous le moyen de passer au Canada, et, rendus là, de leur donner de quoi subsister quelque temps, sans quoi ils ne partiraient que pour mourir de faim.

Poussés par le désespoir: "Vous avez toujours été prêts, ajoutent-ils, à nous venir en aide, et nous n'avons que vous, messieurs, à qui nous adresser pour nous tirer de l'abîme de misère où nous avons été jetés."

Quant au serment d'allégeance, celui qui leur avait été maintes fois proposé en Acadie, attendu qu'il n'y avait pas là, comme autrefois à Port-Royal, aux Mines, à Beaubassin et à Pigiguit, de casuiste pour leur faire entendre qu'il y allait du salut de leur âme, s'ils consentaient volontairement à devenir les sujets d'un prince hérétique et les menacer d'excommunication, ils se déclarent d'avance tous prêts à le prendre.

Ceci se passait à Boston, le 2 juin 1766, onze ans après leur déportation de l'Acadie.

Aucune aide quelconque ne leur fût accordée; tout au contraire, la Chambre passa une résolution spéciale interdisant qu'il leur fût fait aucune avance: *to prevent the Neutrals being supplied any further.* C'était une autre manière de les empêcher de partir. C'était se montrer plus inhumain que les Egyptiens ne l'avaient été pour les Hébreux; car, lorsque ceux-ci sortirent de la captivité d'Egypte, ils purent emprunter des païens des vêtements et autres objets nécessaires à la vie.

Que faire dans ces conditions? Des messagers furent envoyés dans toutes les localités où il se trouvait des prisonniers, afin de prendre l'avis de chacun et d'agir de concert.

Le sentiment fut unanime de passer au Canada, de s'en aller à tout prix, de sortir de l'enfer. Mais les vieillards, les infirmes, les malades, ne pouvaient pas entreprendre le trajet. Allait-on les laisser en arrière?

Il y avait dans le port de Boston des vaisseaux en partance pour Halifax et Québec, qui pouvaient très bien les prendre à leur bord.

Il y avait aussi des goëlettes et des barges de pêcheurs inoccupées, que les Acadiens s'offrirent de manœuvrer eux-mêmes et de ramener, si on voulait leur en prêter quelques-unes. Ils n'essuyèrent partout que des refus.

Jean Labordore, que nous connaissons pour l'avoir vu, au sacrifice de ses biens et au péril de sa vie, sauver un navire et un équipage anglais à Mirliguêche (Lunemburg), avant le Grand Dérangement, rappelle une seconde fois ce service et supplie le gouverneur de lui fournir le moyen de prendre passage, lui et ses huit enfants, sur un vaisseau qui doit partir, le samedi suivant, 20 juillet, pour Québec. Sa prière est rejetée.

Quelques-uns vont à pied, au travers des bois, jusqu'à Québec, solliciter quelque secours de leurs frères canadiens, Edouard Benoit, entre autres, dont la femme est malade, et l'un de ses deux enfants aveugle. Ils s'en reviennent désespérés.

Tout ce qu'il est humainement possible de faire, ces malheureux le tentent pour se procurer un passage au Canada. Un petit nombre seulement y parviennent.

Il ne restait aux autres que l'alternative, ou d'attendre tous ensemble, en captivité, la mort trop lente à venir; ou, pour ceux qui étaient forts et bien portants, de s'en aller, à pied, sans ressources, sans armes, sans tentes, sans vivres, à travers quatre cents milles de forêt, avec la perspective de mourir de faim, soit en route, soit rendus à destination.

Les plus misérables poussaient à partir ceux qui pouvaient entreprendre le voyage. Ils mourraient libres, au moins, ceux-là: cela valait mieux, disaient-ils, que de vivre et mourir esclaves tous ensemble.

Le tableau des scènes qui se passèrent alors dans les cent vingt-cinq villes et municipalités où les prisonniers avaient été jusque-là retenus, scènes d'héroïsme, de générosité, de pleurs, de résignation chrétienne, de désespoir, peut à peine se concevoir, encore moins se décrire.

Il s'en trouva un peu plus de huit cents en état de partir. Ils laissèrent dans chaque localité des hommes valides, et surtout des femmes, pour prendre soin des infirmes et leur fermer pieusement les yeux; et les autres, la mort dans l'âme, rentrèrent, morne procession, dans la sombre forêt.

La caravane prit, pour se rendre à Montréal, où ils avaient résolu d'aller, la route du lac Champlain. On eut pu suivre leurs traces aux croix de bois qu'ils laissaient derrière eux sur des fosses péniblement creusées; ce qui a fait dire à Longfellow:

Aux pierres des tombeaux leur histoire est écrite.

Ceux qui parvinrent au Canada s'établirent au sud de Montréal.

dans les comtés de Saint-Jean et de Laprairie, le plus grand nombre dans un endroit qu'ils nommèrent pieusement l'Acadie:

...Et dulcis moriens reminiscitur Argos.

Ils ne se dirigèrent pas tous du côté du Canada. Un groupe d'environ deux cents, hantés par la nostalgie de leur chère Acadie, poussés par la folie du retour, prirent, à tout hasard, le chemin de la Nouvelle-Ecosse, sans savoir comment ils seraient reçus à leur arrivée et sans s'arrêter à cette pensée.

Quoique les autorités d'Angleterre eussent, deux ans auparavant, notifié le gouverneur Wilmot qu'il eut à permettre aux Acadiens de s'établir à la Nouvelle-Ecosse au même titre que les autres colons, c'est-à-dire en prêtant au roi le serment d'allégeance ordinaire, la loi passée durant l'été de 1759, par Lawrence, son Conseil et la Chambre d'Assemblée, déclarant nulle toute action prise devant les tribunaux pour le recouvrement des biens immobiliers autrefois possédés par les Français, n'en demeurait pas moins en vigueur, en 1766; et également une autre, du printemps de la même année, qui décrétait d'emprisonnement et de bannissement les prêtres catholiques (*papist priests*) appréhendés dans la province de la Nouvelle-Ecosse, et condamnait à une amende de cinquante louis sterling, ou au pilori, toute personne qui leur donnerait asile.

Qu'ils fussent ou non au courant de ces lois passées en contravention du traité d'Utrecht, rien n'ébranla leur inébranlable résolution. L'Acadie était plus éloignée de Boston que le Canada; pour y arriver c'était la même forêt à franchir, mais plus inextricable encore; les mêmes difficultés à surmonter, mais plus grandes, à cause des rivières à traverser; les mêmes dangers à affronter, mais accrus par le voisinage des hommes. Ils partirent quand même.

Les péripéties de leur odyssée ne sont pas consignées aux archives de Halifax, ni dans les procès-verbaux de la Législature de Boston.

Afin de ne donner que des faits strictement historiques et documentés, je laisse la parole à Rameau de Saint-Père, l'un des auteurs les plus consciencieux qui aient écrit sur l'Acadie. Il tient les faits suivants de la bouche même "des fils de ces enfants de la douleur," comme il les appelle.

"Ce fut, dit-il, dans le printemps de 1766 que se forma l'héroïque caravane dont nous suivrons les pas. A pied et presque sans approvisionnements, les pèlerins acadiens affrontèrent les périls et la fatigue d'un retour par terre, en remontant les côtes de la baie de Fundy jusqu'à l'isthme de Shediac, à travers cent quatre-vingts lieues de forêts et de montagnes inhabitées: des femmes enceintes faisaient partie de ce misérable convoi, qui accouchèrent en route. Nous avons connu quelques-uns de ces fils de la douleur, et c'est de leur bouche que nous tenons le récit que leur avaient transmis leurs pères, nés pendant cette douloureuse traversée.

" Jamais on ne saura tout ce que souffrirent ces malheureux, abandonnés et oubliés de tous, en se frayant une route dans le désert.

" Dans les sentiers sauvages qui serpentaient parmi les interminables forêts, cette longue file d'émigrants cheminaient péniblement; c'étaient de petites troupes de femmes et d'enfants traînant le mince bagage de leur misère, tandis que les hommes, dispersés çà et là, cherchaient dans la chasse, dans la pêche et même parmi les racines sauvages, quelques ressources pour les alimenter. Il y avait des petits en fants tout petits, marchant à peine, que l'on menait par la main; les plus grands les portaient de temps en temps; plusieurs de ces malheureuses mères tenaient un nourrisson dans leurs bras; les cris de ces pauvres enfants rompaient seuls, par leurs échos plaintifs, le silence sombre et lugubre des bois.

" Combien sont morts en route: d'enfants, de femmes et même d'hommes? Combien ont expiré, accablés par la lassitude, souffrant la faim ou la soif, assis et oubliés pour toujours dans un sentier perdu, sans prêtre, sans consolations, sans amis?

" A mesure que la triste caravane s'avançait, il s'en trouvait, en effet, dont les forces défaillantes se refusaient à les porter plus loin; tous ne succombaient point cependant, et il s'échelonna ainsi le long de la route quelques groupes, qui demeurèrent comme des noyaux de colonies à venir. C'est ainsi que, sur les bords du fleuve Saint-Jean, plusieurs familles se fixèrent sur les ruines des établissements qu'avaient occupés les Français dans ce district, à Jemsek et à Ecoupag, dans les environs de Fredericton.

" Lorsque la colonne des proscrits, éclaircie par les fatigues du voyage, atteignit les bords du Pecoudiak, il y avait quatre mois qu'ils étaient en route......

" Après le premier mouvement de joie ressenti en retrouvant des parents et des amis, ils eurent à éprouver un grand serrement de cœur. On leur apprit que dans le pays des Mines et de Port-Royal, toutes les habitations avaient été brûlées, les terres confisquées et distribuées à leurs persécuteurs. Ce grand et pénible voyage qu'ils venaient de faire se trouvait inutile: il n'y avait plus pour eux ni patrimoine, ni patrie.

" Cent vingt d'entre eux s'installèrent au milieu des Acadiens qu'ils venaient de retrouver et les autres, soixante environ, reprirent de nouveau leur route, hommes, femmes et enfants. Ils tournèrent le fond de l'ancienne baie française, devenue *Fundy Bay;* ils visitèrent successivement Beaubassin, Pigiguid, les Mines; mais Beaubassin s'appelait *Amherst*, Cobeguit avait pris le nom de *Truro;* Pigiguid celui de *Windsor*, et les Mines avec Grand-Pré se nommaient *Horton*.

"Ils effrayaient les enfants qui regardaient passer la lamentable caravane; ils inquiétaient les femmes et les hommes, comme une menace sortie du tombeau; on s'irritait contre eux, et les malheureux se traînaient de village en village, harassés par la fatigue et par un désespoir qui s'accroissait à chaque étape. La dernière fut à Port-Royal, désormais *Annapolis-Royal*, où ils furent encore plus mal reçus qu'ailleurs."

Pour se débarrasser de ces spectres, les autorités anglaises d'Annapolis les dirigèrent sur les bords inoccupés de la baie Sainte-Marie, où vivent aujourd'hui et prospèrent leurs fiers descendants.

Ne vont-ils pas enfin trouver le repos, ces malheureux fugitifs de Boston, ces pâles pèlerins de la mort? Reste-t-il au fond de la coupe quelque amertume qu'ils n'ont pas encore bue? Ne sont-ils pas parvenus à la dernière station de la voie douloureuse, d'où l'on aperçoit les lointains du ciel?

Non, pas encore.

Les infirmes et les malades qui avaient été abandonnés à Boston, parce qu'ils ne pouvaient pas suivre la caravane dans son exode, n'avaient pas encore tous rendu le dernier soupir que la guerre de l'Indépendance des colonies anglaises d'Amérique contre la mère-patrie éclata.

Un certain nombre d'Anglo-Américains, plutôt que de s'engager dans une guerre fratricide, abandonnèrent leur pays et leurs biens pour se retirer au Canada et dans les provinces maritimes, restés fidèles à l'Angleterre. Il fallait reconnaître un si beau geste patriotique—le geste même des Acadiens vis-à-vis de la France—et établir convenablement les nouveauv arrivés. Mais où? On s'était distribué entre soi et les amis toutes les terres des Acadiens déportés et leurs si riches prairies. Des terres en bois debout, ce n'était pas une récompense digne d'être offerte aux Loyalistes, comme s'intitulaient ces partisans de l'Angleterre fuyant les colonies en révolte contre la métropole.

Le gouvernement de la Nouvelle-Ecosse leur donna, entre autres morceaux princiers, les établissements fondés à Jemsek et à Ecoupag, sur la rivière Saint-Jean, en 1766, par le détachement d'Acadiens que nous avons vu s'acheminant si péniblement à travers les interminables forêts du Massachusetts, du Maine et du Nouveau-Brunswick.

Le nouvel établissement commençait à prospérer. Ses habitants en furent dépossédés et chassés, tout comme autrefois de Grand-Pré et de Port-Royal.

Tout ceci ressemble à de la fiction; à un lointain mirage; à une vision de larmes et de sang, apparue en songe dans la nuit, plutôt qu'à un récit sévèrement historique.

Un enchaînement si inconcevable de maux ne saurait être l'effet du seul hasard, ni non plus de la seule méchanceté de quelques hommes. La volonté de Dieu, mystérieuse et adorable, est là, manifeste. Dieu s'est visiblement détourné de nos pères. Etait-ce châtiment? Etait-ce expiation?

Nous, les héritiers de leur ruine, croyons qu'ils étaient des hommes remplis de foi religieuse et de crainte de Dieu, pacifiques, sobres, chastes, charitables, justes; il nous semble même que, par la simplicité et la pureté de leur vie, ils se rapprochent des premiers chrétiens; à nos yeux leurs souffrances égalent en durée, et souvent en intensité, celles des martyrs. Leur courage nous paraît aussi grand et leur foi la même. Mais nous sommes leurs descendants, et notre jugement peut n'être pas impartial.

On les avait, sans mauvaise intention sans doute, mais enfin on les avait mal éclairés et mal dirigés, dans leurs démêlés avec les gouverneurs de la Nouvelle-Ecosse. Ils avaient été induits en erreur sur la doctrine touchant les choses qu'il faut rendre à Dieu et celles que le citoyen a le droit inaliénable, le devoir même, en certains cas, de rendre à César. Ils avaient été trompés, d'abord, sur leurs droits; ils s'étaient, ensuite, trompés eux-mêmes sur leur devoir de l'heure présente, en ne s'armant pas d'indépendance, et en ne prenant pas sur eux de prêter quand même, au roi d'Angleterre, hérétique ou non, à qui le roi de France, très chrétien et très dissolu, les avait livrés corps et biens, le serment d'allégeance que tout prince, que tout gouvernement régulier, a le droit incontestable d'exiger de ses sujets. Si les Acadiens de 1755 avaient suivi leurs propres conseils politiques, leurs descendants, français et catholiques jusqu'au dernier, formeraient aujourd'hui l'immense majorité de la population des provinces maritimes, comme les Canadiens le sont dans la province de Québec.

Ils reposent tous, depuis longtemps, dans les bois, au fond de la mer, dans les cimetières protestants de l'Angleterre et des Etats-Unis, au Canada, et quelques-uns en la terre bénie de l'Acadie.

Lawrence, aussi, est mort, et Belcher, et Wilmot, et Boscowan. Il reste aux uns et aux autres l'éternité, plus longue à franchir que de Boston à Port-Royal et à Laprairie, à travers les bois.

ROYAL SOCIETY OF CANADA

TRANSACTIONS

SECTION II.

ENGLISH HISTORY, LITERATURE, ARCHÆOLOGY, ETC.

PAPERS FOR 1908

I.—*An Ursuline Epic.*

By LT.-COL. WILLIAM WOOD, Author of "The Fight for Canada."

(Read May 26, 1908).

I.

In the heart of Quebec is an oblong block of houses, about a quarter of a mile long and half as broad. The streets on three sides of it bear the names of St. Ursula, St. Louis and St. Ann. But saints' names alone are nothing unusual in Quebec. It is only the crooked little street cutting off the fourth corner that shows you the sole point of contact between a convent and the outside world. This oblong is the property of the Ursulines; the houses in it all face outward; behind them stands the convent wall; and within the wall the cloisters and a garden of some seven acres.

You wonder what the nuns think and talk about during their few spare moments in that little inward-dwelling world apart, when they never leave the precincts and never read a paper. But since before Confederation they have had one topic of absorbing interest to their whole community. And now they are on the very tiptoe of expectation for the first rumour of decisive news from Rome, about the long-sought beatification of their first and greatest superior, La Mère Marie de l'Incarnation. They explain how many, many difficulties they have had to overcome; how dishearteningly slow their progress was for so many years, because they did not know the proper method of procedure; and how often they had to begin over and over again. At last, the assessors appointed by the Court of Rome appeared to put the nuns through the final cross-examination. One sister, who had made a special study of La Mère Marie's life, can tell you how she occupied the witness box for thirteen days, and that it is the hardest thing in the world to get the very best of women made a saint. But now even Rome itself must be satisfied; and the Holy Father will soon proclaim a saint throughout both worlds. Yes; the Ursulines have something to talk about, after all!

But why should La Mère Marie become a saint; and what did she really do for Canada? The following pages are an attempt to answer this question from French and French-Canadian sources and a Roman Catholic point of view. It is, in fact, her eulogy. There is no devil's advocate to plead against her; no outside public in the jury; no doubting critic on the bench. But the well-attested evidence in her favour is so strong that it would be worth stating for its own sake; while, quite apart from every question of the beatific life, she claims attention from all Canadians, because she was the prophetess, as Laval was the prophet, whose steadfast inspiration upheld Canada through the Three Years' Horror that began with the Iroquois fury of 1660 and ended with the seven months' earthquake of 1663.

II.

When Louis XI. lay on his death-bed, in his château of Plessis-les-Tours, he wished to send the holiest man he could find to bring the greatest saint of Christendom to console his last days on earth. Courtiers and populace all agreed on the same individual, the great-great-grandfather of La Mère Marie, who was accordingly sent to Rome and on to the wildest part of the Calabrian coast, whence he brought back the famous ascetic, St. François de Paule. No members of the family prized this signal honour more than the parents of Marie Guyard. Her father, who was a silk merchant, had such a reputation for piety and justice that his decisions carried more weight than those of the courts of law; while her mother was his equal in devotion and his helpmeet in good works.

Marie was born on the 18th of October, 1599, in the old royal city of Tours, amid *ce doux pays de la Touraine* which Belleforest has called *le jardin de France et le plaisir des Roys.* "Do not ask me why I love Touraine!" exclaims Balzac, when describing the valley of the Indre from Azay to Montbazón. Here, and along the Loire, are all the finest châteaux: Amboise, with its terraces and chapel; Chenonceaux, with its gardens, its white walls, its towers rising sheer from the water, and its romantic memories of Diane de Poictiers and Catherine de Medici; Azay-le-Rideau, a vision of beauty, set in the woods beside the winding river; Loches, with its ancient towers and ramparts massively rooted into its steep hill; and Chinon, where the statue of Rabelais looks down on the market-place and over the quiet quays beside the Loire, where Henry II. breathed his last, and where Charles VII. was called to the relief of Orleans by Joan of Arc. And the heart of Touraine is Tours, calm and beautiful on the southern bank of the Loire, which lingers past in slow meanderings. Here stood an archbishop's palace, here soared a great cathedral; and here was set that exquisite little gem of Gothic architecture, La Psalette, all aglow with the sacred music which so took the ear of the young Marie and wrought her heart to ecstasy.

But her deepest and most thrilling form of ecstasy came to her in visions of divinity. She had always been a religious child; and every predisposing influence carried her on toward the fulness of self-surrender and devotion. The piety of her family was a Touraine tradition; the first words she could articulate were *Marie* and *Jésus;* she had hardly learnt to read before she showed a marked preference for books of edification; her favourite work was succouring the poor; her favourite amusement was "playing nun;" and her favourite holiday was paying a visit to the Benedictine abbey of Beaumont, where the abbess was her mother's cousin. Her first vision was in a dream, when, as she afterwards wrote, she saw Heaven open and Christ come toward her in human form: *Ce plus beau des enfants des hommes, avec un visage plein d'une douceur et d'un attrait indicibles, m'embrassa, et, me baisant amoureusement, me dit: "Voulez-vous être à moi?" Je lui répondis: "Oui;" et, ayant eu mon consentement, nous le vîmes remonter au ciel.*

No wonder that a child like this longed for the life of the Benedictines whom she saw so often and who were so kind to her; nor that her cousin willingly promised to intercede with Madame de Beaumont for her future admission to the order. She then confided in her mother, who also encouraged her. But there the matter stopped. She was meditative, timid and reserved; and it never occurred to her to open her mind in the confessional beyond what she thought a penitent should say there. She knew nothing of private spiritual directors, who would certainly have led her on. So the Benedictines lost a nun, to Canada's great advantage.

When she was seventeen her parents wished her to marry a silk manufacturer, almost as pious as her father. Her answer was idiosyncratic to the last degree. *Ma mère, puisque c'est une résolution prise et que mon père le veut absolument, je me crois obligée d'obéir à sa volonté et à la vôtre. Mais si Dieu me fait la grâce de me donner un fils, je lui promets, dès à présent, de le consacrer à son service; et si, ensuite, il me rend la liberté que je vais perdre, je lui promets de m'y consacrer moi-même.* Both vows were afterwards fulfilled.

Nevertheless, her marriage was a happy one. Madame Martin, as she had now become, was a very practical mystic, and a most capable partner in her husband's business. At the same time she lost no opportunity of shepherding his employees into the one true fold and making them her daily congregation. Doubtless, her pilgrim soul was often grieved by their stay-at-home contentment with the good green earth of rich Touraine, where many a Mimnermus probably went to church, even in those ardent days, when religion was a *casus belli* for the whole of Europe.

At nineteen she was left a penniless widow by her husband's sudden death and failure. Tall, handsome and of commanding presence, capable in management and pious in every thought and deed, she had no lack of eligible suitors. But she would never consider re-marriage for a moment, and she only remained outside the cloister for the next twelve years in order that her son should be old enough to be left with the Jesuits before she made her vows. Never for a moment did she relax her self-imposed ascetic rules for the mortification of the flesh. She literally clothed herself in sack-cloth, and practised so many other physical discomforts that her spiritual directors always had great difficulty in keeping her penitential macerations within due bounds. During four years she lived in utter self-abasement, as the servant of the servants at her brother-in-law's. This relative, who was at the head of a great forwarding business, was only too glad to promote her at the suggestion of her director; and she suddenly passed from below the menials to the local superintendence of sixty horses and a hundred men. For eight years the business prospered exceedingly; and she completed an apprenticeship in practical affairs which served her well during her pioneering life in Canada.

But none of these alien years of successful business management saw any worldling interlude in her religious life. They were, indeed, only more steps up the *Scala Sancta* of her soul. Her visions were no longer childlike dreams, but such as led her Spanish prototype, St. Theresa, through the seven abodes of the spiritual castle—*el Castillo Interior o las Moradas*—and so toward divine espousal with the Son of Man. On the eve of the Incarnation, in 1620, she had recommended herself to God's providence in her usual formula—*In te Domine speravi, non confundar in æternum*—and had set out for her daily work. Then, as she walked beside the city moat, came the flash of apparition. Her whole being stood at gaze; while the panorama of her past was unrolled before her, with all her sins standing out in the shamed dark, against the accusing whiteness of the light of truth; and with the life-blood of her crucified Saviour pulsing to her feet.

The vision over, she entered the nearest church and begged the first priest she met to hear her full confession. Returning next day for absolution she determined that her true conversion was to be counted from this anniversary of the Incarnation; a circumstance which suggested her name in religion, La Mère Marie de l'Incarnation.

Some years after, in a re-birth of unquestioning hope, she was at last caught up again within the highest rapture of heavenly delight; as once before, in her first dream-vision when a child. *Je conversais familièrement avec Notre-Seigneur, et mon cœur s'élançait par un mouvement extraordinaire vers ce bonheur que je ne pouvais comprendre. Jésus-Christ me dit distinctement ces paroles: Sponsabo te mihi in fide, sponsabo te mihi in perpetuum—Je t'épouserai dans la foi, je t'épouserai pour jamais.*

Divine espousals are so essentially characteristic of convent visions that they are always the favourite point attacked by those who sit in the seat of the scornful outside the cloisters. The adverse formulary says that the devotion of all celibates is only the parental instinct of self-sacrifice gone astray, and that a Divine Spouse is only a nun's hysterical substitute for a more carnal object of affection. But this contemptuous view shuts out one obviously common-sense point of refutation, which is almost too profanely worldly-wise for mention here. It simply is that no woman would make it the object of her life to bring in as many other brides as possible for her own beloved spouse, unless her affections were truly spiritual and the object of them divinely infinite.

Opinions will always differ about the signs which mark the calling of a life apart. But all the world agrees that the essential fitness of such a life for the higher aspirations of mankind can only be tested by its resultant actions. So we, who are bent merely on estimating the good influence that La Mère Marie exerted on Canadian history, might judge her by her works alone, if it were not that her visions, faith and works together made a triune all-in-all. This being so, we cannot hope to understand any one part of her life, if we wrest it from the whole. We must reckon with faith and vision as practical determinants at every turn. And, to gain a still further insight into her peculiar case, we must call such a supremely competent witness of the beatific state as St. Theresa, whose evidence goes far to prove, by sympathetic analogy at least, how close the psychic correlations are, even if the visions be only subjectively existent. In the 28th chapter of her autobiography she gives her conclusion of the whole matter: "Like imperfect sleep, which, instead of giving more strength to the head, leaves it only the more exhausted, mere imaginings only weaken the soul. . . . . A genuine heavenly vision yields her a harvest of ineffable spiritual riches, and an admirable renewal of bodily strength. I gave these reasons to those people who so often accused my visions of being the work of the enemy of mankind and the sport of my imagination. . . . I showed them the jewels which the divine hand left with me—they were my actual dispositions. All those that knew me saw that I was changed. . . . . As for myself, it was impossible to believe that if the devil were the author of this change he could have used means so contrary to his own interests as the uprooting of my vices and the filling me with masculine courage; for I saw clearly that a single vision was enough to enrich me with all that wealth."

When she was thirty and her son twelve, La Mère Marie committed him to the Jesuits and entered the Ursuline convent of Tours. The nuns were eager to hear her expound her visions, especially one of the Trinity, which is strangely like Dante's in the final canto of his *Paradiso*:

> Nella profonda e chiara sussitenza
> Dell 'alto lume parvemi tre giri
> Di tre colori e d'una continenza:

> In that abyss
> Of radiance, clear and lofty, seemed, methought,
> Three orbs of triple hue, clipt in one bound;
> And, from another, one reflected seemed,
> As rainbow is from rainbow: and the third
> Seemed fire, breathed equally from both.

She freely told all that she had seen beyond the veil of the flesh; and by her human aptitudes, no less than by her other-worldliness, she was soon in perfect harmony with the life around her.

The Ursulines were originally founded on St. Catherine's Day in 1537; two years after Jacques Cartier's discovery of Quebec; a time when the full flood-stream of Renaissance and Reformation was beating against every bulwark of the Roman faith and government. Ignatius Loyola and Angela of Merici hurried to the defence of the dangerous breach made in Catholic education, and set to work to rebuild it under fire. In 1540 Loyola drew up the constitution of the Jesuits, in which the education of boys stood first of all in relative importance. Four years later the Sovereign Pontiff approved the constitution of the Ursulines, in which the first place was given to the education of girls. "I have just given you some sisters," said Paul III. to St. Ignatius, after signing the document. How this Pope would have rejoiced to see his famous dictum so signally borne out a century later, in the distant mission field of Canada!

The novitiate over, La Mère Marie chose the conversion of St. Paul for her profession; and accordingly, on the 25th of January, 1633, she made her final vows. At the time, she seems to have chosen this day only because it reminded her of her own conversion, and not from any sense of missionary zeal. But two years later she dreamt of meeting a lady she had never seen before, and of taking her by the hand and going a long journey into a strange country, pointed out by an apostle who met them by the way. An idea that she was not to spend her life among the Ursulines of Tours kept on recurring; but it seemed so impious that she kept on as continually repulsing it. The other nuns began to notice her obsession; and one day she broached the subject to Father Dinet. This famous Jesuit, soon to become the King's confessor, said he thought the hand of God was pointing her to Canada. She had never even heard of such a country before; but it quickly filled her whole imagination. *Je ne vis plus d'autre pays pour moi que le Canada; et mes courses ordinaires étaient parmi les sauvages, avec les missionaires.* A pilgrim's staff from Notre Dame de Lorette and a copy of the *Relations des Jésuites*—both coming anonymously from an unknown Canadian missionary—still further inflamed her zeal. But the convent life went on around her as usual, and she was at a loss to know whether or not she had been called elsewhere.

At this juncture another unknown friend was coming to her side. Madame de la Peltrie, *née* Marie Madeleine de Chauvigny, was of the *haute noblesse* of Normandy. She had been well married and left a widow, though her own inclinations had always been toward the cloister rather than the world. One day she read Father Le Jeune's appeal for a devout woman to convert the Indian girls of Canada: *et depuis ce temps,* says La Mère Marie, *son esprit fut plus en Canada qu'en elle-même.* But her road thither bristled with worldly obstacles. She had run away from home and taken refuge within a convent in a vain effort to escape her first marriage; and now her family were bent on making her contract another. She was noble, rich, attractive, and much sought after; and she was at her wits' end what to do. In her extremity she asked a consummate Jesuit director, who advised her to tell her troubles to M. de Bernières, a man devoted to the cause of missions, and throw herself upon his protection as her husband. The pious layman, who also desired a life-long celibacy, was astounded at this proposal. But his own spiritual director was of the same mind as hers; and many common friends were instant in proving how desirable it would be to take such means to reach so good an end for the sake of the missionary cause. Finally, as both parties were equally unwilling to marry, it was agreed that no marriage should take place; but that the world should be allowed to believe them man and wife, in order that M. de Bernières should manage Madame de la Peltrie's large property in France, while she went out to Canada as the benefactress of the Ursulines. A visit to the holy man already known as "the archangel of human charity" made her resolve irrevocable; and so the great St. Vincent de Paul must be reckoned among the founders of the convent in Quebec.

Meanwhile, M. de Bernières was writing to La Mère Marie about Madame de la Peltrie, and Father Poncet, who had sent the pilgrim's staff, was writing to Madame de la Peltrie about La Mère Marie. The two women were thus brought together under the happiest auspices, and immediately became fast friends. A third now appeared, La Mère Marie de St. Joseph, an Ursuline who also had read the *Relations des Jésuites* with awakening devotion to the same cause. Her whole family—de la Troche de Savonnières—rose in horrified protest against the idea of her going out to the dreadful heathen wilderness. But the three women stood together; and presently arrived in Paris, where the wildest rumours about their proposed Canadian mission had preceded them. They became the vogue; and when the Archbishop refused to let a Parisian Ursuline go with them, he was besieged by great ladies, headed by the Duchesse d'Aiguillon; and when he fled the capital to escape this importunity, the Queen herself pursued him with royal messengers, though all in vain. La Mère Marie had a long audience of the Queen, who seemed much interested in this daring religious venture beyond the outer seas. Anne of Austria might well have sighed for some of the peace of mind which the Ursuline leader wore like a suit of living armour, for her own life was the unhappy sport of a king and two great worldly cardinals. The King treated her with cold neglect, Richelieu pressed her with unwelcome amorous advances, and Mazarin, whom she really loved, used her heart as a stepping-stone to power. Her harmless flirtation with Buckingham, told with such gusto in the immortal *Trois Mousquetaires*, was turned to malicious account by Richelieu when first presenting Mazarin at court: "Your Majesty will like him, he has quite the air of a second Buckingham."

Several troubles beset La Mère Marie while still in Paris. M. de Bernières fell seriously ill, and her son came to implore her not to leave for Canada. The young man had been leading *la vie à vingt ans* for a few months, though his wild oats would have made a very absurd little handful in the eyes of any genuine *viveur*. The mother's influence soon prevailed, and he afterwards became the Benedictine, Dom Claude Martin, of pious memory. But new troubles followed M. de Bernières' recovery, and the arrival of the party at Dieppe. The de la Troche family sent post-haste to arrest the daughter they thought so mad. The trading company of New France said they had no more room left aboard their vessels. And the third Ursuline had not yet been found. But La Mère Marie persuaded the alarmed family to let La Mère de St. Joseph go, with their blessing on her undertaking. Madame de la Peltrie chartered a vessel of her own. And a most devoted third nun was found in La Mère de Ste. Croix, who joined from the convent at Dieppe.

On the 4th of May, 1639, the little flotilla set sail with ten passengers for the service of God in Canada: three Jesuits, three Hospitalières to found the Hôtel-Dieu in Quebec, our three Ursulines, and Madame de la Peltrie. They had hardly cleared the harbour when a new danger appeared, in the form of a hostile Spanish fleet coming up the

Channel. The French were only just in time to sheer off, stand over for the English coast and hug the shore there till the enemy got hull-down astern. The voyage was long and stormy; and just as the last verse of the office was being sung on Trinity Sunday, an alarm of *'Ware ice!* brought all hands on deck to see a berg threatening the destruction of the ship. Father Vimont even gave the general absolution. But La Mère Marie never flinched for a moment. Her letters tell us how carefully she arranged her dress, "so that it might befit her modesty when the end came;" and other witnesses relate how, with one arm round Madame de la Peltrie, she stood foremost to face apparent doom. At the last moment the vessel veered just enough to graze past the berg.

On the 1st of August the nuns were rowed up from the Island of Orleans in the Governor's barge, and landed in Quebec amid the acclamations of the whole assembled colony.

III.

The landing of La Mère Marie de l'Incarnation was indeed an event of deep national importance. She is unquestionably one of the five founders of New France; and her fame with posterity is quite as secure as that of Champlain, Laval, Frontenac or Talon. The little band of colonists could not foresee this; but they recognized her at once as their fellow-pioneer, the leader of the first *religieuses* to answer the call of their new, wild, far-off home. Canadians were then in dire need of men, money and material from the *Mère-Patrie* to safeguard their country's infant life against stark, constricting circumstances. Yet they freely gave a heartfelt welcome to a woman who brought no other wealth than that which is the only inheritance of the saints on earth. Their hopeful faith in her was amply justified by history, both before and since her time. For, besides being one of the five founders of New France, she was the third of three great nuns, whom the three great Latin races brought forth in the service of the Church of Rome, at three most critical epochs. All three had a close affinity of devotion; but this was made effectual in the widest diversity of environment. The Italian, St. Catherine of Siena, was the last of the really mediæval saints; the Spaniard, St. Theresa, was the first great woman leader against the Reformation; while in La Mère Marie colonial France found the Moses and Joshua of what proved to be the Promised Land of Canada.

St. Catherine of Siena is one of the most intimately human and intensely sympathetic of all the saints. She was all things good to every man and woman she could influence; and no one that met her could fail to be influenced by her magnetic moral genius. Her letters are full of plain speaking against ugly sins; yet none are more wonderfully persuasive. She did in very truth become the spiritual "dearest sister" of each correspondent, and the "Slave of the servants of Jesus Crucified;" and no one better understood how many different ways of holiness could lead to the one Heaven, adapted to every variety of character: "in my Father's house are many mansions" is her favourite refrain. The world had need of her in that lax age of sundering strife, which is only too well described in the chronicle of Neri di Donato for 1373:——" . . the Brothers of St. Austin killed their Provincial at Sant' Antonio, and in Siena was much fighting. At Assisi, the Brothers Minor fought, and killed fourteen with the knife. The Brothers of the Rose fought and drove six away. . . . So all Religious everywhere seemed to have strife and dissension among themselves. And every Religious, of whatever rule, was oppressed and insulted by the world. . . . It seems there are divisions over all the world. In Siena loyalty was not observed; gentlemen did not show it among themselves nor outside; nor did the Nine among themselves, nor with people outside, nor did the Twelve. The people did not agree with their leader, nor exactly with any one else."

The youngest of the twenty-five children of a common dyer of Siena, St. Catherine was only sixteen when she had already lived down the opposition excited by her precocious ecstasies, her visions, her vows and her ascetic practices. Devoted followers began to gather round her; and she threw herself into the work of rescuing errant souls from this mad flux of evil with all the effectiveness of the practical mystic. It was characteristic of her that when she started on a pilgrimage, at the age of eight, she took bread and water with her, lest the angels might forget her on the way. Her success in personal persuasion was the wonder of her own age, as it has been of all succeeding. The consummation of her visions came on the last day of the carnival of 1367, when she was divinely espoused to her Redeemer. Henceforth she knew herself "bought with a price." She had previously become a Dominican tertiary, one of those devout women who live at home under religious rule. She never sought the cloisters; but, on the contrary, became more active in domestic and social life as time went on. She quickly got into touch with people of all classes, all occupations, all opinions. There never was a wider correspondence: with two Popes, several cardinals and many humbler "religious" of both sexes; with the King of France and the concupiscent Giovanna, Queen of Naples; with the reclaimed Brother William of England, and with that redoubtable free-lance, Sir John Hawkwood; with the members of her own humble family, and with others as various as they were many. Yet it was only in 1377, when she was thirty, that she learnt to write. Before this she had been dependent on the secretaries who willingly came to her from every walk of life. She became an ambassador in bonds for the Pope. She went to Pisa and Lucca to persuade these towns not to join an anti-papal league. For the same purpose she went to Florence, where a Papal Legate was flayed alive, and where she just missed martyrdom herself in 1378, to a regret as poignant as Togo felt because Tsushima denied him a victorious death. She was sent as an Envoy Extraordinary to and from the Papal Court, on what were practically international affairs; and at Avignon in 1376 she certainly became a self-appointed Minister Plenipotentiary, and gained her ends by sheer moral suasion. This alone fixes her historical position firmly within mediæval times. It would almost be a modern parallel if the Tzar Alexander II. had sent Father John of Kronstadt to checkmate Lord Beaconsfield at the Congress of Berlin, and if Father John had nominated himself into the chair for the two Peace Conferences at Hague.

By the irony of fate she failed only in world-politics. She bent all her energies, she literally gave her very life, in a vain attempt to unite Italy and the rest of Christendom round the universal Church, centred in Rome and reformed from within. She did, indeed, do more than anyone else to bring back Gregory XI. from Avignon; and Urban VI. began with a fury of reform. But the one had the velvet glove without the gauntlet, and the other the gauntlet without the velvet glove. Besides, the times were hopelessly out of course for the nice re-adjustment of temporal and spiritual affairs from the obsolescent mediæval point of view. She was too late and too early for the work on which she had set her heart. She was too late, because the age of St. Francis was the last when any such scheme would have had a chance of acceptance throughout all Christendom. She would have made an excellent Franciscan in all departments of woman's aid, from the revivalizing tours with the saint—which did, within the Church, what Methodists and Salvationists have since done outside it—to the royal interview between "Beatus Ægidius" and St. Louis, whom she would have found a far more kindred spirit than the other King of France to whom she wrote. She was too early, because no Luther had yet aroused Loyola and Theresa to lead a counter-reformation in that part of Christendom which was naturally Roman Catholic by temperament and circumstances. And, in her own generation, she could have little affinity with the intellectual Joachites, the followers of the holy Joachim da Fiore, who thought the Church had not always been the same, and that it should develop dynamically in adaptation to the needs of a changing world. The Joachites were, in fact, empirical evolutionists, and not favoured by the upholders of static religion. Had they published a manifesto it might have waited till our own day before getting the stamp of *Nihil obstat, Imprimatur.* Protestants might suppose this privilege would never have been granted at all. But let them look at *The Priest's Studies* of Dr. Scannell, which actually recommends works based on the theory of evolution as applied to theology, and which passed the censor with flying colours in the very year of the "Modernist" Encyclical.

And so this most human of saintly women died at thirty-three, the very age of Christ, heart-broken at having failed in her Church-and-State reform; but leaving an example of mediating service between God and man that will quicken individual effort to the end of time.

St. Theresa's worldly circumstances were entirely different. She was born in 1515, of aristocratic family, at Avila, in gallant, proud, sententious Old Castile. As a child she had the true Don Quixote love of books about knight errantry. At seventeen she was a pretty *débutante;* and doubtless spoke the language of mantilla, fan and eyes as well as others of her sex and people. Even when she entered the local Carmelite convent of the Incarnation, she acquiesced, though with qualms of conscience, in the rather worldly intercourse that went on there. "For twenty years I was tossed about on a stormy sea in a wretched condition; for, if I had small contentment in the world, in God I had no pleasure. At prayers I watched the clock to see it strike the end of the hour. To go to the oratory was a vexation, and prayer itself a constant effort." It was only in her fortieth year, after her father's death, that the sight of her Saviour's wounds struck her so intensely that she fell in tears before the crucifix, while every worldly emotion died within her. In vision she saw herself as a clear but formless mirror, which shone with the inner light of Christ. She felt his bodily presence so constantly that she named herself Theresa of Jesus. An angel then appeared and pierced her heart with a fire-tipped lance; a mystic act which became a favourite subject with religious artists, and is still represented in the frontispiece of all her books of devotion. She immediately began reforming the Carmelite practice, and, of course, met with strong opposition. Finally, in 1562, she opened a little house of her own in Avila, with four poor women living under the strictest rule. Here she spent her five happiest years, following every self-denying precept, and writing her immortal works. Philip II. valued her manuscripts so highly that he kept them in the richest cabinet in the Escorial, and always carried the key about his person. She died in 1582, and was canonized by Pope Gregory XV. forty years later.

There are many curious links, historical and psychological, connecting these three saintly women with each other and with their religious affinities. St. Theresa, who did so much of the woman's work in aid of the Jesuit efforts against the Protestants, was canonized in the same year as Ignatius Loyola. La Mère Marie has been the accepted *Ste. Thérèse de l'Amérique* ever since Bossuet first called her so; Pope Paul III. told the Jesuits he was giving them sisters when he approved the institution of the Ursulines; and Jesuits and Ursulines worked together as the pioneers of education and conversion in the early days of Canada. St. Catherine of Siena is the true psychological link between St. Theresa and St. Francis, and the Franciscans were the first of all missionaries to America, whither they went with Christopher Columbus on his second voyage in 1493.

Instances might easily be multiplied; and many comparatively trifling coincidences added, such as that Diego de Yepez, Philip II's confessor, published the Life of St. Theresa in 1599, the year La Mère Marie was born. But what is most significant to the Church's universal work is that the three women were not really so much alike as complementary. St. Catherine was of lowly origin, only learnt to read after she was grown up, and to write three years before her death. She embodied the best traditions of mediæval sanctity, and yet was almost Pauline in her exhortation and persuasiveness. St. Theresa was highly born, well educated, and the first of modern female saints. She did not write so much to exhort and persuade directly as to reveal and justify. She did not live in the tumultuous world as St. Catherine did, and her only statesmanship took the special form of expanding and consolidating her Theresian Carmelites. The St. Catherine we know from her quick-worded letters is a woman appealing to soul after soul to help the Mother Church with their own salvation and re-union. The St. Theresa of the autobiography and *El Castillo interior* is a steward of the mysteries of God, a high priestess who enters the Holy of Holies alone, and afterwards re-tells to the faithful the message revealed to her beside the Ark of the Covenant, in presence of the Cherubim.

La Mère Marie was neither highly nor lowly born, though very well connected on her mother's side. She was more statesmanlike than St. Catherine, more practical in worldly matters than St. Theresa. They were of mediæval and modern Europe: she was a pioneer and missionary in the sternest of the New-World wilds. There, when the colony was still in its impressionable youth, her cunning hand fashioned the moulds for the same work that her two sister saints had done within their own spheres of usefulness, and fashioned them in a spirit at once akin to and adaptively different from theirs. Her pen, too, completed their accounts of Church activities, from a nun's standpoint, by telling the first story of convent life in North America. It is true that she wrote no formal work, and that her letters are rather documents than history. And it must be admitted that her writings are not, and never will be, French classics, as St. Catherine's are Italian classics to a certain extent, and St. Theresa's are Spanish classics altogether. They are just a little like very good dispatches, and by just so much they miss the saving grace of a native style. They were generally written under great pressure of time, amid many distractions, and partly as reports. So their very nature prevents vivid presentation, and keeps them on the lower literary level of description. The spiritual passages are always excellent; but here the lack of a sustained context and of the trained instinct for the one inevitable word combine to prevent the expression from doing full justice to the ideas. The saint, in fact, was greater than the author.

It is her life, rather than her letters, that is the important point even to-day. And this was of still more importance at the time she came to Canada. For she came as the inheritor of a great tradition, as the third of a trio of nuns who played a great interdependent part in the history of their Church, as the foundress of the first convent, as the first educator of Canadian girls, and as the first white woman to evangelize the Indians. And what heightened the importance of all this was that the French-Canadians were then, as they are now, by tradition, training and consent, the most Roman Catholic community in the world. She had no dire troubles within the Church to strain her heart to death, as St. Catherine had; no challenging Protestants to confute, like St. Theresa. Her spiritual warfare was the universal one against the powers of evil, and her earthly work was against savagery and the forces of nature. In both she was prepared to acquit herself excellently well. And her landing at Quebec was indeed an event of profound significance.

IV.

Quebec was then but a tiny outpost on the edge of an unknown, illimitable wilderness. It had been in precarious existence for only some thirty years. Its founder, the staunch and pious Champlain, had died a little over three years before, leaving it with barely a hundred inhabitants. It had only three small public buildings, Fort St. Louis, the store-house of the *Cent Associés*, and the parish church of Notre Dame de la Recouvrance, from whose belfry he caused the angelus to be rung three times a day—a custom still religiously observed in Quebec. Beyond this one narrow foothold of France, on the mighty river which came from no one knew what vast inland wilds, Canada was little but a name. Only ten years before La Mère Marie arrived, the Kirkes had taken Quebec without a blow; because they had a handful of men to serve the few tiny guns aboard their two little ships, while Champlain despaired of standing a siege on a barrel of fish and half a dozen sacks of potatoes. New France had hardly become even a footnote to history. With what an airy charm of royal condescension does Charles I. add the unconsidered trifle of "The County and Lordship of Canada," to the *other* estates of good Sir William Alexander, Earl of Stirling and Baronet of Nova Scotia!

But, among her few, Quebec counted almost as many heroes as early Rome or Sparta. And bravest of the brave, the Jesuits. Here was an untamed, new, defiant world to wrestle with. And here the Church, Antæus-like, rose stronger from each fresh contact with the primal earth. Nothing could stop her indomitable pioneers; neither cold nor heat, hunger, thirst and fatigue; not the lurking danger which dogged their every step, nor the fiendish death by torture which so many of them suffered; nor yet the silent, awful isolation in which their work was done. They crossed a waste of waters to enter an even wilder waste ashore. Quebec was, in fact, as much a point of departure and landfall for an inland journey as a coast sea-mark is for an ocean voyage. Within each new horizon, far and near, the forest veiled the mysteries of Earth as closely as the sea; and, like the sea, lay still in calm, or surged in wash and back-wash of green surf beneath the storm. And, whether in calm or storm, it closed impenetrably round each man who ventured within its labyrinthine depths. The Iroquois—so tiger-like in craft, stealth, spring and wild ferocity—filled with mortal dread everyone else whose way led through the woods. But not the Jesuit. He had no human hand to help him there; yet the bravest soldier was never more confidently eager at the front. As, in the time of Cæsar, every Roman legionary knew that the might of a whole empire lay waiting for his call at need; and as, in Nelson's day, every blockading British man-of-war went boldly into action, single-handed and against any odds, sure that every consort would soon be sailing to the sound of the cannonade; so every Canadian Jesuit pressed forward undauntedly, among all the ambushes and strongholds of a pitiless foe, ever upheld by the confident belief that he was no mere lost and isolated man, but one of the pioneers and vanguard of the advancing army of the Lord of Hosts.

The Ursulines held their first triennial election, and their choice naturally fell on La Mère Marie. Their first convent was a mere hovel, near the site of the present Notre Dame des Victoires, and their first Indian school in it was broken up by a terrible attack of small-pox. In 1641, the first stone was laid on the site of the present convent. But the next spring Madame de la Peltrie, burning to carry the cross still further into the wilderness, followed Maisonneuve to the founding of Montreal, and left the Ursulines of Quebec almost penniless in their half-finished building. Even M. de Bernières answered La Mère Marie's appeal by advising her to send away her pupils and workmen, give up everything and come home, unless Providence should raise up a second benefactress. However, she immediately wrote back to say that having once put her hand to the heavenly task she would never give it up alive. She kept her Indian pupils, urged on her workmen, and, in every detail of duty and leadership, plainly showed how fully confident she was that Canada was only at the beginning of assured success, instead of at the end of utter failure.

After an absence of eighteen months Madame de la Peltrie came back, never again to leave Quebec. She found the new convent inhabited, the school open, and La Mère Marie as full of determined hope as ever. There was little comfort in the new home, a building 92 feet long and 28 feet wide. Two open fires barely took the frost out of the air—stoves were only introduced twenty-six years later. Yet the devoted life went on with increasing vigour. New nuns came out: some from the mother-house at Tours; another from Ploërmel, in the Breton "Land of Pardons." In 1648 the convent was at last finished, after seven years of hard work and much anxiety from lack of funds.

Meanwhile, Quebec grew slowly: half mission, half trading post, and wholly bureaucratic. On New Year's Eve, in 1646, the first play performed in Canada, Corneille's *Le Cid*, was given before the Governor and the Jesuit Fathers. Two years later the Governor-in-Council appointed Jacques Boisdon—bibulous cognomen!—first and sole innkeeper, on the following conditions:—"That the said Jacques Boisdon settles in the square in front of the church, so that the people may go in to warm themselves, and that he keeps nobody in his house during High Mass, sermons, catechism or vespers." In 1663, the population had increased to 500 souls, of whom 150 belonged to the religious communities.

The thirteen disastrous years from 1650 to 1663 were the nadir of Canada's fortunes. More than once the colony nearly lost its flickering life altogether. The Iroquois scourged the land like a plague. Not a man was safe outside a fort. All that were left of the once powerful Hurons crouched miserably under the protection of Quebec. La Mère Marie was ever foremost in succouring them and bringing their children into her school. She took lessons herself in Huron from Father Bressani, who had escaped death at the hands of the Iroquois as by a miracle, after having suffered the extremity of torture. But, just as her classes were well established, the convent was burnt to the ground. The nuns hardly escaped with their lives, running out barefooted and half-clad into the intense mid-winter cold. La Mère Marie issued her orders as calmly as if going through her regular routine. She went all over the building to make sure that everyone was safe, paused one reverential moment before the altar, and then walked out as the flames met behind her.

Next day the Hurons assembled in full council to see how they could help the "Paleface Virgin Saints." To their grief they found that the whole merchantable wealth of their nation now consisted in two long strings of porcelain beads, each containing twelve hundred. But, headed by their chief, they went in procession to the Hôtel-Dieu, where they were received by La Mère Marie, surrounded by her Ursulines, the Hospitalières, and Father Raguenau, who records the address delivered by Taicaronk. "Saintly sisters, you see here but the walking corpses of a mighty nation, which is no more. In the country of the Hurons we have been eaten and gnawed to the bone by famine, war and fire. Alas! your misfortune recalls our own, and with your tears we mingle ours. In our old home the custom was to give one present to unfortunates like you, to dry their tears, and then another to fortify their hearts anew. All that we have we offer you. First, a string of beads to comfort you, and root your feet so firmly in this land that all your friends across the great water will never be able to draw them out and take you away. And next, another string, to plant a new House of Christ to outgrow the old one, and be a place of prayer and teaching for our children." After the chief had ended there was a long, sad silence, before La Mère Marie responded in words which breathe the very spirit of the Book of Ruth. She told the Hurons how she never would desert them, but fill her days with willing service for their need, and how, when she died, her body would remain among them in Quebec, as her heart and soul did while she was alive.

Other friends pressed to her aid. Father Vignal, her chaplain, though now an old man, set to work on the Ursuline farm near the famous Plains of Abraham, and was rewarded by a bountiful harvest, which fed the teachers and scholars for the succeeding winter. Madame de la Peltrie sheltered the whole community in her own house, which was no more luxurious than the convent, though she was a very rich woman. The Governor, the Jesuits, in fact, the whole colony, did everything in their power. But their power fell far short of their good will. Men were scarce, money scarcer; so La Mère Marie and her zealous nuns cleared away the débris with their own hands, and prepared the site for rebuilding. The new convent rose quickly from the ruins of the old. Within a year the nuns were back: all, except La Mère de St. Joseph, whose delicate frame at last had given way under repeated hardships, and whose epitaph might be fitly taken from the letter La Mère Marie wrote home: *Ma douce et angélique amie.*

In 1660 Canada was apparently doomed. Only four years had passed since the Iroquois had swooped down on their prey again, and nearly killed out the last, palsied remnant of the Hurons at the Island of Orleans. The lines of war-canoes had glided snake-like down the St. Lawrence to their vindictive massacre, under the very guns of Quebec, the crews screaming savage defiance at the bewildered Governor, who cowered behind the walls of Fort St. Louis. And now every threatening war-path was once more astir with painted Iroquois, wild for a final glut of blood. The rumour ran that their grand council had decreed the extermination of all the Christians in Canada, and that their whole assembled horde was coming hot-foot down the valley of the Ottawa. Night and day the shadow of death closed in from the vast encircling forest, darkening the terror of suspense. All Quebec stood to arms. The Ursuline convent was garrisoned by eighty men and twelve huge watch dogs, trained to hunt down and tear in pieces the hostile Indians. La Mère Marie, resourceful as ever, told off her nuns to different duties, and reserved for herself the most dangerous of all—the carrying of powder and shot in action.

As Canada turned despairingly at bay, her necessity brought forth a champion, the faithful, undauntable Daulac. He and sixteen others in Montreal volunteered to go up the Ottawa and hold the Iroquois by a life-and-death defence, long enough to let the colony have some time for preparation. At the Long Sault, Daulac was joined by a hundred Christian Hurons under Anahotaha. The allies then took post in an old Algonquin fort, which, unfortunately, was too far from water. Symbol-loving souls afterwards saw a mystical assurance of salvation in the strange recurrence of the sacred number, seven. For seven days and seven nights, seven hundred Iroquois furiously attacked the seventeen Frenchmen who defended the stockade. The attackers fell in heaps under the steady fire. A letter of La Mère Marie's tells how those seventeen fought for Christ and Canada: *Dès que l'ennemi faisait trève, ils étaient à genoux; et sitôt qu'il faisait mine d'attaquer, ils étaient debout, les armes à la main.* Worn out by unceasing vigils and tortured by thirst they still held out. But resounding war-cries announced the arrival of another five hundred Iroquois; and they then prepared to sell their lives as dearly as they could. The enemy advanced and called a parley, during which some apostate Hurons persuaded most of their Christian tribesmen that an immediate change of sides was the only way of escaping certain death by torture. This desertion reduced the garrison to the seventeen Canadians with only eighteen Indians. In the thick of the final assault some Iroquois got in so close that they could chop at the foot of the stockade without being exposed to the fire from the loop-holes. Daulac then tried to dislodge them with a barrel of powder. But this, unfortunately, miscarried. The barrel blew up inside the fort, killed and wounded several of the defenders, and left a breach wide open. The Iroquois at once swarmed in from all sides, though, even then, they could not close with their steadfast opponents. Anahotaha, worthy comrade of Daulac, charged and killed five with his tomahawk. But, as he regained the ranks, he fell, mortally wounded, beside the burning palisade. "Lay my head on the fire," he implored with his dying breath, "the Iroquois must never get my scalp!" Daulac fell next. A last desperate scuffle, and all was over. The Iroquois were dumbfounded at the resistance they had met with and disheartened by their enormous losses. Their next council broke up after deciding that a country defended by such heroes was too dangerous to attack. They slank back to their wigwams, while a contrite apostate Huron escaped to carry the tale of death and victory throughout the waiting settlements. Thus ended Canada's Thermopylæ.

The Colony dragged through the misery of three more years. Then came the memorable earthquake which threatened an almost greater ruin. One effect of this stupendous and widespread upheaval may still be seen at Les Eboulements, where the whole face of a mountain fell headlong into the St. Lawrence. In Quebec the shocks recurred violently for seven months, and the terrified people thought it was the end of the world. The first great shock scared the roisterers at the carnival out of their senses. The second threw all the Ursulines to the ground while they were singing matins. Throughout this long, heart-shaking ordeal trembling women and children kept coming to La Mère Marie, as to the one human sanctuary that could preserve them from the Avenging Angel. Not since the Great Famine, nearly four hundred years before, when long processions of naked Flagellants scourged themselves through every high street and market square in Europe, had there been such universal contrition. The priests could scarcely leave the thronged confessionals, even to eat and sleep. Again the cry of "Back to France!" went up, and was piteously echoed from the whole stricken colony. But two winged souls rose to the foreseeing heights of prophecy, and two clear voices called on the people to stay their panic and have steadfast faith in Canada. One was the voice of Laval, the first bishop, who set a supreme example by founding, in this terrible 1663, the great seminary which still bears his name and carries on his work with undiminished vigour. The other was the voice of La Mère Marie, who, for the third time in her life, stood between a discouraged people and apparent ruin, and nerved them to one more effort for the salvation of their country.

The unshaken faith of both was fully justified. The tide of fortune was already on the turn. This very year New France became a Royal Province. And in 1665 de Courcelles, the new Governor, arrived. With him was his lieutenant, the Marquis de Tracy, and Jean Talon, the great Intendant, well called the Colbert of Canada. The pitifully weak garrison was strongly reinforced by the famous *Régiment de Carignan*, fresh from its victorious Hungarian campaign against the Turks. Two hundred and twelve new colonists of title or fortune came out to take up concessions of land. And, most important of all, perhaps, there was a very much larger number of more humble immigrants, who were destined to a long and successful career under the well-known name of *habitants*. With these arrivals a different régime began. The first great hero-age was over.

V.

La Mère Marie had a deep, though indirect, influence on the new order of things. All the women of the old order had passed through her school, all the girls of the new were her pupils. Her reputation for sanctity and wisdom extended over people of both sexes and all classes. And she never failed to throw the whole weight of this wider influence into the scale on the side of Laval, in his fights for the missionary system against the parochial one favoured by the Governors, and for Indian prohibition against the indiscriminate brandy traffic favoured by the traders. Laval was the living embodiment of the Church militant, and was inclined to stretch his authority rather far over spheres of public influence which are generally understood to be within the province of the civil power. But his missionary system, worked under his own eye, and through his seminary, undoubtedly met the needs of a new and extending population better than the fixed cures which the Governors vainly tried to establish. Laval wanted his shepherds to keep continual touch with him and each other, while they followed their flocks about the ever-opening pastures; but the Governors preferred to find each individual shepherd sitting ready for inspection inside an isolated fold. As for the brandy trade, it was simply debauching the Indians, body and soul. And when La Mère Marie supported Laval on these two burning questions, she proved herself as statesmanlike in the first as she was philanthropic in the second.

Her letters show how many human interests she touched, and with how sure a hand she set each interest in its due relation to her belief and practice. She was an indefatigable writer: in one autumn she sent home over 600 letters. Her correspondents range from Royalty down;

but most of her spiritual letters were to her son or the Ursulines. In theology she had some lively passages with the Jansenists, who did their best to persuade her to adopt their views. But she was an everyday and deeply sympathetic eye-witness of the work of the Canadian Jesuits, and that was enough. In religious advice and prayer she was the constant support of an Ursuline of Tours, whom she had initiated before leaving France, and who was aunt to *cette touchante Duchesse de la Vallière, dont la destinée sera l'éternel attendrissement de l'histoire.* She had special devotions and penances in Canada, on behalf of the errant Duchess, who was, like herself, a native of Tours; and the celebrated conversion at court was held to be greatly owing to the ardent intercessions at Quebec.

She evidently never thought she had any written message to leave to the world. She let all her spiritual memoirs, destined for her son's eye alone, be burnt with the convent, rather than run the risk of letting them fall into other hands in the confusion. Perhaps she felt that the divine afflatus would not take literary form in her as it did in St. Theresa. It is certain that she wrote less and less about the inner life, though her reasons for her growing silence are themselves excellently expressed. "Au reste, il y a bien des choses, et je puis dire que presque toutes sont de cette nature qu'il me serait impossible d'écrire entièrement, parce que dans la conduite intérieure que Dieu tient sur moi, il y a des grâces si intimes et des impressions si spirituelles, que cela ne se peut dire. C'est en partie ce qui me donne de la répugnance à traiter de ces matières, quoique ce soient mes délices de ne point trouver de fond dans ce grand abîme, et d'être obligée de perdre toute parole en m'y perdant moi-même. Plus on vieillit, plus on est incapable d'en écrire, parce que la vie spirituelle simplifie l'âme dans un amour consumant, en sorte qu'on ne trouve plus de termes pour s'en expliquer." Nevertheless, in response to divine orders to comply with her son's renewed appeals, she rewrote the lost letters, on condition that he promised not to show them to anyone. Dom Martin has a prettily turned simile to express their influence on his life—"ces grandes grâces m'excitent à suivre ses traces, comme l'aigle mère excite ses aiglons à voler après elle."

Though her worldly interests were always strictly subordinated to her spiritual ones, she wrote many admirable letters on public affairs. European news is discussed with a good knowledge of its bearings on Church and State. The troubles of the Fronde, the peace of the Pyrenees, the death of Charles I. of England, all find their place in her correspondence. But Canada comes first. Indeed, her letters in 1654, 1655 and 1656, form the best documentary history of those troublous years. She notes the natural wealth of the country and the abounding fertility of the population. "M. Boucher a dit au roi qu'on peut faire au Canada un royaume plus beau et plus grand que celui de la France. C'est là le sentiment de ceux qui disent s'y connaître. Il y a des mines en plusieurs endroits; les terres y sont fertiles. Il y a surtout un grand nombre d'enfants; ce fut un des points sur lequel le roi questionna le plus M. Boucher. Un pauvre homme en aura huit et plus, qui l'hiver vont nu-pieds et nu-tête, avec une petite camisole sur le dos, qui ne vivent que d'anguille et d'un peu de pain; et, avec tout cela, ils sont gros et gras." No doubt some of these eels came from the Ursulines' fishery at the Anse des Mères, just above Cape Diamond. How many little *habitants* are still to be found in one family, and how many of them still get "gros et gras" on this very warming winter diet! Who that knows the story of the French-Canadian will dispute the wisdom of this: "Au fond, tandis que les habitants s'amusent à la traite des castors, ils n'avancent pas tant leurs affaires que s'ils cultivaient le sol et s'attachaient au trafic de la pêche et des huiles de loups-marins et de marsouins." La Mère Marie knew a good deal more about the future of Canada in the seventeenth century than Voltaire did in the eighteenth, with his *quelques arpents de neige.*

Nothing useful is too small for her attention, nothing great too difficult for her judgment. She sends home to Tours "une certaine bourre qui ressemble au coton, afin de tenter en plusieurs façons ce qu'on en pourrait faire." There spoke Marie Guyard and Madame Martin. And here, again: "C'est une chose merveilleuse d'entendre parler de la beauté et de la bonté de ce pays-là . . . . les épis ont une grande coudée, et chaque épi donne plus de quatre cents grains." "Sa Majesté nous a donné deux belles cavales et un cheval, tant pour la charrue que pour le transport." Talon's introduction of new industries—weaving, tanning and others—excites her warm approval, and she rightly concludes that "le pays est plus fait et les affaires ont plus avancé depuis que M. Talon est ici, comme intendant, que depuis que les Français y habitent." The Marquis de Tracy is equally praised for excellence of another kind. "Nous allons perdre M. de Tracy . . . . Cette nouvelle Eglise, et le Canada en général, perd plus en lui qu'il n'est possible de dire; car il a mené à bonne fin des expéditions qu'on n'aurait jamais osé entreprendre ni espérer." Marie was emphatically a woman of light and leading, both in Church and State.

With the Indians she was, of course, thoroughly at home; and the wisdom of many bluebooks is concentrated into her pithy comments on the grand-paternal royal edict which ordered them to be immediately "civilized," as well as christianized. "They must see the woods and follow their parents to the chase. It is the nature of the Indian. He cannot submit to constraint. Loss of liberty makes him sad, and sadness makes him sick. We have more experience on this head than anyone else, and we freely confess that we have not civilized one in a hundred. Nevertheless, if it be the will of our Sovereign, we shall attempt the task." On the other hand, she can find no words too strong to explain how successful the nuns were in converting them. "Quatre d'entre elles communièrent à Pâques; elles s'y préparèrent avec tant de désir de s'unir à Notre-Seigneur, que, dans l'attente de le recevoir, elles s'écriaient: 'Ah! quand sera-ce que Jésus nous viendra baiser au cœur.'" 'Thérèse la Huronne' was faithful through three years of captivity with the implacable Iroquois, during which she openly confessed to her fellow-prisoner, Father Jogues, though she saw him tortured in a way that might have shaken many a stout heart. These five were Indian girls who had been a considerable time under convent influences. But the full-grown braves and squaws, once converted, were quite as staunch. The baptismal rite appealed to them with peculiar force, as the conditions under which its liturgy originally reached full growth in the fourth and fifth centuries were being reproduced in Canada. The Indians, like most early converts, came straight from ingrained adult Paganism. And so their initiation was very different from the short and simplified ceremony through which the infant heir of Christian ages is taken to-day. The Ursulines often gave the first instruction to the *audientes*. Afterwards came the immediate preparation of the *compétentes*: a lenten education in the new supernatural, in which great emphasis was laid on exorcising the demons of the old. The command *dæmonia ejicite* was never forgotten. And no sooner were the heathen demons cast out by many ritual solemnities, than the Jesuits warned the catechumen against the myrmidons of Satan, who took the warpath against unwary Christians. The good Fathers believed in object-lessons, and several times sent urgent messages to France for pictures of still more terrifying devils. Finally, the brave was baptized, during the regenerating joys of Easter, and sent forth, with the armour of Christ fast girt upon him by all the symbols of the Church.

La Mère Marie often encouraged the braves to give their own views on Christianity: "et lorsque j'entends parler le bon Charles Pigarouich, Noël Négabamat ou Trigalin je ne quitterais pas la place pour entendre le premier prédicateur de l'Europe." No legitimate means of conversion were neglected. She nursed the sick, quite in the spirit of Luke, the beloved physician. And though there probably were some "blanket Christians" in that as in other ages, yet she never had cause to regret her continual hospitality. "Comme la faim est l'horloge qui leur fait juger de l'heure du repas, il nous faut songer à ceux qui peuvent sur-venir, et tenir de la sagamité toujours prête." On the contrary, she found a genuine aid to conversion even in the serio-comedy of a regular *festin de gala*. "Pour traiter splendidement soixante ou quatre-vingts de nos sauvages on y emploie environ un boisseau de pruneaux noirs, quatre pains de six livres pièce, quatre mesures de farine de pois ou de blé d'Inde, une douzaine de chandelles de suif, deux ou trois livres de gros lard, afin que tout soit bien gras, car c'est ce qu'ils aiment. Voilà ces pauvres gens contents et ravis d'aise, bien qu'il y ait parmi eux des capitaines qui, à leur égard, passent pour des princes et des personnes de qualité. Ce festin, qui leur sert tout ensemble de boire et de manger, est un de leurs plus magnifiques repas; c'est ainsi qu'on les gagne, et qu'à la faveur d'un attrait matériel, on les attire à la grâce de Jésus-Christ."

The arrival of the Marquis de Tracy inaugurated a more sheltered life for the inhabitants of Quebec. But La Mère Marie was beginning to sink under the strain of the terrible years that went before. Gradually she was forced to give up her activities, one by one. But what she could do she did with a will. She could no longer teach the Indians under the old tree in the garden; so she had them brought indoors. She wrote a sacred history and a glossary in Algonquin, and a catechism for her old fierce enemies, the Iroquois. Her relations with these last blood-thirsty braves had gone through every phase. She had received their ambassadors with all due honour, and made an attempt to convert them. She had stood guard against them when they threatened Quebec. And now, having rightly drawn the sword at the proper time, she was again trying the persuasive arguments of the Church.

In 1671 she received a great shock in the death of her life-long friend. Madame de la Peltrie was suddenly struck down with pleurisy early in November: she took the news that it was fatal with perfect calmness; called in the Intendant Talon, to witness her will, and thanked him with as much grace as if he had been paying her a visit of state. M. de Bernières, nephew of her old protector in France, gave her the last rites; and, on the evening of the 19th, as the *Angelus* was sounding across the square from the parish church, she died, murmuring the words so often on her lips during her illness—*Lætatus sum in his quæ dicta sunt mihi; in domum Domini ibimus.—I was glad when they said, we will go into the house of the Lord.*

The following Easter, the year Frontenac first came out to Canada, La Mère Marie was in the throes of a mortal malady herself. She had all the girls in the convent called into the infirmary to receive her last benediction, which she gave to each one separately as they knelt beside her. She entrusted her last message for her son to Mère St.

Athanase—*dites-lui que je l'emporte en mon cœur dans le paradis.* Nor was public duty forgotten. One of her last acts was to dictate a letter to an influential personage in France, urging the completion of her well-considered scheme for the re-union of all branches of the Ursuline Order throughout the world. To the great regret of everyone Bishop Laval was then absent from Quebec. But the veteran Père Lallemant, who had served in every post of danger since the time of Champlain, gave her the last consolations of the faith. For some hours on the day of her death she neither spoke nor heard—rapt in ecstasy between both worlds. The evening *Angelus* was sounding, as it had for her fellow-labourer five months before, when she opened her eyes for one final look at the Ursulines kneeling round her, and then gently closed them again forever. All who were present saw a ray of celestial light rest on her face as her soul took flight for Heaven, and believed it to signify her consummated union with her Lord. The Ursulines commemorate this to the present day, by singing a special *Te Deum* on the last night of each recurring April. Père Lallemant preached the funeral sermon, pronounced the benediction, and the congregation dispersed. Then the Governor and Intendant, with the clergy and nuns, approaching the bier, were so struck by her expression that they sent for an artist to perpetuate it. The original of this portrait was burnt in the second fire; but a contemporary copy sent to France was afterwards returned to Canada, and is now in the convent. The portrait taken, the coffin was closed and this inscription placed upon it: *Ci-gît la Révérende Mère Marie Guyart de l'Incarnation, première supérieure de ce monastère, décédée le dernier jour d'avril* 1672, *âgée de* 72 *ans et* 6 *mois. Religieuse professe, venue de Tours. Priez pour son âme.*

The night she died in Quebec her Ursuline niece in Tours distinctly saw her laid out in a winding sheet, while a voice breathed close by, "Elle est morte." The other nuns were averse from believing this story next morning; but the first ship from Canada brought the confirmation of it. The whole Ursuline Order deplored the loss of such a saintly life. The Jesuits and all who knew her bore equally ready witness to her surpassing virtues. While Dom Martin's filial piety and religious zeal prompted him to publish her life and letters a few years later: "C'est ici un livre de reconnaissance envers Dieu et de piété à l'égard d'une personne à laquelle je dois, après lui, tout ce que je suis, selon la nature et selon la grâce."

Her cult began forthwith and has grown ever since. Fifty years after, Father Charlevoix hoped to hasten the day of her beatification by a new account of her merits. In 1752 a Quebec Ursuline writes: "Nous avons eu quelque espérance de voir notre vénérable mère mise sur les rangs pour la béatification; mais la personne qui avait pris la chose à cœur n'est plus. . . . ." And so it went on, at intervals, for more than a hundred years. Everyone who examined her life freely admitted that she ought to become Ste. Marie de l'Incarnation, yet nobody appeared with sufficient influence at Rome to get a place on the calendar for this remote Canadian saint. In 1867, the year of Confederation—so long ago as that—Archbishop Baillargeon of Quebec succeeded in getting her cause definitely begun. Some of the *lettres postulatoires* sent to Rome on her behalf are rather remarkable documents. The Canadian Zouaves, who went to uphold the Temporal Power in 1870, might perhaps be expected to address Pio Nono thus: "Nous, laïques, aimons à signaler que cette grande servante de Dieu est venue la première arborer sur nos plages le drapeau de l'éducation chrétienne, et que cette éducation, perpetuée par les imitatrices de son zèle, fait les femmes fortes et chrétiennes dont notre jeune pays se glorifie. Très-saint père, c'est au nom des mères chrétiennes qui ont donné leurs fils avec tant d'amour et de générosité pour la défense du saint-siège, que nous demandons avec instance la béatification de la Mère Marie de l'Incarnation." But the following is a curiously telling appeal, coming as it does from the cabinet ministers of Her Britannic Majesty for the Province of Quebec: "L'action bienfaisante de son œuvre se fait encore sentir de nos jours, et est pour toute la province une source de biens incalculables à tous les points de vue. . . . . . Chargés d'une grande responsabilité dans le gouvernement de cette province qu'habita la Mère Marie de l'Incarnation nous sentons le besoin de nous appuyer sur son intercession pour bien remplir les devoirs qui nous incombent." In 1877, she was pontifically declared 'venerable.' But for thirty years more the process for her beatification—which the Quebec Ursulines longed for even before the British conquest of Canada—has not been ended in her favour. Yet it was known to be in its final stage of all in 1907. No wonder the faithful Ursulines are on the tiptoe of expectation for the latest news from Rome!

The process may have been wearyingly long; but what French-Canadian, viewing her with the transfiguring eye of faith, could ever have doubted the result? The impulse towards sanctification has come spontaneously, and from the mass of the people, who still feel the exalting touch of this most effectual mystic. No doubt she had a share of personal faults and human failings. An age like ours would not be lenient in criticising either. But—unless all tradition, record and corroboration be untrue—even our age cannot deny her a befitting eulogy. Her actions and outlook were certainly bounded by the limitations of her Church. But, within those limits, she gave new lustre to the golden truth that there is more variety in virtue than in vice. And we Canadians of 1908, who are now entering the fourth century of our country's history, who, like the rest of mankind, prefer amusement to interest and incident to character, and who are now more than ever apt to mistake comfort for civilization:—we, in this twentieth century, can certainly not afford to neglect the example of all the zeal, devotion and self-sacrifice which went to the making of that well-wrought career.

VI.

La Mère Marie's influence has always remained inspiringly alive; and the tradition of her service has been greatly strengthened by many personal links between the passing centuries. Only three nuns had died during the first Ursuline generation; and some of the twenty-five on the roll in 1675 lived long enough to connect Frontenac's first administration with the first capture of Louisbourg in 1745.

Indian converts were as eagerly sought for as ever. Frontenac used to bring back the brightest Iroquois girls he could find whenever he went to Kataraqui, where Kingston is now. The Algonquins, Abenakis and Hurons were in still closer touch with the convent. The books of the "Séminaire," as the Indian classes were always called, contain many entries like these. "On the 15th of July, 1682, Marie Durand left the seminary after having been provided with board and clothing for a year." "La Petite Barbe, of the Mohawk tribe, who has been six years in the seminary, has returned to her parents at Ancienne Lorette." In 1686 an Indian girl called Marie Rose laid the foundation stone of a new wing; she was "dressed in white and represented the Infant Jesus." An Abenaki called Agnes Wes-k-wes even found the call of the cloister more compelling than the call of the woods. Only death prevented her from taking the veil; and the fame of her piety drew every Christian Indian near Quebec to her funeral.

Within four months of the day the corner stone for this extension was put in position the convent was burnt again. A brave lay sister, Marie Montmesnil, nearly lost her life in rescuing the precious relics. The *Hospitalières* again offered shelter in their cloisters, where the Ursulines intoned a *Laudate* and sang a *Memorare* to their perpetual superior, the Blessed Virgin, in token of resignation and thanksgiving. The *Hospitalières* greatly cheered the homeless Ursulines by remembering to make a special celebration of the feast of St. Ursula the following day. As before, every one in Quebec showed the greatest kindness, and a return visit of acknowledgment was headed by the Mother Superior, who called on the Marquis de Denonville at the Château St. Louis and on the Intendant at his palace. After going to see the eight sisters who had remained on guard in an outbuilding of the burnt convent, the little deputation re-entered the Hôtel-Dieu, and their records state that "the peace of the cloister was delightful after a day of such fatigue and dissipation." In November they all went into Madame de la Peltrie's house, near which a barn was converted into a temporary chapel, "not"—as their annalist quaintly says—"in the style of the Renaissance, but in that of the Naissance." The makeshift cloister and chapel were all that was most uncomfortable. "I see everything here to make you suffer," said the kindly bishop. The nuns, however, rejoiced at re-union under any circumstances: *Ecce quam bonum et quam jucundum habitare fratres in unum.*

1689 was a year big with the fate of empires. The Great Imperial War between France and England had just begun. It was to be renewed at intervals for more than a century, to culminate in both the Old World and the New in 1759, and to continue till Trafalgar had confirmed the British command of the sea for more than another hundred years. In Canada Frontenac began by a bold swift stroke at New England. In the British colonies, Peter Schuyler was formulating the original "Glorious Enterprise" of conquering New France that Pitt found the means of carrying out seventy years later.

In the midst of these wars and rumours of war, the Ursulines completed their present convent and celebrated their first jubilee. All of the original three were dead; but a nun who came out in 1640, and so was in her fiftieth year of service, took part in all the proceedings. Longevity has always been distinctive of this community. At every succeeding jubilee there have been nuns who had already assisted at a previous one. And the senior nun in 1908, the tercentennial year of Quebec, was not the junior in 1839, the bicentennial year of the convent. The Indians were already receding before civilization in 1689; and there were fewer at the jubilee feast than there used to be round the hospitable tables of La Mère Marie. The nearby friendly tribes had begun to wither at the touch of the town; the hostile war-paths stopped farther and farther west. The massacre of Lachine sent a shudder of apprehension through the whole colony. But no Indians ever again threatened the safety of Quebec. Frontenac, on the contrary, carried the war into the Iroquois country. And the Ursulines, who had drawn the sword at need in 1660, did so again for the common good in 1696, by equipping a tiny though efficient contingent of two men. But their favourite weapon was and remained conversion.

In 1690, New England made her counterstroke. On the 7th of October the vanguard of the American fleet was sighted below Murray Bay. Quebec stood aghast, defenceless; for Frontenac was much further off inland than Phips was by the St. Lawrence. The Ursulines were instant in prayer, "seeking in every way to appease the divine judgement and obtain the favour of God for their country." And the townsfolk thought these intercessions had been accepted, when contrary winds so delayed Phips that Frontenac arrived first and flung back defiance at the summons to surrender:—"I have no answer to give, except from the mouth of my cannon." Phips at once began his bombardment, and the convent received its baptism of fire. "The first day a cannon-ball burst through a shutter and finally lodged at the bedside of one of our boarders; another cut a piece of her apron off one of our sisters. Others fell in the garden and court-yard. . . . . Our house was crowded with women and children, so that we could hardly pass to and fro, but had to take our food standing and in haste, like the Israelites when they ate the Paschal Lamb. . . . We lent our picture of the Holy Trinity to be hung on the steeple of the cathedral, to show under whose protection we were fighting." On the 21st—Trafalgar day—the festival of St. Ursula was duly observed. Father de la Colombière seized the opportunity to extol the heroism of the virgin martyrs as worthy of present imitation. And Bishop St. Valier had just intoned, with vibrant solemnity, *Maria Mater gratiæ. . . .* . . . . *Et mortis horâ* . . . . when the hush that followed the benediction was suddenly rent by the crash of artillery. But, this time, Phips was only covering his retreat; and Quebec went wild with exultant joy. Frontenac became a hero of the people, and has remained so ever since. The church built beside the St. Lawrence, on the site of Champlain's *Abitacion,* became *Notre Dame de la Victoire.* And, three thousand miles away, in famous France, *Le Roi Soleil,* in the hey-day of his European renown, commanded a special medal to be struck in commemoration of this Canadian feat of arms—*Kebeca liberata, MDCXC, Francia in nova orbe victrix.*

The 18th century opened with famine, pestilence and war. Fever and small-pox carried off a fourth of the population of Quebec. Funeral knells became so frequent and so depressing to the spirits of the living that they were forbidden altogether. Five epidemics in eleven years scourged the town and turned the convent into a hospital. The last was in 1711, the year Sir Hovenden Walker's armada made its disastrous attempt against New France. The convent resounded with the noise of warlike preparations, close beside the cloisters. The nuns again prayed fervently for the French arms. And the British expedition, ill found and badly led, retired discomfited and alarmed by the many shipwrecks it suffered far down the River. *Notre Dame de la Victoire* was henceforth called *Notre Dame des Victoires.* Two years later the Treaty of Utrecht freed Bishop St. Valier from the Tower of London, where he had been nine years prisoner of war. This time the cannon roared in greeting, and every bell in Quebec was rung as the bishop landed amid the acclamations of the people, who all went down to the water side to bid him welcome home. The convent annals of the 18th of August, 1713, record his first visit to the Ursulines since his captivity. "In the course of the afternoon we had the pleasure of seeing our good bishop and hearing him express his joy. For our part, great is our gratitude to the God of all goodness, who has vouchsafed to grant us such consolation after our long and heavy trials."

In 1708, a very different prisoner of war had appeared at the convent. This was Esther Wheelwright, the twelve-year-old great-granddaughter of John Wheelwright, one of the most honoured of New England Puritan ministers. The child had been carried off in the raid against the little village of Wells, five years before. The Abenaki chief who took her had adopted her; and she had almost forgotten her English when Father Bigot came into the camp on a missionary tour. It was no easy matter to rescue her. An Indian chief thought pale-face prisoners were trophies of war, quite as much as objects of ransom. And it was only after long diplomacy and many seductive presents that Esther was given up to the *Great Captain of the French*, the Marquis de Vaudreuil, who sent her to school at the Ursulines' with his own daughter. Was it the contrast between the savage restlessness of the forest, as well as the civilized restlessness of French society at the Château St. Louis, on the one hand, and, on the other, the calm of the convent, that revived her childish memories of home and school and the happy orchard beside which she was torn away that midsummer morning, more than half her life ago? Who knows? But when the peace that restored the bishop to his diocese had let her family write for her return to them, she had learnt a second separating language, and found a new home and a new faith, and had taken the white veil among the Ursulines as Sister Esther of the Infant Jesus. She petitioned the Governor, as her adopted father, to allow her to make her final vows. The bishop approved; and Father Bigot preached the sermon at her admission. Letters were exchanged with the family, and the portrait then painted for them in her nun's dress is now in the possession of the seventh generation from the one to whose members it was sent.

But Esther was not the only, nor even the first of the Puritan Ursulines. Mary Davis, carried off from Salem in 1686, entered the novitiate in 1698. And, twenty-four years later than this, Mary Dorothea Jordan also found her happiest earthly home in the "House of Jesus," which the French missionaries had so often described to the three little captives among the Indians as the great sanctuary of the "pale-face virgins" in Quebec.

Forty-two years of comparative peace followed the return of the bishop from the Tower. The life of cloister, school and chapel went on with little disturbance from the outside world. Indeed, the outside world of Quebec was more moved by convent interests in 1739 than the convent was disturbed by worldly intrusions. A whole year had been devoted within the cloisters to preparing a *fête* worthy of the centennial year of the Ursuline order in Canada. The community now consisted of fifty-three nuns. Exactly fifty-three had died during the century. And their annalist rejoiced to think there was an evenly divided number to make an antiphon of praise in earth and Heaven. All pious observances were prolonged; all relaxations were shortened; silver plate was melted down to make a sanctuary lamp; and a general "retreat" heralded the approach of the famous first of August. The canons of the cathedral celebrated; the Jesuit Fathers preached; the Bishop constantly attended; and Pope Innocent X. granted an indulgence to all who took part—clergy, nuns and laity alike. The Indians were not forgotten. A special High Mass was celebrated for them, at which they sang the *Kyrie* and *Credo*. A feast of such abundance as to recall the best of those given to their predecessors by La Mère Marie brought their part of the ceremonies to a triumphant close. It was their last great entertainment at the Ursulines'. They had receded much further since the jubilee of 1689. At the time of the next jubilee the world was going very differently, far and near. The French Revolution had begun; a British sovereign had held the allegiance of Canada for thirty years; and the Indians were only at home beyond the ever-expanding frontiers of that *Western Country*, which was, in its turn, to be succeeded by a still farther-off *Far West* before the bi-centennial year had come.

The second quarter of the 18th century was the halcyon day of the old *régime* at Quebec. The kindly Marquis de Beauharnois governed the colony for fifteen years. A great "Father in God" was then bishop, Count Henri de Pontbriand. The *seigneurs* lived in homely affluence among their *censitaires*. One of them enjoyed the manor and vast domains of the baronies of Portneuf and Becancour. His house and chapel bore the insignia of nobility. Royal letters patent gave him "the right of arms, heraldic honours, rank and precedence, like the other barons of the Kingdom of France." His daughter Anne had all the colony could give her in the way of social amenities and distractions. Yet three years of society disgusted her with what she called the "gay follies" of "bowing and courtseying in the middle of an illuminated hall." She became contented only when she took the veil, and could summon the community to its daily duties by ringing the bell at four o'clock in the morning—an office she performed without a break for forty years. Another nun of this period, who came from the most comfortable home the colony then had, was Geneviève de Boucherville, whose father's note-book contains the significant entry:—"The land being mine, I think it my duty to settle there as a means of being useful to society." This anti-absentee landlord, Pierre Boucher de Boucherville, was the father, grandfather and great-grandfather of Ursuline nuns; for, besides Geneviève, three of the next and four of the following generation took the veil. His piety was proverbial, and its memory was kept alive for many years by the custom his descendants had of meeting to hear his "spiritual will" read aloud on the anniversary of his death. They were a long-lived family. Pierre Boucher was born during the life-time of Shakespeare; yet his Ursuline daughter did not die till the life-time of the Duke of Wellington.

The other classes of society shared the novel pleasure of this time of peace and comparative plenty. From the convent windows the nuns could see the snug little whitewashed cottages strung along the Côte de Beaupré—that well-named "shore of the beautiful meadow," which rose two hundred feet or more in one bold bluff from the St. Lawrence, and then, in evenly rising uplands, swept back to the Laurentians, twenty miles away. Or they could look out to the left of this, across the valley of the St. Charles, over a still greater natural glacis, sloping up and up to the blue ramparts of the same Laurentian mountains further west. Here the cottages were clustering round the churches into little straggling villages, which tamed the wild woodlands with fruitful spots of greenery. Or they could see the harbour, in the right foreground of the Côte de Beaupré, with, beyond, the rich Island of Orleans, bearing at first such native produce that the early settlers chose it as the garden of Quebec, and afterwards bearing such crops that every traveller's eye was taken with the scene of bright fertility at this seaward gate of Canada.

The very troubles of that time were those inflicted by prosperity. Church and State cried out against the increase of luxury. There were laments over the good old times of more frugality, when the *habitants* stayed on their farms, instead of crowding the wharves and warehouses to spend their savings, whenever a ship came in from France with a cargo of men's and women's frippery. Young men of more stirring natures turned to the wilds for profit and adventure. The paternal government was horrified to see hundreds of *coureurs des bois* "absent without leave." And the Church was more justifiably grieved to find how many of them were active as "the devil's missionaries" in the brandy trade among the Indians.

An education at the Ursulines' offered the acknowledged corrective to social excesses and the best preparation for the future mothers of the colony. Civil and ecclesiastical dignitaries were always willing to lend their countenance to such a school *fête* as the one recorded in the annals for the 23rd of August, 1752. Geneviève de Boucherville, now nearing her eightieth year, receives the distinguished guests with all the grace of the salon without any of its empty compliments. Duquesne, the last great Governor, and the Bishop and Intendant, with their suites, are there, surrounded by everyone whom the society papers would have mentioned next day, had there been any papers then. At the end of the reception room is a grove, from which the nymphs and shepherdesses issue in procession to greet the Governor-General with a triumphal ode, comparing his services for the king in Canada to those performed by his ancestors for the kings in France. There was no lack of poetastic incense; but Duquesne had won the right of patriotic homage, as had the bishop, who was addressed next. This good prelate's visitations into the further wilderness were duly chronicled in glowing verse. "All Olympus' faded hierarchy" was pressed into unwonted fellowship whenever the occasion seemed to warrant it, and some very quaint "conceits" were the result. When the Quebec Ursulines heard what yeoman service the bishop had done after their Three Rivers sisters were burnt out they gave him a place among the gods of Greece, quite in the effusive spirit of the fashionable pastorals of the day. The translation made for a later generation of English-speaking pupils is even quainter than the original.

Among the gods, if poets' lays are true,
Deeds most surprising were not rare to view;
And all Olympus did the feat admire,
When bright Apollo cast aside his lyre,
Forbore to sing and seized the heavy spade,
Or with the mason's trowel mortar laid.
Like him, my Lord, you put the apron on,
And soften hearts, while you are laying stone.

But very different days were coming; days when the heart of New France was failing it for fear; when the land was eaten up with corruption and gaunt with famine.

Before the middle of the century there came a new Intendant, a man at once so consummate and so outrageous in all dishonesty that even the last hundred and fifty years of public life in the United States and

Canada has failed to produce his superior in villainy. This was Bigot, whose sinister influence is seen even inside the convent, in the letter he wrote the Superior, forbidding her to sell or give away any food during the famine, except through him. A few years later the younger Vaudreuil became Governor-General, and gave the plausible and insinuating Bigot a free hand, while spitefully thwarting the great and incorruptible Montcalm at every turn. No former miseries had been so bad as these; for New France now had worse false friends at home than open enemies abroad.

In 1755 the Ursulines saw their sisters in the General Hospital burnt out, with loss of life. Messages were instantly sent offering a return of the kindness shown to the homeless Ursulines in the previous century; and presently the Hospitalières arrived. One of their number had been burnt alive; another was dying. She was nursed with all possible care in the infirmary, and when she died the Ursulines buried her in their own vault, "in order," as their annals say, "that her ashes, mingling with ours, may serve to make still more enduring that union which has ever bound us together."

The next three years were years of ever-increasing apprehension. The French arms were often victorious; but victory became more and more barren. Braddock's defeat at the Monongahela was the last real check to the British advance. Montcalm's battles were desperate rear-guard actions, in which his skill snatched victory for the time being from forces whose reserves were always closing up the ranks of his enemies and pushing the lines of converging invasion one step further into the doomed colony. The Ursulines were devotedly patriotic, and looked upon race and religion as almost one and the same. The contrast between New France and the English-speaking world was, indeed, a striking one. Not a heretic was to be found in Canada; while Roman Catholic disabilities were a striking reality in England, and the *Bostonnais* were the straitest Protestants in the world. But, even apart from religion, French priests and nuns have always been French of the French abroad; so much so, indeed, that their services to French influence were freely used by atheists like Paul Bert and Gambetta, who agreed that "Anti-clericalism is not an article of export." Montcalm, a frank and unswerving believer, looked upon the final struggle as somewhat of an Armageddon, though he was man-of-the-world enough to know that the British side was not in the service of an Anti-Christ. His Ticonderoga letter to the Superior of the Ursulines shows the bond of sympathy between the cloister and the sword in that great crisis. "Continuès, madame, à m'accorder vos prières et celles de votre sainte communauté . . . . . Je me flatte que celui qui a pris Chouagen saura repousser à

Carrillon les ennemis de la religion. C'est *Dieu* qui a fait un vrai prodige dans cette occasion. Je ai voulu Le servir, je Lui raporte tout, et je reçois avec reconnaissance votre compliment et celui de votre Illustre Communauté."

Day by day new stories of British preparations against Quebec were told through the grille at the convent. The taking of Louisbourg left New France shrunken, starved and isolated in the grip of a hostile sea. Three hundred French ships were taken on the Atlantic that year. No mail came out from France for eight silent months of disappointment. And when Bougainville arrived in the spring of 1759, the convent historian significantly praises his skill and bravery in having "penetrated the enemy's lines." Even the scanty fare usual in the refectory had to be reduced to four ounces of bread a day. Clothes, books, household necessities—everything—were lacking. Montcalm had only a little horseflesh at his dinners, his army was on half rations, the *habitants* often on less. Only Bigot and Vaudreuil fared sumptuously and gnawed the people to the bone.

On the 26th of June the British fleet appeared in the South Channel of Orleans; and the Ursuline annalist that evening closed her entry with the words: "The colony is lost!" From the convent there was a full view of Montcalm's seven miles of entrenchments along the Beauport shore, from the mouth of the St. Charles to the Falls of Montmorency. The British men-of-war could be seen feeling their way into the harbour; Wolfe's soldiers landing in detachments at the Island of Orleans, and afterwards, in great strength, just beyond the Falls. At nine o'clock on the night of the 12th of July the bombardment from the Levis batteries, across the St. Lawrence, suddenly began; and "at the first discharge from the English batteries the convent was struck in many places. We passed the night before the Blessed Sacrament, in such terrors as may be imagined." The next morning the Superior, La Mère Migeon de la Nativité, headed a sorrowful procession to the General Hospital, each nun carrying all she took with her in a little bundle. Ten volunteers remained to safeguard the convent, as best they could, under the brave Mère Davanne, and with the assistance of their chaplain, Father Resche, and two of his friends.

The General Hospital had already become a sanctuary for 800 people, including the nuns of the Hôtel-Dieu, who, like the Ursulines, immediately took the harassing duty of nursing the sick and wounded in overcrowded wards and with hardly any proper hospital appliances. Wolfe's unsuccessful assault on the Heights of Montmorency sent in many patients. Among them was Captain Ochterloney, of the Royal Americans, who had been wounded in a duel the day before; had left hospital to take part in the battle, saying he could never let a private quarrel stand between him and his public duty; had been shot through the lungs while leading his company of Grenadiers, had refused to leave the field after such a defeat, and had been rescued from a scalping party by a French soldier of the Regiment of Guienne. Two days later a messenger came out, under a flag of truce, for Ochterloney's effects, which Wolfe sent in, with twenty guineas for the soldier who had saved him. But Vaudreuil theatrically refused to allow any money to be given for this gallant deed. So Wolfe replied, thanking Vaudreuil, and promising Madame de Ramesay, directress of the hospital, that he would grant her special protection if victory should crown the British arms. This promise soon became known, and the hospital was more crowded with refugees than ever. Towards the end of August Ochterloney died, having been tenderly nursed by the good sisters to the last. And both sides ceased firing for two hours, while Captain de St. Laurent came out of Quebec to announce his death and return his effects.

In September hopes began to revive. It was thought the Canadian autumn would compel the British fleet to raise the siege. Wolfe's restless energy had to be reckoned with. But Montcalm's skill was depended on to keep him at arm's length. And so it might have, though ultimate conquest was only a question of time, if Vaudreuil's meddling counter-orders had not thwarted Montcalm's foresight. Suddenly, on the morning of the 13th, Quebec gasped at the desperate news that the red wall of the British army was on the Plains of Abraham, cutting off the town from the west as the British fleet cut it off from the east. Within four hours the French army had marched up from its entrenchments, formed line of battle, attacked, and been broken in defeat. The Ursulines in the General Hospital saw the fugitives flying for their lives down the Côte d'Abraham and across the valley of the St. Charles. By midday the overcrowded hospital had to receive hundreds more of their wounded friends. At midnight a detachment of wild-looking Highlanders took possession and guaranteed protection. The next morning the British wounded were brought in, and every nook and corner in the hospital and all its outbuildings was filled with friend and foe, now drawn together by the sympathy of common suffering, and become but man and man once more under the ministering hands of the good nuns.

While the Ursulines in the General Hospital were busily struggling to do this service in the thickest of all the crowding horrors of war, the little garrison left behind in the convent was racked by still further suspense. The dire news that Wolfe was on the Plains had reached them early in the morning. Their straining ears had heard the sharp, knelling clap of volley after volley from that steadfast British line; then the confused noise of hand-to-hand fighting, yells that might have come from Iroquois, followed immediately by loud, exultant British cheers, and, as they strained their eyes to see if their ears deceived them, the foreboded truth struck them to the heart when a mob of white and blue and grey fugitives fled in mad haste for the bridge of boats leading back to the French entrenchments. Even as they watched they heard of another disaster from the street beside them. Montcalm had just ridden through St. Louis' Gate, mortally wounded—and this news touched the quick of anguish. Some terrified women, seeing him pass by between two Grenadiers, who supported him in the saddle, had shrieked out: "Oh, Mon Dieu—le Marquis est tué!" And he had tried to reassure them by replying: "Ce n'est rien! Ne vous affligez pas pour moi, mes bonnes amies!" The surgeon told him he had only a few hours to live:—"So much the better. I shall not live to see the surrender of Quebec." But he attended to the last details of his public duty before he let his memory turn to his beloved family circle among the happy olive groves of his home at Candiac. He sent a farewell message to every member; and then, as his life was ebbing fast away, he made his final peace with God. Often, in that dreadful night, he was heard praying and rendering thanks for the consolations of the Catholic faith. Just as the dreary day was breaking he breathed his last.

What desolation met the eyes of the nuns that morning! The seven miles of French defences stretched as usual along the Beauport shore to the heights of Montmorency; but no one manned them. The guns were dumb and deserted. There was no stir of life about the empty tents. Nothing moved along the road which had so lately bristled with ten thousand bayonets. The houses were as desolate as the camp. Death had struck peace as well as war.

Bad news kept coming in all day long. All the other French generals had fallen in the battle, with no one knew how many officers whose daughters were pupils of the convent. In the afternoon the death of two Ursulines was reported from the General Hospital. One was La Mère Charlotte de Muy de Ste. Hélène, daughter of a Governor of Louisiana. She was the convent annalist who lived just long enough to see the fulfilment of her foreboding entry for the 26th of June: "The colony is lost." By a strange coincidence the other was Mary Jordan, a Puritan, whose former compatriots were represented by the American Rangers in Wolfe's triumphant army. But she was "La Mère de St. Joseph," heart and soul, when the battle was joined the day before, and she died, just after Montcalm, as French, as patriotic, and more intensely Roman Catholic than he.

The day wore on, and the nuns in the convent had more time than those in the hospital to realize what a desperate pass the colony had come to. A homeless and despairing people, a broken and fugitive army, and the last half-mile of the rock of Quebec, close beset by victorious forces on land and sea:—and this was all that was left of the Canada they knew!

That night a funeral procession stumbled its way through the encumbered street to the convent, bearing the great and unfortunate Montcalm to his last resting place in the Chapel of the Saints. The town had been in such confusion all day that no one could be found to make a coffin, except an old servant of the Ursulines, "le bonhomme Michel," who wept bitterly as he worked at his makeshift of a few rough boards. At nine o'clock the mourners entered by the fitful glare of torchlight. De Ramesay and every man in the garrison that could be spared from duty were there, with many civilians and women and children. One little girl, who held her father's hand as she felt the awestruck silence when that rude coffin was lowered into the shell-torn ground, afterwards became La Mère Dubé de St. Ignace, and used to tell the story of that memorable night to successive nuns and pupils, down to the Ursulines' bi-centennial year of 1839; and one of her most attentive listeners, both as pupil and nun, is still alive to repeat the tale in Quebec's ter-centennial year of 1908. *Libera me, Domine,* chanted Father Resche and his two companions; while the little choir of siege-worn nuns replied from behind the screen. It was one more fulfilment of the family tradition: *La Guerre est le Tombeau des Montcalm.*

On the 18th Quebec capitulated. Three days later the Ursulines returned to their shattered home. On the 27th an Anglican memorial service was held for Wolfe, in the same chapel where Montcalm lay buried, and the funeral sermon was preached by the Rev. Eli Dawson, chaplain to H.M.S. *Stirling Castle.* The style of this oration is too inflated; but the preacher was right in his estimate of the immense importance of the victory. "Ye Heralds of fame already upon the wing, stretch your flight and swell your Trumpets with the Glory of a military exploit through distant worlds! An Exploit which for the fitness of Address in Strategem, the Daringness of the attempt, and the Spirit of its execution shall take rank with the choicest Pieces of ancient or modern Story in the Temple of Fame, where it remains immortal."

The Mothers winced at the unwelcome necessity of having to yield up their altars to what they thought unhallowed rites. And the conquerors had the usual Protestant predisposition to take the mass for superstitious mummery. But personal experience and many amenities on both sides made each more tolerant after that long, hard winter.

General Murray, now in command of the British army of occupation, quickly won golden opinions by his justice and generosity. He and his men cheerfully gave up a whole day's rations every week for the benefit of the poor, and always paid religious processions of all kinds "the compliment of the hat." And it soon became known that, before leaving for England, Townshend, though obliged to borrow money from the fleet for the needs of the army, had yet sent Bougainville enough to help the French sick and wounded.

Murray established his headquarters in the convent, which was also used as an officers' hospital and had a guard of Highlanders. The sanctity of the cloisters was religiously observed, and not a single complaint was ever made against the British garrison. On the contrary, the officers and men did all they could for the nuns, shovelling the snow for them, seeing they got the best food that could be had, and generally making them as happy as possible under the circumstances. As the winter began to set in the annalist records that the Highlanders, "exposed by the peculiarities of their costume to suffer severely from the climate, became objects of compassion to the nuns, who set to work to knit long thick stockings to cover the legs of the poor strangers." Captain Knox, of the 43rd, records another pleasant amenity in his journal for the 30th of November. "The nuns of the Ursuline convent having presented the Governor and other Officers with a set of crosses of St. Andrew, curiously worked, they were displayed in compliment to this day: in the corner of the field of each cross was wrought an emblematical heart, expressive of that attachment and affection which every good man naturally bears to his native country."

Thus passed the terrible 1759. How different from 1659, when La Mère Marie de l'Incarnation was writing home to France her patriotic congratulations on the Peace of the Pyrenees and the rising glories of His Most Christian Majesty, *Le Grand Monarque* and *Roi Soleil*!

French hopes began to revive with the spring of 1760. The gallant de Lévis was gathering his forces at Montreal; his army was to be joined by all the able-bodied manhood of the country as he came down; and the *Fleur de Lys* was to float from the Citadel again. On the 21st of April Murray ordered all the inhabitants, except the nuns, to leave Quebec. All private property left behind was stored in the Récollet church, on the site of the present Anglican cathedral, watched by two delegates chosen by the townsfolk, and placed under a strong guard. On the 23rd the ice moved down and navigation opened. On the 25th Lévis' vessels began to arrive at Pointe-aux-Trembles; and a desperate struggle was seen to be imminent. On the 28th every British soldier that could be spared from actually manning the walls marched out to prevent Lévis from closing in to the commanding heights at decisive ranges. A desperate fight ensued; far bloodier than the first battle of the Plains, and in a few hours the little British army staggered in, beaten back to its walls, with the loss of more than a third of its numbers. The French army had lost even more men; and the convent was presently filled with the wounded of both sides. Lévis opened his batteries: all the dangers of a siege began again, and at much closer quarters than the year before. The vanguard of a fleet was reported coming up stream under a press of sail. It rounded into harbour after dark; and a French officer on the Beauport shore sent off a message to Lévis to say the French reinforcements had arrived at last! The rumour flew round and fired the besiegers to instant action. But just as they were about to carry the town by assault they found they were mistaken, and that the whole British fleet was coming to relieve Quebec and cut off their own retreat. They at once raised the siege, retired in all haste on Montreal; and there, brought to bay by irresistible forces on land and water, they laid down their arms forever. Three years later the convent annals record the momentous change of sovereignty in these few and simple words:—"On the 24th of May, 1763, a treaty of peace was signed between the Kings of France and England. Canada is left to the English. God grant religion may continue to flourish there!"

This devout wish seemed at first destined to disappointment, in the sense desired by the annalist. The good and great Bishop de Pontbriand died before the final surrender, and the Canadian branch of the Church was bereft of its ordinary head, at the very time that the State was wrested from its *Mère-Patrie*. For eight years, from 1758 to 1766, not a novice joined the thinning ranks; and the novitiate, consequently, soon ceased to exist. "To add to our difficulties, all commerce with France is forbidden: yet what credit could the Canadian merchant, even if not already ruined, hope for in London? And how many articles of prime necessity, especially for the Church and altar, and for the apparel of persons living in religious communities, are no longer to be found on the list of English manufactures, since their proscription by the law of the land!"

However, the nuns faced every privation with undaunted courage. They did Indian bark work, which they sold to the British officers' families. Perhaps they were taught by Esther Wheelwright, who was elected Superior in 1761, and who might still have retained the art she learnt in her five years' wanderings in the forest, between her Puritan home and the convent. They earned a little money from their own people by embroidery and gilding and other work useful in restoring religious service in the ruined churches. They were poorer than they had ever been, even in the worst days of a hundred years ago. The present of a little seed grain is thankfully recorded as likely to enable them to tide over the next winter without losing their pupils.

In 1761, there were 37 boarders, and English names appear for the first time. Some years later the annals say:—"It has been a great consolation to us, in the midst of so many difficulties and trials, to see our classes always well filled, there being often as many as sixty boarders, French and English. The latter are naturally very gentle and docile; but it is sad not to be allowed to bring them up in our Holy Faith." There are very few Anglo-Canadian families, of any social standing during the first century of British rule, whose daughters did not get at least some of their education from the Ursulines. And was not St. Ursula herself the daughter of a Prince of Britain?

1766 was a turning point in Ursuline history. The novitiate was re-opened; Monseigneur Briand, the Vicar-General, arrived out after being consecrated as fourth Bishop of Quebec; and the foundress of their Order was beatified as St. Angela of Merici. "The happy event was celebrated with as many outward demonstrations of joy as if the whole country had still been under Catholic rule." The breach between French and French-Canadian public life was already widening. In 1767, La Mère Marchand de St. Etienne writes to the Ursulines in Paris: "The news we have had from France this year grieves us profoundly. Although expatriated by the fate of war our hearts are as French as ever, and this makes us doubly sensitive to the decline of that dear motherland. I cannot help saying that it is as well to be in Canada, where we enjoy the greatest tranquillity. We are not in the least molested on the score of religion. We have a Governor, who, by his moderation and benignity, is the delight of every one, and a bishop who is the joy and consolation of his flock." This juxtaposition of British commander-in-chief and French-Canadian bishop speaks for itself. A little later on La Mère de St. Louis de Gonzague writes:—"Religion is perfectly free. People say it is not the same in Paris, where religious communities suffer persecution. We are told that you were even obliged to celebrate the beatification of our Blessed Mother Angela in secret. We have no such difficulties here under British rule."

In 1773 the Jesuits, hereditary friends of the Ursulines, were suppressed in France. In 1774 the British Parliament passed the Quebec Act, favouring French-Canadian rights and privileges. In 1775, an army of American Revolutionists invaded Canada and besieged Quebec. Bishop, clergy and nuns all saw the peril of intolerant assimilation staring them grimly in the face; and all stood as firmly British as they did against the third American invasion, in the war of 1812. And in 1799, when Monseigneur Plessis preached a sermon in the Basilica to celebrate Nelson's victory at the Nile, no church in Canada responded with heartier alacrity than the Ursuline chapel to the Bishop's *mandement* ordaining a general thanksgiving for the blessings ensured to the French-Canadians by the just laws and protecting arms of the British Crown.

And this appreciation of British right and prowess was not wrung from any assemblage of mere frightened women, cowering for protection beneath the first strong hand; but sprang spontaneous from the well-proved heroines of three sieges and four battles.

VII.

St. Ursula is reverenced in the cloisters as a great patroness of learning. St. Angela founded the Ursulines as a teaching order in 1537. And La Mère Marie de l'Incarnation and her successors have always looked upon their school as the prime object of all their work in Canada. Ursuline teachers and boarders are always drawn from the best social classes in their respective communities; and these female Etons exert considerable influence in different parts of the Roman Catholic world, with their 500 convents, their 12,000 nuns, and their 100,000 pupils.

Quebec society offered a fair field and much favour to the Ursuline teachers in the 18th century. Charlevoix found it very much to his taste in 1720. " . . . . . a little world where all is select. . . . . . A Governor-General with his staff, nobles, and troops; an Intendant, with a Superior Council . . . . a Commissary of Marine, a Grand Prévôt, a Grand Voyer; a Superintendent of Streams and Forests, whose jurisdiction is certainly the most extensive in the world; merchants in easy circumstances, or at least living as if they were; a bishop and a large staff of clergy; Récollets and Jesuits; three old-established communities of nuns; and other circles almost as brilliant as those surrounding the Governor and Intendant. . . . . There are abundant means of passing the time agreeably. . . . . Current news is confined to a few topics. News from Europe comes all at one time; but then it lasts a whole year. . . . The arts and sciences have their turn, so that conversation never languishes. The Canadians breathe, from their earliest years, an air of good will which makes them very agreeable in social intercourse. Nowhere else is our language spoken with greater purity. . . . There are no really rich people here. . . . Very few trouble themselves about laying up riches. They live well; that is, if they can also afford to dress well. But they will stint themselves at table in order to dress the better for it: and it must be admitted that dress is becoming to our Canadians. They are a fine-looking people, and the best blood of France runs in their veins. Good humour and refined manners are common to all; and even in the remoter country places the slightest approach to boorishness is quite unknown." In 1757, Montcalm found the ladies "spirituelles, galantes, dévotes," and notes in his journal that "Quebec is a town of distinctly good society. . . . at two splendid balls I saw more than eighty charming ladies, all beautifully dressed." So, perhaps, the "good old times," which form the theme of a lament written from the convent in 1785 were not so very different from the new as the writer would have her Parisian Sisters believe. "There is liberty to profess our holy religion; but there is little care for living piously, young girls are not brought up so well as they used to be. Some of our pupils are taken from us and allowed to go to the theatre before the age of fourteen. We hear many complaints of the vanity and luxury which are becoming prevalent in society; yet there are many good people who persevere faithfully in the path of duty." Society was probably getting more complex in Quebec, and throwing off its froth and depositing its dregs as it always has since social complexities began. But the fair field and much favour were there, for all that. Very few convent schools have ever enjoyed such opportunities, and none have used them better.

Yet in one important respect the Ursulines were at a very serious disadvantage. All communication with France was cut off by the British conquest in 1759, by the War of the American Revolution in 1778, and again by the long wars of the First Republic and Empire; while no French book was printed in Canada till 1765, and very few of any general educational value appeared there during the next fifty years. The only source of supply was from a French bookseller in Paris whose London correspondent managed to forward a few text-books, from time to time, as occasion served.

This separation from many forms of French life in those troublous times of universal questionings, and the difficulty of getting secular text-books, combined to throw the whole soul of the teaching more than ever into the religious sphere. But this overwhelming preponderance of one aspect of instruction did not crush out all other aptitudes, as some might think. Literature was certainly not taught on modern comparative lines; but there are many books in use to-day which are of an altogether lower world of literature than the Roman liturgy, with its profoundly intimate adaptability to so much human yearning, and its perennial grandeur of expression. How those Ursulines would have rejoiced exceedingly to see the fulness of knowledge uniting with the charm of the best French prose in praise of the æsthetics of the liturgy, in Dom Cabrol's *Conférences* at the Institut Catholique de Paris on *Les Origines Liturgiques*! "Ainsi l'Eglise s'est servie des sens, des cérémonies extérieures, pour vous élever vers Dieu; c'est le premier degré vators of religion? Look at this French version of his *De Spec,* c. xxxix, P.L., t. 1, col. 735, and be convinced forever:—" Vous avez des spectacles saints, perpétuels, gratuits; cherches-y les jeux du cirque, regarde le cours des siècles, les temps qui s'écoulent, compte les espaces, attends qu'on touche la dernière borne, défends les sociétés des églises, ressuscite au signe de Dieu, lève-toi à la voix de l'ange, glorifie-toi de la palme du martyre. . . . . Nous avons, nous aussi, cette littérature, nous avons de la poésie, des sentences, même des cantiques en grand nombre, des chants;—pas de fables par exemple, mais des vérités. . . . . . ."

But how could there ever have been any place for English-speaking pupils, and, above all, for Protestants, in such an atmosphere? The only answer is that there always has been room for both creeds and both races in all matters of secular instruction and that the class-room *entente cordiale* has remained unbroken from the appearance of the first English pupils to the present day. As English schools became established, however, fewer Protestants attended. Now-a-days the boarding school is mainly French-speaking and almost entirely Roman Catholic; while the Roman Catholic equivalent of Sunday-School work is carried on among the girls of the public schools, who attend the convent for that purpose only. Education moves within certain limits in all branches; but, within those limits, it is thorough. The facilitative amenities of life are nowhere better understood; and the feminine of "manners maketh man" is nowhere better put in practice.

Religion is very naturally made pervasively attractive to every Roman Catholic; and the nuns and pupils are generally the best of friends. Many a girl leaves in tears: but these do not recruit the ranks of the novices nearly so much as those who leave less regretfully, "have their fling," and then return for consolation from a hollow world.

A childish impression is sometimes fixed for life by the beautiful commemoration which marks the fête-day of La Mère Marie, when every hand helps to strew her grave with roses. And what pupil ever forgets the end of her first Christmas term? Long before daylight, while the little girls in the junior dormitories are still asleep, soft, distant music floats through the open doorway, stealing over each warm coverlet, to take the ear between dream and waking. *Noël! Noël!* are the first words soaring on the wings of that glad melody. And, presently, the now expectant eyes discern the first tall, white, gliding form, with taper-lit blonde head, leading the undulant, long procession of the elder choir girls. Voices, violins and organ—a swelling tide of sound—flow on and in, until the very air of the whole vibrant room thrills with sympathetic harmonies. A few sweet, rapt moments of full ecstasia . . . . . . and the choir is passing through the farther door . . . . and the music, The great renunciation made, the *Postulante* leaves the chapel, while the nuns remain in continual intercession. Presently she returns, robed as a sister; and makes her vows of service. Then, like a living crucifix, she prostrates herself before the Throne of God. There, while her sisters chant thanksgiving to the Mercy Seat of faith, there—in a long, enraptured vision—she lies prone, all else shut out. . . . . . . She is so still . . . . . . so still in silent adoration . . . . you hardly know if she is drawing human breath.

At length she rises, turns toward the rest of her community, slowly passes down the waiting lines, where each nun greets her with the kiss of peace; and then, as they file out, she follows, last of all, never again to leave the cloisters in either life or death.

VIII.

Who does not want to pass that massive inner door, which guards the inviolate cloisters of one of the most romantic buildings in the world, which has been a gate of honour for every Governor-General of French or British empire, and for every Royal party that has set foot in Canada, and which the personal command of kings and viceroys alone can open?

Visits are rare and visitors of high distinction; and the whole convent is astir to give befitting welcome. A word through the double-screened wicket to the left, a word in reply from the invisible nun on watch, two strong turns of solid, double locks; and the door is flung wide, and reveals a semi-circle of bowing and smiling Sisters. You enter, and it instantly swings to; both keys turn firmly, and you stand there a wondering moment, with the same sense of mingled strangeness and familiarity as you had when your first glimpse through a telescope at night carried you off to the scene of things unrealized.

The next minute a nun is asking if this is your first visit to Quebec, and if you had a rough crossing. The Superior is a little ahead, doing the honours with inimitable grace. The corridor is high and well-lighted; it looks into the sunshiny garden; the pace is quickened, and you move on, a willing captive to the charm of such unexpected gaiety. You turn a corner—what can you be coming to now—a ball-room? The same *brou-ha-ha* of intervolving sound, and the same little puffs and gusts of laughter—only with less forced notes, the same fleeting little calms! You step in, just in time to catch the point of that capital story about the shy visitor who got lost in the cloisters, and mistook the right door, and . . . . . and here, at your very elbow, actually is a nun with whom you have danced in many a ball-room, and who remembers perfectly how often that splendid two-step was encored!

Over at the other end of the room the respectful little semi-circle has been instinctively re-formed, as some more nuns come forward to be presented to the guest of honour and make sweeping curtseys that could not be excelled at court. A pathetically happy group is standing beside one of the deep-set windows. It is a nun with her father and sister, who have permission to follow *à la suite* on this occasion, and who are seeing her in the same room, instead of through the grille, for the first time for—"ever so long," they say, indefinitely, though they remember well enough the exact dates of such rare events. But that nun pities her sister in the cold world outside, and is really sorry that as you are a man you can never experience the joys of her cloistered life.

This is the private reception room, where the visitors' book is kept; and the nun who holds it open while you write notices that by having paid two visits within a month you have broken all precedents, and she promises you the gold medal for attendance and good conduct. The room is typical of the whole convent. The floor is bare natural wood, spotlessly clean. No First Lieutenant ever had a smarter deck. There is some fine dark panelling round the walls, harmoniously plain. A door opens through the panel at the far end. It is quite indistinguishable at a little distance, and has an air of mystery about it. How the nuns laugh when you ask if that's the way to their *oubliette*! The only ornament, beside a few small pictures, is a huge, old-fashioned fire-place, with a chimney-nook you would like to sit beside, and build castles in the dying fire some midwinter evening. The mantel-piece and frame are of handsomely carved, smoke-brown oak. The dogs and fire-irons are enormous, with a long-established air about them. The whole is flanked by cannon balls and shells—grim reminders of troublous times, and glorious trophies of the steadfast bravery shown during the four sieges through which the convent has passed.

The library has the appearance of being deep down, the windows being high, and the light coming only from above. You look round and quite naturally ask how many "tomes" there are—"volumes" seem such mundane things compared with these ranks of solemn folios. There is a case or two of modern secular books, some up-to-date Canadian histories among them. Here is the only known impression of the seal of the famous Company of New France, or *Cent Associés,* founded by Richelieu in 1627. The seal is three inches in diameter, the encircling inscription is *Me donavit Ludovicus Decimus Tertius,* and a figure holding the cross stands against a background spangled with the *fleur de lys.* On the other side is a ship under sail, with the inscription:

In Mari Viæ Tuæ. This ship and its fine motto, *Thy ways are in the Sea,* have been adopted by the Champlain Society, and the Quebec Tercentenary crest displays both sides of the seal.

But the most interesting of all is the wealth of correspondence: letters written during the last three centuries by people of every class, from a reigning sovereign to a simple *habitant.* Anne of Austria, Frontenac, Montcalm, Murray, Carleton—all who were greatest in Canada's heroic ages were correspondents of the Ursulines. But more appealing than the rest are the letters from two Parisian Ursulines during the Reign of Terror. In spite of the horrors surrounding them and the fate which sent twenty-five of them to the guillotine, these faithful nuns did all they could to safeguard the property and revenues of their sisters in Quebec. Half of their letters are filled with accounts of the business precautions taken by their indefatigable *dépositaire,* La Mère de Ste. Saturnine, then in her eightieth year. The other half alternately freeze the blood and set one's veins on fire with indignation.

On the 13th of January, 1793, the nun who then signed herself "ex-Superior of the Ursulines of the Faubourg St. Jacques" wrote to the Superior in peaceful Quebec:—"Dear Reverend Mothers, you have doubtless heard with grief of the destruction of all the religious houses in France. Our monastery has not escaped the common fate. Your compassionate hearts would have bled to see the cloister-wall broken down, and ourselves forcibly driven out from our asylum. To our great regret, we are all scattered . . . . . beg our Divine Lord to grant us grace to make a holy use of the heavy trial he has sent us. All the clergy we knew have disappeared; we cannot discover any who have escaped the massacre of the 24th of September. Our venerable confessor and our two chaplains were certainly among the victims. . . . . . . I recommend myself to your good prayers as one already dead, for although my health is fairly good, which seems a miracle, considering my seventy-four years and cruel situation, yet I may not be among the living by the time this reaches you. The holy will of God be done. If I were younger I might try to accept your invitation." The letter was not delivered till after her death, as presentiment had told her. But neither correspondent could have imagined beforehand what adventures that farewell message was to undergo. It was carried over to England by some refugees flying for their lives, and confided to the care of a shopkeeper, who mislaid and forgot it. Finally, one day in 1802, nine years after it had been written, an English merchant, who had found it in London, called at the convent and gave it to the third successor of the Superior to whom it had been addressed!

The annals contain some curious entries about distinguished visitors. Thus it is recorded that when King William IV. paid a visit, as a young naval officer of twenty-two, the nuns found him "most affable and gracious, *although a sailor*." Four years later, in 1791, came the next member of the Royal Family, Queen Victoria's father, then called Prince Edward, who was colonel of the 7th Fusiliers stationed at Quebec. The good Mothers were delighted with him. He took refreshments with the bishop in the Superior's room, and bought some bark work for which he insisted on paying twenty times its value. Again, in 1860, the greatest of all their public receptions was given to King Edward VII, then on his Canadian tour as Prince of Wales. The annalist records with pardonable pride that the Prince spent two whole hours in going over the convent, after the ceremony, and that "he showed as much interest in observing the plain apartments, the bare floors, the simple cells, as any one of us might have felt in seeing Windsor Castle."

The Refectory is where "plain living and high thinking" are practised *in excelsis*. Here are the signs and symbols of both. This room looks centuries older than the others. It is in perfect fitness for its present use; but it is long and comparatively low; quaint steps lead down into it from its garden door, the ceiling is massively ribbed with huge dark beams, and the whole appearance of it is distinctly mediæval. The tables are long, bare, immensely heavy; so, too, are the deep and narrow benches. You can't imagine that chairs and carpets have ever been invented. The table is set for supper. There are white water jugs at intervals; and heavy semi-globular pewter salt cellars on thick stems and solid bases. These are over two hundred years old. At every place there is a little birch-bark bread-basket, used to "gather up the fragments that remain." A lectern, like a witness-box in shape, serves for the *lectrix* who reads aloud during meals from some book of devotion. It is all so simple, and so unstudiedly natural. A nun explains the bill of fare, and the great difference between fast and feast days. You would mistake the feast for the fast days, if you had not heard about the latter first! But it seems that, beyond marking the difference in the calendar by difference in diet, the Refectory is merely a place to refresh one's body for the sake of one's soul. "Won't you give us the pleasure of your company at dinner?" laughs a nun who has not been cloistered many years, "you'll be better afterwards than if you dined at the club." And so you would.

As you approach the class-rooms there is a quick, settling shuffle of little feet, a tap with a wand, a soft "Hsh!"—and there is the nun at her desk, and all the girls standing before her, exactly as teachers and taught stand for inspection all the world over. The prize-winners wear coloured scarves over their left shoulders; but they are wisely not "shown off" before the visitors. A half-holiday is asked for and granted in honour of a distinguished guest; and instantly every girl is dropping pretty, smiling curtseys to a running accompaniment of multitudinous *Mercis!*

"It would be such a privilege to be allowed to present the novices." So the party goes on to where fourteen are being marshalled in an adjoining corridor. Two broad sunbeams are pouring steeply down into the far end of the long room in which you are waiting; and as the timid little procession begins to move in, beneath the high window, veil after mist-like veil becomes an aureole in the transfiguring light. One face and figure arrests your eye. The colour comes and goes, shifting incessantly under the rich, warm, half-Italian complexion. The neck strains a little, and pulses fast; though the face is calm enough, and the delicately poised figure is almost still, it sways so imperceptibly. What is her beauty doing here, secluded and immured from every hope of triumph? Look again. She is evidently interested in all that is taking place; but, just as evidently, only in so far as these outside interests relate to her vocation. "Vocation" is the dominant in the rhythm of her whole expression. Some other novices catch their breath with shyness before answering your questions; but her words are as untroubled as her brow. Is this the "Blessed Damozel" that haunted the imagination of Rossetti with a vision of earthly beauty looking back on us

> From the gold bar of Heaven?
>
> . . . .
>
> The wonder was not yet quite gone
> From that still look of hers.
>
> . . . .
>
> Her eyes were deeper than the depth
> Of waters stilled at even.

There is an astounding volume of sound from what must be four-handed piano-playing in the music room. No wonder: it is a fourteen-handed performance! The solitary harp looks neglected in its corner. Is it out of favour, even in convents, now-a-days? At one time it was the chosen instrument to give the languishing, romantic finish to a lady-like education. Perhaps its truer virtues will be recognized again, and the fit though few will re-awake its glamour as bards and angels are famed to do.

A hurrying little group meets you in the passage. They had forgotten the Indian pupil! She is a curiosity now; perhaps the last of her race to be taught there—within a few short steps of where Marie de l'Incarnation used to gather so many round the famous ash tree. She is a new-comer; and the convent is almost as strange to her as to the visitors who cluster round. One of them knows some words of her native tongue. Her eyes look far out beyond her surroundings as she answers. Is it only a freak in the association of ideas that always makes certain Indian languages set your fancy wandering among wind-swept pines and "the voice of many waters"?

But there are so many things to see! The corridors seem unending; they are so long, so many; weather-beaten grey outside, solid through and through, as if they had grown, rough-hewn, from the rock of Quebec and had been hand-chiselled afterwards, just to humanize them. Every window gives a glimpse of golden-tinged block-tin roofs, with a steep pitch and studded with little pointed windows. The stairways are innumerable. One is called after St. Augustine—a great hero in all convents—and on the landing is a statue of St. Joseph which was placed there in commemoration at the jubilee of 1689. The Blessed Virgin Mary, of course, watches over the Community Hall, in her quality of Perpetual Superior. A bell is ringing—it is the same one that is rung at four o'clock every morning of the year. You confess that the last time you heard it at that hour you were coming home from a dance. "What different worlds there are in this one," says the nun beside you; and then adds quickly, "but innocent pleasures are very good for refreshing the mind—we take a great deal of pleasure in our garden." Another nun, with a turn for ornithology, regrets that as the town spreads further and further, all round the convent, the birds get fewer and fewer. "They would come back if they could; this is their sanctuary."

These things excite your own interest. But what interests the nuns most of all? Probably the Chapel of the Saints. A very ancient and highly venerated statue of Our Lady of Great Power stands benignant in the centre of the altar. The whole breadth of the wall on either side is covered with pictures and relics. In every other niche, too, there are relics in pious plenty. Some of them were added during the life-time of La Mère Marie, like those of the martyrs, Justus, Modestus and Felix, which her son, Dom Claude Martin, sent out in 1662. An Ursuline of Metz sent a relic of St. Ursula herself. All that is mortal of St. Clement is here, by permission of Pope Innocent XI. In 1674 the collection was already so rich that it was decided to build a special chapel in its honour. Since then it has increased enormously in value to the devotee. Here are the trophies of the Holy War, of the war from which there is no discharge but death, the war against the Powers of Darkness and the principalities of this wicked world: relics of Ignatius Loyola, founder of the Jesuits who so often befriended the Ursulines; of the "most lovable" Saint Francis de Sales, of the great St. Augustine; of the foundress of the Ursulines, St. Angela de Merici; relics of all ages and all countries, from the first century to the twentieth and from Canada to China; and, shedding a diviner virtue on them all, genuine particles of the Cross of Christ and of His Crown of Thorns.

Will objects connected with Marie de l'Incarnation soon be numbered with relics of the saints? You cannot help hoping that they will, so eager are her followers in this just cause. Her tomb is already a shrine for nuns and pupils... .. ..
But here is something different, something to bring you back to secular affairs, and waken memories of the heroes of world-history. It is the skull of Montcalm, a gruesome relic of that vivid personality. The chaplain keeps it in the same room as Father Resche used during Wolfe's siege of Quebec. A curious link between a changeful past and present was supplied by the life of Father Daulé, another chaplain, who was born at the end of the Seven Years' War and died as France and England were about to send an allied army to the Crimea. You will find a deeper and less mortuary interest in the historic old chapel. *La Guerre est le Tombeau des Montcalm.* At Bougainville's request the French Academy had composed a Latin inscription for a memorial tablet shortly after Montcalm's death; and Pitt had willingly given permission to have it sent out to Quebec and erected here. But many delays occurred; and this tablet was only unveiled on the hundreth anniversary of the burial, at a service held with all the magnificent rites of the Church which the hero loved so well. The elaborate inscription recites Montcalm's titles to remembrance at full length. But it is little more than a good official document beside the terse French epitaph which Lord Aylmer, a British Governor-General, had inscribed on the grave many years before. This noble tribute, from one soldier to another's fame, will live so long as self-sacrificing loyalty is held in honour, and victors and vanquished alike can appeal for equal justice to the God of Battles.

HONNEUR A MONTCALM!
LE DESTIN
EN LUI DÉROBANT LA VICTOIRE
L'A RECOMPENSÉ
PAR UNE MORT GLORIEUSE.

No other spot of equal size in the whole New World touches the heart of universal history so nearly as this old chapel. It is just beyond beheld the very birth of Life; and then not feel how the most modern self transcends its wonted boundaries of time through all its endless kinship with the immemorial past and illimitable future.

Re-enter now the high-throned Upper Town, girt like a giant armed. Seek its heart once more. The sacred solitude does not chill you now, as it did when you came here first, out of mere bustling curiosity. Your feet no longer seem muffled in the dust of death. Greatness no longer seems departed; but omnipresent, immortally alive. For here, in this veteran chapel, which has braved so many dread ordeals with the heroic Ursulines, the twin renown of Wolfe and Montcalm becomes a shrine of memory, where the pilgrims of all chivalry can find inspiration for the exalting service of every age.

One step beyond, within the cloisters, a living link brings this Valhallan past almost as close in the body as you have just felt it in the spirit. Here is an aged nun who perfectly remembers the tales of former days, told her so often by La Mère de St. Ignace, who saw Montcalm's shattered corpse lowered into the grave after the Battle of the Plains. While Mère St. Ignace herself heard the still older tales of Geneviève de Boucherville, who saw the perpetual Lamp of Repentigny first lighted more than two hundred years ago, and whose father remembered the time of Champlain, whose tercentenary of the foundation of Quebec is being celebrated in this present year of grace. The combined ages of these four human links already exceed three hundred and seventy years. Long may this mighty span continue to grow with the life of the survivor!

A few steps more, and you are again in the historic garden, with its intimate memories of La Mère Marie. Here, between her intercessions to the King of Kings, she formed the statesmanlike resolve to persuade Canadians that, if they would be steadfast through the appalling devastation of famine, war and earthquake, they could make Canada the Land of Promise for countless generations. And here the nuns still come to reinvigorate mind and body; and for the solace of the soul. Here is a haunt of ancient peace, in which to ponder great, still books of meditation. Here is the old French cross, upheld by a pedestal made from the original ash-tree, beneath whose shade La Mère Marie taught and exhorted her faithful converts. Near by is the corner of wild garden, as wild to-day as when the little Indian feet brushed so deftly through its springing flowers, never treading one down because she loved them all to grow there as God himself had planted them. And here, where the very ground seems native to the Golden Age, the nun who passes by in venerative mood might well apostrophize the first great Ursuline of

Canada in words addressed to another spirit of the same deep constancy and calm:

> Thy soul within such silent pomp did keep,
> As if humanity were lull'd asleep;
> So gentle was thy pilgrimage beneath,
> Time's unheard feet scarce make less noise,
> Or the soft journey which a planet goes:
> Life seem'd all calm as its last breath.
>
> A still tranquillity so hush'd thy breast,
> As if some Halcyon were its guest,
> And there had built her nest:
> It hardly now enjoys a greater rest.

But the garden wakens deeper memories than these. Are not its walls the harp whose unseen, æolian strings have echoed to the voice of cloister melody from morn till eve, year after year, and in five years of jubilee? At dawn the Godward day begins:

Ad Te de luce vigilo.

During more secular hours there are the busy hum of school and rippling treble of an interlude of play. But, where all is done *ad majorem Dei gratiam,* even these sounds become attunable to the dominant strain of a glad *Te Deum* or the full self-surrender of a suit preferred *in forma pauperis* to the Throne of Grace:

O Cor amoris victima.

At dusk the whole Sisterhood commits soul and body to Heavenly safe-keeping for the night:

In manus tuas, Domine.

And is not all this but one accordant note in the full chorus of praise addressed by a single Church in a single tongue to the one true God— a chorus of praise unwearied for nineteen Christian centuries, and unwearied still, as, with the sun, it passes from choir to choir unceasingly, among the Catholic faithful the whole world round?

And even when her Chapel is dim and silent, and the midnight garden is only a hushed seclusion at her feet, the watching Ursuline is brought home to the Divine Infinitudes by her very Convent. Here, from her roof-side window, again within the stupendous colosseum built by Titanic Nature round the arena of Quebec, she finds all that Earth can show her of Eternity:—the home of a vanished past, lost to all record or tradition; the home, too, of deeds to stir the hearts of men while history remains; the scene now of quickening life along the great, ship-bearing River, in the busy streets, and among the girlhood at school beside her: and then the hills, the old, the everlasting hills; and the primordial tides, throbbing so far inland with the full pulse of the Atlantic; the wide, wide sky; the universe of stars; the view of all immensity.

Murs, ville
Et port,
Asile
De mort,
Mer grise
Où brise
La brise—
Tout dort.

Ce bruit vague
Qui s'endort,
C'est la vague
Sur le bord;
C'est la plainte
Presqu'éteinte
D'une sainte
Pour un mort.

On doute
La nuit..........
J'écoute..........
Tout fuit,
Tout passe,
L'espace
Efface
Le bruit.

Then, when an angel lays his ear to this still convent, as we lay ours to catch the voice of Ocean whispering through a single shell, he surely hears those undertones of lowly human service which are the soul of all the harmonies on high.

II.—*The Administration of Sir James Craig.—A Chapter in Canadian History.*

By LIEUT.-COL. CRUIKSHANK.

(Read May 26th, 1908.)

The lamentable attack upon the frigate *Chesapeake* on June 21st, 1807, at once brought the United States and Great Britain to the verge of war. A portion of the militia of Lower Canada were immediately embodied, and seem to have obeyed the call with great alacrity. A soldier of high reputation, Sir James Henry Craig, lately in command of the British army of occupation in Sicily, was appointed Governor-General and Commander-in-Chief of the forces in British North America, and a division of ten thousand regular troops was detailed for the reinforcement of the garrisons in those provinces. This distinguished officer had attained the rank of lieutenant-general through long and meritorious service and laborious study of his profession, of which he had acquired an intimate and practical knowledge in all its branches. Born at Gibraltar in 1748, he had entered the army as ensign in 1763, but obtained permission to pursue his education in the best military schools of the Continent, where he remained for several years and became proficient in the French language. During the revolutionary struggle he had served in America from the beginning of the war. He commanded a company of the 47th Regiment and was severely wounded in the assault of the insurgents' position at Bunker's Hill, and next year accompanied Lieut.-General Burgoyne to Canada. He took part in the action at Three Rivers, and afterwards commanded the advance guard of the force engaged in the pursuit of the Americans until they were finally expelled from the province. In the spring of 1777, he was put in command of a considerable body of French-Canadian militia, which was embodied to co-operate with the regular troops in their advance upon Albany. He was wounded in the engagement at Hubbardton, and again in that at Freeman's Farm. His ability and good conduct were so conspicuous during the campaign that Burgoyne appointed him one of the officers to whom was entrusted the painful duty of arranging the terms of capitulation with General Gates. Being then sent to England with despatches, he was promoted to be major without purchase and returned to America with little delay. He next served under Brigadier-General Allan Maclean during the defence of Penobscot, and joined Lord Cornwallis in North Carolina in 1781, under whose command he displayed such readiness and good judgment in the conduct of light infantry that he was promoted to be lieutenant-colonel of the 82nd Regiment. When peace was restored he spent much time in France and Germany studying foreign systems of tactics and drill, and became such a recognized authority on these matters that he was frequently consulted by Sir David Dundas, while preparing his famous manual known as the "Eighteen Manœuvres," which was first adopted in Craig's own regiment, the 16th Foot. He acted as Adjutant-General of the Duke of York's army during its inglorious campaign in the Netherlands in 1794. In the following year he became a major-general, and commanded the small land force which invaded the Dutch Colony of the Cape of Good Hope, won the battle of Muysenburg and drove the enemy into their entrenched camp, which they surrendered on the arrival of the British reinforcements. In recognition of these services he was knighted and placed in command of the Benares District in India. While there, he was designated for the command of an expedition against the Philippine Islands, which was not carried into effect. When selected as commander of the picked force destined for special service in the Mediterranean in 1805, he was universally considered as one of the ablest generals in the British army, and his conduct while in Sicily and Naples was uniformly characterized by coolness, firmness and judgment, but he was compelled to return to England by ill health about a year later, and had not since been actively employed.

In person, he was short, but so remarkably broad-shouldered and muscular that a friend aptly described him as "a pocket Hercules." His face was remarkably white and his regular clear-cut features seemed carved in ivory, illuminated, however, by large lustrous dark eyes. Habituated to command by more than forty years of military life, his manner was curt, peremptory and rather pompous. Highly esteemed and respected by those who knew him well, he lacked the faculty of winning wide popularity, and his political views and acts judged by the standard of to-day unquestionably seem illiberal and autocratic.[1] His familiarity with the French language and personal knowledge of Canada and its people were considered additional qualifications for the post, but unhappily he was then suffering from a painful disease which rendered him peevish and irritable, and often incapacitated him from the transaction of business altogether. In the conduct of public affairs, he was so thoroughly conscientious and painstaking that he never affixed his signature to any important despatch or other document that he had not drawn up or corrected with his own hand.[2]

---

[1] Bunbury. Some passages in the War with France, p. 182. Boothby. Under England's Flag, pages 3-8.

[2] Ryland to Lord Liverpool, 19th August, 1812.

His official instructions related mainly to the defence of the provinces he was sent to govern, and indicated the preservation of Quebec and Halifax as the first objects to be kept in view in the event of an invasion from the United States, since these were the only posts that were considered tenable with the limited number of troops placed under his command.

Accompanied by a considerable staff of officers for the organization of the militia and fortification of military posts, he arrived at Quebec on 21st of October, 1807, but immediately after landing was disabled for several weeks by a severe attack of illness which prevented him from even writing a letter.

Returning to Canada after the lapse of nearly thirty years, the new Governor-General could not fail to be greatly impressed by the improved condition of that province. When he went away the population numbered not more than 75,000 persons plunged in abject poverty. There were no merchants of any standing and the exports consisted entirely of furs and fish. There was no trade in timber. Shipbuilding had been wholly discontinued. The quantity of grain grown in the colony was scarcely sufficient to meet the wants of the scanty population. Mills were few and inefficient. Hops and barley were not grown at all. The only foundry in the province was about to be closed. Quebec contained hardly six thousand inhabitants, and Montreal less than two thousand. There was not a single white settler between the Ottawa and Detroit rivers.

In 1807, the population had increased more than three-fold, and was sometimes estimated to amount to 300,000. The number of English-speaking inhabitants had grown from less than one thousand to more than twenty thousand. The new province of Upper Canada had a white population of between sixty and seventy thousand. The cities of Quebec and Montreal with their suburbs each contained about twelve thousand people, of whom three-fourths were French-Canadians. The area of cultivated land had increased from 1,569,818 acres in 1783 to 3,760,000 in 1807. The number of horses and horned cattle had more than doubled, and that of sheep and swine had tripled. A continuous chain of farm buildings fronting upon the St. Lawrence from Kamouraska upwards gave it the appearance of a village street, interspersed with narrow fields of grain and pasture land. The seigniories of Rivière du Loup, Machiche, Maskinongé, York, and Berthier were particularly noted for their fertility and the heavy crops of wheat they produced. The island of Orleans also was well cultivated, and annually exported much grain. Fruit, however, was not grown to any extent anywhere except upon the island of Montreal, which was called the garden of

Canada. Hops were successfully grown at Sillery and a sufficient quantity of barley was raised for the supply of several small breweries at Quebec, which furnished the province with ale, porter, and table beer. The recent great demand for wheat in England and the consequent advance in price had given a great stimulus to its cultivation in Canada. In 1796, the colony had exported only 3,106 bushels of wheat, 4,352 barrels of flour, and 3,882 cwt. of biscuit. In 1802, the exports of wheat amounted to 1,010,033 bushels, besides 28,301 barrels of flour, and 22,051 cwt. of biscuit. In 1807, the exports had diminished, however, to 234,543 bushels of wheat, 20,424 barrels of flour, and 28,047 cwt. of biscuit. Colonel Henry Caldwell, the Receiver-General of the province, and other English residents, had built several large grist mills which carried on a very profitable trade. The French-Canadians in general were considered rather slovenly and negligent farmers, and were slow to adopt improved methods of cultivation. The average crop of wheat was estimated as low as twelve bushels to the acre.[1]

Since the ports of the Baltic had been closed to British commerce, the timber trade of Canada had flourished greatly. In 1797, the total exports of oak and pine timber were valued at £32,144. Ten years later they amounted to £134,344. Shipbuilding had also been successfully carried on at Quebec and Montreal for many years. There were four ship-yards at the former and one at the latter city, each launching annually six or eight vessels of from 200 to 500 tons burden, and paying out in wages more than £20,000 among them. The forges and iron foundry at St. Maurice near Three Rivers had been much enlarged and employed three hundred workmen, who were chiefly engaged in the manufacture of stoves, potash kettles, plough shares and mill machinery. The iron made from the native ore was considered as good if not better than the best Swedish. The furnaces were kept in operation with charcoal burnt in the neighbouring forests. Another smelting works had lately been established at Batiscan.[2]

The town of Three Rivers contained 1,500 inhabitants, and besides being the distributing point for the products of the St. Maurice forges carried on a very thriving trade in furs and potash, which were brought in from the adjacent country and exchanged for manufactures of all kinds. The principal merchants were the three brothers Hart, English Jews, who had acquired considerable wealth and influence and were much respected. Here also was situated the only brick-yard in the province.

---

1 Lambert Travels, Vol. I, pp. 134, 232.

2 Lambert Travels, Vol. I.

Sorel was smaller than Three Rivers, and had declined in importance in consequence of the recent closing of a ship-yard which had been in operation for some years.

Montreal was the headquarters of the fur trade with the western Indians, and of all kinds of trade with Upper Canada. The Northwest Fur Company, composed exclusively of Scotch and English residents of Montreal, employed fully 3,000 clerks, *voyageurs* and trappers. The goods for conducting this trade were forwarded in a flotilla of forty or fifty large canoes, which set out from Lachine annually about the 15th of May, by the way of the Ottawa river for the head of Lake Superior. Their posts were established as far west as the Rocky Mountains, and as far south as the Missouri river, some of which were so distant and difficult of access that returns were not usually received until the fourth year after the despatch of the goods. This trade was so extremely profitable, that it was said that it was not unusual for a clerk to retire after fifteen or twenty years' service with a fortune of £20,000 and a broken constitution. Another powerful association of Montreal merchants had lately been formed under the name of the Southwest or Michilimackinac Company, to carry on the fur trade within the territories of the United States in the vicinity of the Mississippi and its affluents. At Montreal also were the stores of the Indian Department, from which a fleet of thirty canoes conveying goods to the value of about £10,000 was annually despatched for distribution among the western Indians, among whom they were apportioned by the resident agents at the upper posts. The trade with Upper Canada had begun to attain large dimensions. Between April 27th and November 28th, 1807, thirty-nine scows from that province arrived at Montreal, carrying 19,693 barrels of flour, 1,460 bushels of wheat, 127 barrels of potash, 48 barrels of pork and eight packs of furs, besides 340 rafts containing 277,010 feet of oak timber, 4,300 feet of pine timber, 691,200 staves, 72,440 planks and 985 masts and 701 cribs of firewood, containing 6,300 cords.[1]

The influence of the *Noblesse* and seigniors had greatly diminished since the passing of the Constitutional Act of 1791. Several of them had secured seats in the first Legislative Assembly of the province, but few had been elected since. Many of them had removed into the cities and towns and only visited their estates at intervals for the purpose of collecting their rents, which were usually paid in kind, and their relations with their tenants were frequently far from cordial. On the other hand many shop-keepers and notaries had grown comparatively

[1] Lambert Travels, Vol. I, pp. 236-249.

wealthy and some of them had become the possessors of considerable estates. Some of the seigniories had already passed into the hands of strangers. Ross Cuthbert, a son-in-law of Dr. Benjamin Rush, of Philadelphia, had become seignior of Berthier. Colonel Gugy, an *émigré*, formerly an officer in the Royal Swiss Guard of France, had inherited the seigniory of Machiche. Colonel Bruyeres of the Royal Engineers had purchased the seigniory of Beçancour. Moses Hart, a Jewish merchant in Three Rivers, owned the seigniory of Grondines, a rather barren possession. Several noble families had lately retired to the beautiful little village of Boucherville, near Chambly, where they could live modestly upon their diminished incomes in a circle of friends of their own choice.

The farms occupied by the *habitans* along the St. Lawrence usually were not more than twenty or thirty chains in width by ninety or one hundred in depth. Their houses with few exceptions were built of squared logs dovetailed together at the ends, with the interstices tightly packed with clay, and were scrupulously whitewashed with lime, both inside and out. As a rule, they were but one story in height with a garret or sleeping loft, divided into four rooms, one of which was the kitchen, the remainder being bedrooms. The chimney was built in the centre of the house, with a large fireplace opening into the kitchen, in which a large kettle of soup constantly hung over the fire. The furniture consisted of a few wooden chairs, a table and two or three beds. The best room sometimes contained a tall clock, and a crucifix and a few prints or wax figures of the Virgin and the Saints looked down from the walls.

Fat pork was the principal article of food in the winter. Their bread was made of a mixture of rye and wheat flour, and was generally sour, coarse and heavy. Pea soup with a large piece of pork boiled in it often furnished breakfast, dinner and supper for a family day after day, varied occasionally with fried sausage and bread. Tea was little used, the younger people of both sexes usually drinking milk or water at their meals. Rum was very cheap, and drunkenness was so common that it was remarked that the old men rarely returned home sober from market.[1]

The ordinary costume of the adult male *habitan* consisted of a long-skirted grey frock coat with a hood, girt about the waist with a worsted sash of some bright colour, ornamented with beadwork, a waistcoat and trousers of the same material and moccasins or swamp-boots. On his head he wore a knit woollen cap or *bonnet rouge*. His hair was tied in a long thick *queue*, and he was seldom seen without a short black

[1] Lambert, Travels, Vol. I; Gray, Letters from Canada.

clay pipe in his mouth. The *habitans* produced or manufactured almost everything they used. They cultivated flax, which they dressed and wove into linen. Their clothing was made of homespun cloth from the wool of their own sheep, and their moccasins and boots were in like manner manufactured from the leather they had tanned themselves. They knit their own stockings and caps and plaited their own straw hats and bonnets. They built their own houses, barns, stables and ovens and made their carts, ploughs, harrows and canoes. Their bread, butter, cheese, soap, candles, sugar and tobacco were all home-made. They rarely purchased any article which they could make themselves or do without, and were slow to adopt improved implements and methods of agriculture introduced by British settlers. There were few schools outside the cities of Quebec and Montreal, and the mass of the people, including many persons of influence, were so illiterate that the Quebec *Mercury* in May, 1808, sarcastically suggested that an elementary school should be established for the instruction of the members of the Legislative Assembly in reading and writing. In general, the inhabitants were abundantly provided with the necessaries of life. They paid low rents and no taxes. Their desires were simple and they seemed contented and happy. Their manners were easy and courteous and they were gay and hospitable.

The commerce of the province was conducted mainly by Scotch and English merchants, most of whom were prosperous and wealthy. Four weekly newspapers were published in Quebec and two in Montreal. The two oldest of these, the Quebec *Gazette*, founded in 1764, and the Montreal *Gazette*, founded in 1778, were printed partly in English and partly in French, while the Quebec *Mercury*, founded by Thomas Cary in 1805, and the *Canadian Courant*, established at Montreal in 1806, by Nahum Mower, an American, were printed entirely in English. *Le Canadien*, established at Quebec in November, 1806, was absolutely conducted as the political organ of the opposition to Government measures in the Legislature. The expression "La Nation Canadienne," frequently appeared in its columns, while the English speaking inhabitants were designated as "intrus" and "étrangers." The only other French newspaper, *Le Courrier de Quebec*, was very small, and devoted almost entirely to literature. The printing offices were the only places where books were sold and their stock was scanty. There was but one public library—that in the Bishop's Palace at Quebec.[1]

It could scarcely be contended that the French-Canadians had any good ground for complaint against the existing government, and it was generally acknowledged that the country was better governed and that

[1] Lambert's Travels; Gray, Letters from Canada.

the inhabitants were much more prosperous than when Canada was a French dependency. Still it was evident that there was an undercurrent of discontent and hostility to Great Britain, which might easily be fanned into a flame. The gentry and land-owners generally and many of the clergy were believed to be well-disposed, but many of the townsfolk and *habitants* alike were strongly suspected by British residents of rooted disaffection, and of entertaining a desire to be reunited to France. Writing to Colonel William Claus on the 23rd of September, 1805, before the battle of Trafalgar, had put an end to Napoleon's hopes of gaining the mastery of the seas, Colonel Isaac Brock said, "These ungrateful wretches (the French Canadians) expect fully to be French subjects before the end of the war." After a residence as Governor-General for more than two years, Craig described them in an official letter to Lord Liverpool (21st May, 1810) as being "French," adding—"I use the term designedly, My Lord, because I mean to say they are in language, in religion, in manner and in attachment completely French, bound to us by no one tie but that of a common government, and on the contrary viewing us with sentiments of mistrust and jealousy, with envy, I believe I would not go too far, were I to say, with hatred. So complete do I consider this alienation that on the most careful review of all that I know in the province, there are very few I could venture to point out as not being tainted with it. The line of distinction between us is completely drawn. Friendship, cordiality, are not to be found, even common intercourse scarcely exists. The lower class of the people to strengthen a term of contempt add "Anglois," and the better sort with whom there formerly did exist some interchange of the common civilities of society, have of late entirely withdrawn themselves. The alleged reason is that their circumstances have gradually declined in proportion as ours have increased in affluence. This may have had some effect, but the observation has been made that this abstraction has taken place exactly as the power of the French in Europe has become more firmly established."

Craig cannot be regarded as an unprejudiced witness, and his letter was written in the heat of his struggle with the French-Canadian majority in the Legislative Assembly, but strong evidence can now be adduced to sustain his statement.

General Turreau, the French minister to the United States, relates that soon after his arrival at Washington in 1806, a French-Canadian farmer who lived near the frontier called upon him to make known the hopes and wishes of his countrymen, which he desired him to communicate to the French Government. Turreau told this man that it would be necessary for him to furnish him with further details as to the character of the men who were prepared to lead a revolt and the means they possessed. A few months later he received a letter dated at Newark, N.J., and signed by J. Perreault and Finlay de Gros Pin, "Canadian officers," who represented that they had been authorized by the northern nations of Indians and their Canadian brethren to inform him that they had determined to dig up the hatchet, so often stained by the blood of the English, and seek the assistance of the Emperor of France. Turreau returned an encouraging reply and invited his correspondents to meet him at Baltimore. On the 27th of October, 1806, he received a second letter from them dated at New York, stating that they had been warned by their relatives in Canada that their design had been suspected by the government and instead of supplying them with money as expected, they had urged them to return home without delay.

"The Canadians are French," they continued. "Their ancient patriotic devotion has not diminished. They are treated as a conquered people. Foreign upstarts oppress them. These tyrants avoid the punishment of their peculations and horrible crimes by a feigned loyalty, which a base interest would cause them to abjure very quickly. Their number is small. The mass of the people suffer and languish, hence their hope and desire for a change."[1] They added that they would await his reply at New York. Turreau then invited them to visit him at Washington, but as they had given him no address he caused a search to be made in New York, which revealed the fact that they had returned to Canada five or six days after their arrival in that city. Meanwhile, on November 4th, a man named Johnson gave Turreau a letter in English, dated at Quebec sometime in October, and signed by one Samuel Turner, who styled himself a captain in the Canadian militia, stating that the writer and his friends deemed the time propitious for the reconquest of Canada by the French. They had all their plans laid, the writer stated. They knew the strength of the garrison of Quebec and the condition of its fortifications. They could furnish pilots acquainted with the navigation of the St. Lawrence and were ready and able to enlist a large number of men for service in the French army. They had already at their command a sufficient number of adherents to form a garrison for Quebec until re-inforcements could arrive. There could be no doubt of success.

Turreau again signified his approval, but desired more definite and

[1] Les Canadiens sont Francais; le local n'a point degenere leur ancien amour patriotique. On les traite comme un peuple conquis. Des parvenus étrangers les tyranisent. Ces tirans n'évitent le châtiment de leurs peculats et crimes horribles que par une loyauté simulée qu'un vil intérêt leur ferait abjurer bien vite. Ils sont en petit nombre. La masse du peuple souffre et languit. De là les souhaits et désirs d'un changement."

detailed information as to the extent of co-operation an invading force might expect from the inhabitants. No answer was returned, and the years 1807 and 1808 elapsed without any message reaching him from Canada, but indirect information confirmed him in the opinion that "The Canadians hated the English and were sighing for French domination."[1] The encounter between the *Leander* and the *Chesapeake*, stimulated his hopes that the United States might declare war against Great Britain, and on the 18th of July, 1808, he reported to Talleyrand that the President had said to him, "If the English do not give us the satisfaction we demand, we will take Canada, which wants to enter the union, and when together with Canada we shall have the Floridas, we shall no longer have any difficulties with our neighbours and it is the only way of preventing them."[2]

When Craig arrived at Quebec, he found the country practically defenceless against a well directed invasion from the United States. None of the military stations in Upper Canada were in a position to resist an attack for two days together. "The posts that do exist," he wrote, "are just calculated to insure the loss of such men as may be put into them." The Provincial Marine, however, although weak in seamen, was still superior on Lakes Ontario and Erie, but in the spring of 1808, the American government began the construction of the brig *Oneida*, of 18 guns at Oswego, to counterbalance which Craig immediately directed a ship of 22 guns to be built at Kingston. On Lake Champlain there was not a single British vessel afloat, and he dared not undertake the construction of any as there was no fort or harbour of any kind to shelter them, nor had he any troops which he could detach for their protection, while the flourishing state of the American settlements on both shores of the lake would afford them every facility for interrupting the work and destroying the dockyard. The fortifications at Isle aux Noix, and St. Johns had fallen into ruins, the fort at Chambly was badly situated and at best defensible only against musketry, while a projected work at William Henry (Sorel), had not yet been commenced. The defences of Quebec were greatly out of repair. An English traveller looking from the city at the Citadel upon Point Diamond could see nothing but "a heap of ruins and rubbish, a heterogeneous collection of log houses and broken-down wall."[3] Craig made no effort to strengthen any of the frontier forts as he found it necessary to employ all the means

[1] Faucher de St. Maurice. Notes pour servir a l'histoire des officiers de la marine et de l'armée Française qui ont fait la guerre de l'independance Americaine. Appendix B.

[2] Henry Adams, History of the United States, Vol. IV, p. 36.

[3] Lambert. Travels in Canada, Vol. I, p. 41.

at his disposal upon the fortifications of Quebec, and he deemed it useless to establish posts which he had not troops to garrison. Outside of that city, with the exception of a few field guns, there was not a single piece of artillery mounted or dismounted anywhere in Lower Canada as Colonel Brock, who was in command before Craig arrived, had brought in for safety all the guns that had been distributed at the various military posts. Although several new roads had been recently opened to the American frontier, by which small parties of troops might enter the province, the principal army of invasion must still advance by the main route from Lake Champlain by way of St. Johns. The smallest regular force with which Craig considered that the two provinces might be successfully defended, was twelve thousand men,—of whom he proposed to station two thousand in Upper Canada, two thousand as garrisons at Quebec, and other posts in Lower Canada, leaving eight thousand available for operations in the field. A considerable body of militia had offered their services in the summer of 1807, and about one thousand of these in the cities of Montreal and Quebec, had already been armed and equipped and had provided themselves with uniforms at their own expense.

"My confidence in the service to be derived from the militia is, I confess, not very great," Craig reported. "Yet at the same time, I am bound to do them the justice of observing that they express every good disposition that can be desired, at least such is the substance of all the reports I have on the subject; but however this may turn out, I hold it is a certainty that the benefit to be derived from them can only be in proportion to the support they may have from regular troops."[1]

Craig's illness prevented him from giving any instructions to Lieut.-Governor Gore, of Upper Canada, until December 6th, 1807, when he despatched a letter to him by a special messenger, directing him to put that province into an immediate state of defence as far as his means would permit, but at the same time expressing the opinion that if the Americans attempted to invade Lower Canada as he expected they would, that undertaking would absorb all their forces and prevent them from a simultaneous attack elsewhere. With the small regular force then at his disposal, he could not hope to do more than delay the invaders' advance and must eventually retire into Quebec and defend that place to the last extremity. In that event he wished a force from Upper Canada to operate in rear of the besieging army by breaking up their communications and cutting off convoys. If the Indians were not employed by the British he entertained no doubt they would be employed against them and the valuable fur trade with the western nations would be lost, but great

[1] Craig to Castlereagh, Canadian Archives, Q., 109, p. 10.

caution must be observed in dealing with them before hostilities actually began.[1]

In his reply a month later, Gore replied that little could be done for the defence of Upper Canada except as far as repelling incursions by small parties might be concerned. The inhabitants from Kingston downward could be depended upon, but he entertained grave doubts as to the loyalty of many persons residing near Niagara and Long Point. If the American posts at Mackinac and Detroit could be taken, he believed that many of the western Indians would declare for the British and agreed that they would certainly side with one party or the other. The prophet of the Shawanese, who was supposed to be able to influence about a thousand Indians, appeared to be well disposed. Thomas McKee, the Deputy Superintendent at Amherstburg, reported that the Americans were making great efforts to win over the Indians, who were leaving that place daily in consequence; and he complained that he had been compelled to buy ammunition with his own money to supply them as the government store contained none.[2]

Craig soon after cautioned Gore to do nothing to irritate the Americans in his efforts to preserve the attachment of the Indians as any public communication with them would furnish the war party in the United States with a fresh subject of complaint. He was able to report that the utmost good feeling prevailed in Lower Canada and that great cordiality had marked the proceedings of the House of Assembly which met in February, 1808. The Non-Intercourse Act passed by Congress had been openly set at defiance by the people of Vermont and New York all along the frontier of Lower Canada. A mammoth raft, said to cover ten acres of water had been built by the smugglers on Lake Champlain, on which an immense quantity of potash, provisions and staves was stored, and it was then towed near the boundary line where it was moored for several days, in sight of an United States Revenue cutter stationed there to enforce the law. A high gale finally forced it into British waters

---

[1] Canadian Archives, Craig to Gore. Q., 107, p. 209.

[2] On January 16th, 1808, *Le Canadien* published an extract from a letter from the captain of a merchant vessel on Lake Erie, dated Fort Erie Roads, 3rd October, 1807: "The British have armed all their vessels on this lake, that is to say, the *Camden*, brigantine, of 18 guns, the *General Hunter*, of 10 guns, and all their merchant vessels. On Lake Ontario, as I am informed, they have the *Duke of Kent*, brigantine, of 18 guns, a ship, the *Toronto*, of 24 guns, and the Governor's Yacht. The last a few days ago exercised its seamen and guns alongside the brig *Adams*. If hostilities begin immediately, the posts of Mackinac and Chicago will be the first attacked by the English to expose a more extensive frontier to the savages with whom they are negotiating for an alliance."

and the men in charge declared that they would resist any attempt to make them return by force and were permitted to proceed to St. Johns.[1] Other rafts afterwards succeeded in crossing the boundary in a similar manner. Elsewhere, houses were built as smuggling resorts, half being in Canada, and the other half in the United States. The Embargo and Non-Intercourse Acts, consequently became a source of great profit to Canadian merchants and shipmasters. The harbour of Quebec was thronged with vessels and rafts while the American seaports were silent and deserted. So numerous and well organized were the bands of smugglers that President Jefferson finally issued a proclamation declaring that certain districts of Vermont were in a state of insurrection and requiring the Governor of that State to call out a force of militia to restore order.[2]

Craig lost no time in strengthening the defences of Quebec. The old walls were repaired and new works built. A powerful battery was built on the highest ground within the Citadel and several martello towers were constructed on commanding points without.

A line of telegraph stations was established connecting the Citadel of Quebec with Bic. Six regular officers were appointed inspecting field officers of militia, and put in charge of the several districts into which the province was divided. Preparations were made to embody one-fifth of the militia, but were not carried into effect. The expenditure of public money upon the fortifications of the city created considerable industrial activity, and the Governor-General himself maintained a much greater retinue of servants than his predecessors in office, and entertained liberally. During the summer of 1808, he resided at the Powell House, near Wolfe's Cove, four or five miles from the city, where, from time to time, he invited most of the principal inhabitants to breakfast with him in the open air. He kept a large number of horses and gave his patronage to races, which were held on the Plains of Abraham.

His apprehensions of a war with the United States were much abated by the arrival at Washington of Hon. D. M. Erskine, as a special envoy from Great Britain; and Craig readily promised that every pre-

---

1 Lambert, Travels, Vol. I, 254-5.

2 *Le Canadien* quotes a statement from the Louisville *Gazette* (18th June, 1808): "There are in Upper Canada more than 740 persons who have deserted at different times from the service of the United States. There are now in prison in Canada about 140 who have refused to perform military service and to bear arms against the United States. Many of these are citizens of the United States who have emigrated to Canada in the hope of obtaining grants of land. Within two months about 300 families have returned to the State of Vermont who had been lured from the United States to the British Colonies."

in consequence. One French-Canadian candidate for the House of Assembly "after using very unwarrantable language with respect to the views of the Government and the English, did not scruple to say that if an Englishman was elected for his colleague, he would not attend the parliament." [1]

Fourteen members of British origin were, however, returned to the new House of Assembly, among them Ezekiel Hart, who was elected for the borough of Three Rivers. Mr. J. A. Panet, who had been Speaker of the Assembly from its organization in December, 1792, was defeated in the Upper Town of Quebec, through the influence of the Government, but was immediately returned for a rural constituency. Among the French speaking members there were fifteen lawyers and notaries and fourteen *habitans,* and only seven seigniors. Three-fifths of the members belonged to the opposition party, but several of them were rather negligent in their attendance.[2]

Immediately after the elections the Governor-General unwisely determined to assert his authority by the dismissal of all persons holding office under the Government who were in any way concerned in the publication of *Le Canadien,* which was declared a seditious newspaper. One of these, Joseph Planté, a member of the last Assembly, who held the offices of "clerk of the terrars" and Inspector-General of the King's domain, immediately declared his disapproval of many articles that had appeared in that paper and denied all responsibility for their publica-

---

[1] Craig to Castlereagh, Can. Archives, Q., 109, p. 134.

[2] In No. 38 of *Le Canadien,* there appeared an address to "mes compatriotes canadiens." in which the writer said:—

"Nous sommes absolument obligés, le par devoir parceque tout sujet se doit entier à son roi, à son pays et à son Dieu et ennemi de son Souverain s'il s'écarte de ses engagements; 2d. Par intérêt parceque depuis la conquête du Canada nous n'avons cessé d'éprouver combien il est heureux de vivre sous un Gouvernement doux. Il est pourtant vrai de dire que quelques intrus se sont souvent permis des réflexions noires sur notre compte, mais je suis persuadé qu'ils sont alliés de très près aux ennemis dont nous sommes menacés, nous devons donc avec raison craindre que p·isqu'un si petit nombre de ces méchantes créatures nous a fait éprouver tant de disgrâces quand ils seront plus considérables et maîtres de nos foyers nous deviendrons leurs plus vils esclaves. 3d. Par reconnoisance; oui, je repète, mes chers compatriotes, notre reconnoissance doit être sans bornes pour pouvoir égaler et contrebalancer, s'il est possible, les bontés infinies du plus digne des monarques envers le peuple canadien. Qu'a-t-il exigé de nous? Que vous a-t-il demandé? N'avons-nous pas toujours joui de toutes les prérogatives qu'il a accordées à ses fidèles sujets? Et ne serait-ce pas pousser l'ingratitude au dernier point que de se refuser au devoir et à l'intéret qu'on a de le maintenir dans ses droits."

tion, while he admitted that he had been concerned in its establishment as the political organ of the French-Canadians. He had a large family dependent upon him, and the Governor-General, who probably desired to show the people that he was neither implacable nor ungenerous promptly re-instated him. The commissions as officers of the militia held by four members of the new Assembly, Panet, the former Speaker, Bedard, Borgia and Blanchet, were at the same time revoked. Panet was lieutenant-colonel; Bedard, a captain; Borgia, a lieutenant, and Blanchet, a surgeon in the town militia of Quebec. The commission of J. T. Taschereau, another captain, was also cancelled, and his father, Hon. G. E. Taschereau, the *Grand voyer* of Quebec, was directed to cease employing him as his deputy. These dismissals naturally provoked a storm of indignation in the columns of *Le Canadien*, whereupon the *Mercury* tartly reminded the complainants that during the election for the county of Quebec, a hand-bill had been circulated in which the Government had been described as "feeble." "Those concerned in the hand-bill" it added, "now it seems, feel that they are not quite under the government of King Log."[1]

The Legislature did not meet until April 9th, 1809, when Panet was immediately re-elected Speaker of the Assembly in the expectation, it was generally supposed, that Craig would refuse to recognize him, but he deemed it politic to confirm their choice which was done through the Speaker of the Legislative Council in rather chilling terms.

In his speech from the throne, the Governor-General referred to the satisfactory results of the Embargo Act of the United States, which he declared had called forth the energies of the people of Canada, and made them better acquainted with the resources of their own country. By industry and perseverance he anticipated that the advantages already secured might be made permanent and he expressed his hope that the Legislature would not allow causeless jealousies and suspicion of the Government to blight these fair prospects.

The question whether judges should be permitted to sit in the Assembly, which had been debated in the preceding parliament, was again brought forward, but a motion to expel Hon. P. A. de Bonne, a justice of the King's Bench, who had been re-elected for the County of Quebec, was defeated and the question was referred to a committee. The expulsion of Mr. Hart was, however, effected by a resolution declaring that "Ezekiel Hart, professing the Jewish religion, cannot sit or vote in this House." The majority obstinately refused to hear any argument founded on the

[1] Christie, Hist. Canada, Vol. I. p. 277.

consequence thereof to prorogue and dissolve them you will take care to use such temperate and chosen language as may not leave it in the power of the Legislative Assembly, which may afterwards be chosen to question the propriety of your statements as affecting their privileges or the Constitution." [1]

In a private letter of the same date, he added this further warning for his guidance in the future:—

"Nothing appears to me more difficult or delicate to manage than a Provincial Assembly constituted like that of Lower Canada, wherein all the privileges of the House of Commons of Great Britain are claimed or exceeded, where there exist little means of influencing and inducing them to coalesce with the Government, and wherein from the example of the American States and the very nature of a popular Assembly, active and turbulent minds have great materials and opportunities to raise themselves into imaginary or real importance by opposing the administration, and the difficulty becomes thus great from another peculiar circumstance that there is no means whatever of punishing an Assembly but by dissolution, and this method when the conduct of the Assembly is popular is sure to fail of success and to increase the evil it is intended to cure.

"It is therefore of the utmost consequence to take care that in any difference which may arise between a Governor and a Provincial Assembly, he should not advert to any particular proceeding of the Assembly that is not clearly unconstitutional and illegal, and that when the improper opposition of the Assembly arises from discussion of a mixed nature when they can plausibly plead their privileges and rights in favour of their conduct, however, improper, no particular allusion to such conduct should be made by the Governor on which the Assembly might fasten a complaint.

"Neither of the grounds on which the Assembly was dissolved appear to have been unconstitutional.

"In regard to the measure of excluding the judges from a seat in the Legislature, there is no repugnance felt to the measure should you at any time see it right to acquiesce in it." [2]

This unmistakable rebuke produced an almost immediate alteration in the Governor-General's bearing, and it was soon surmised by the leaders of the opposition that his conduct had in some way incurred the disapproval of the ministry, but of this they were unable to secure any confirmation to strengthen their position.

---

[1] Craig to Castlereagh. 7th Sept., 1809, Canadian Archives, Q., 109, p. 217.

[2] Canadian Archives, Q., 109, p. 219.

act of the British Parliament in the 31st year of the reign of George III, and while not directly challenging the supremacy of Parliament or the validity of that Act, yet they asserted that they were to be regarded as the sole judges of their own proceedings, and refused to be controlled or bound by the acts of another legislature. They did not even ask Mr. Hart to avow or deny his religious belief, and it appeared that he had taken the oath in exactly the same manner as every other member of the House. Craig and the Executive Council, to whom he submitted the case, on the other hand, were unanimous in the opinion that he was eligible, providing he took the oaths prescribed by the Act of Parliament. A month was consumed in desultory and profitless discussion, while the number of members present seldom exceeded twenty-five or thirty. The Governor-General had apparently considered the expediency of dissolving the House as soon as he found a reasonable pretext, even before it had met, and he then determined to act. On May 15th, after giving his assent to half a dozen unimportant bills, he prorogued and dissolved the Assembly, scolding them soundly in a lengthy speech for wasting their time in frivolous and factious debates while he as warmly commended the Legislative Council for their zeal, unanimity, and public spirit. This indiscreet and arbitrary act seems to have commanded the approval of the greater part of the British and a portion of the French inhabitants. Soon after the dissolution of the Assembly, he visited Three Rivers, Montreal, St. Johns, and Sorel, where he was warmly welcomed. At all of these places he was presented with addresses signed by many of the principal residents, strongly approving of his conduct. Upon his return to Quebec, he received another, in which many citizens of that place congratulated him upon his "judicious and firm administration." These indications of popular approval certainly induced him to believe for a time that the coming elections might result in the return of a majority of members favourably disposed towards the Government.

But Lord Castlereagh, the Secretary of State for War and the Colonies, was not inclined to view his action in this respect with unqualified approbation.

"I have no doubt," he informed him, "that in the measures you have taken you have been really influenced by a sense of your duty to His Majesty, and as you represent that it is approved by the English part of the community and the sensible part of the Canadians, I shall entertain a hope that it may not be attended with any prejudicial effect.

"I am at the same time to impress upon you this counsel that if any unfortunate difference should arise hereafter between you and the Legislative Assembly, which may render it necessary for you to advert to their proceedings, (which should always be done cautiously), and in

Early in 1809, Craig was warned by the British Minister at Washington, that war might be commenced at any time by the United States without any formal declaration, and he at once resumed his preparations for defence. About the same time General Turreau renewed his efforts to communicate with the malcontents in Lower Canada, by authorizing the Chevalier Le Blond de Saint Hilaire to proceed to that province as his agent with secret instructions to make arrangements for an insurrection which was not to be commenced until the French Government was prepared to support it. Saint Hilaire seems to have resided in Canada for several months unmolested and did not return to the United States until March 1810.[1]

The elections of 1809 resulted in little change in the complexion of the Assembly. Joseph Papineau who had sat in the first and second parliaments of the province now returned to the Assembly after an absence of nine years and at once assumed a position of influence and authority. His son, the noted Louis Joseph Papineau, was also re-elected as a member of the extreme opposition, with which the father warily declined to identify himself. Acting upon the instructions conveyed in Castlereagh's private letter of the 7th September, 1809, the Governor-General announced in his speech that he was prepared to give his assent to a bill disqualifying judges from sitting in the Assembly, which had been the subject of such prolonged agitation.

"This measure," he said in a letter to his confidant, Colonel Bunbury, "had a very considerable effect, so much so that though the leaders felt no small degree of mortification, and one of them was even heard to say, 'Ma foi! Il est plus fin que nous,' yet they could not do otherwise than join in the general sentiment."

There is not much doubt, however, that this concession was at the same time construed by many into a confession of haste and indiscretion in dissolving the preceding legislature. Craig's whole manner was conciliatory, and two days later he entertained all the members at dinner, except two who were not invited.

"Had anyone peeped in after dinner," Craig wrote to Bunbury, "he would certainly have supposed it to be a marriage feast and not a meeting of grave legislators."

Still the majority were by no means disposed to overlook the discourteous manner in which the late Assembly had been dissolved and a resolution was soon introduced and carried declaring that every attempt to censure the proceedings of the House by the disapproval of the conduct of certain members and the approval of others was a breach of

[1] Faucher de St. Maurice.

[illegible] to suppress this paper [illegible] its publication upon a [illegible]

[illegible] informed Lord [illegible] employed in sowing their pernicious [illegible] people, and as unfortunately [illegible] they have succeeded in disseminating among them a strong spirit of jealousy, disaffection and mistrust of His Majesty's Government, mixed with a considerable degree of animosity towards the English part of their fellow-subjects. These have at length shown themselves in very many, indeed, I may almost say in every part of the colony and that with respect to the press in so open and daring a manner that it became indispensably necessary to take decisive steps to avert the evil that was threatened by it. I am singularly happy in feeling warranted in giving your Lordship my opinion that those steps have been adopted precisely at the most favourable moment, when the mischief is sufficiently obvious to arouse the exertions of the well-disposed at the same time that it is not so far advanced as to give reason to doubt the effect of their exertions in support of the energy of Government.

"With the advice of the Executive Council I have seized the press that was employed in the service of this party and by the same advice and under their warrant, three of their leaders, Bedard, Blanchet and Taschereau, together with the printer, have been arrested on a charge of treasonable practices. Fortunately the act for the better security of His Majesty's Government, which is in fact an act for the suspension of the *habeas corpus* was one of the only two that were passed last session, and it is under the authority vested in the Executive Council by that act that they have been apprehended."

Three other persons were also arrested in the District of Montreal, Pierre La Forée and Pierre Papineau of Chambly, and François Corbeil of Ile Jésus; and a reward was offered for the apprehension of a man named Cazeaux, who was suspected of being an agent of the French Government. Cazeaux could not be found, and Turreau's correspondence reveals the fact that these arrests quite dismayed Saint Hilaire, who instantly returned to the United States and reported that the Governor-General's action had been caused by the indiscretion of one of his agents.[1]

General Brock, who was in command of the military forces in Lower Canada at that time, warmly approved of the coercive measures adopted to repress disaffection.

"We have been in a bustle and on the alert for the last ten days,"

[1] Quebec, 8th August. 1807. Tuesday last Mr. O'Sullivan, of Montreal. returning from Newfoundland, where he had been travelling, was examined by Colonel Brock on a suspicion caused by his resemblance to a suspected person, supposed to be in the city. After a short interview he was politely released. *Le Canadien*, No. 38, August 8th, 1807. A reference is made to a reward offered for the apprehension of one Cazeau or Casserio, 23rd January, 1808.

he wrote to Colonel William Claus from Quebec on March 22nd, 1810. "The spirit of insubordination and revolt was advancing so rapidly among the Canadian population of the province that it became absolutely necessary for the peace to put a check to it, and fortunately a person was found at the head of the Government of sufficient energy to meet and crush at once the monster who strived to draw the people from the state of unexampled prosperity to all the horrors of civil commotion. Several persons have been arrested. Bedard, Blanchet and Taschereau are the principal. I hope at any rate, terror will prove effective, for I begin to think gratitude and a recollection of the sacrifice any change would produce will scarcely operate a reform in their rooted animosities against all anyway connected with the name of Englishman. All confidence has forever vanished, and the bubble set up by Lord Dorchester and Sir R. S. Milnes, has completely burst never to rise again." [1]

Turreau relates that Saint Hilaire informed him that a French expedition for the recovery of Canada would simply be a matter of entering into possession as the hearts and arms not only of the French inhabitants but of the neighbouring Indians were devoted to the Emperor. The English, he said, were so fully convinced of the strength of this sentiment of disaffection to them, that as soon as the French flag was seen in the St. Lawrence the scattered detachments of regular troops would be withdrawn into Quebec and Halifax and the invaders would be permitted to become masters of the rest of Canada, probably without firing a shot. He had, in fact, been informed that instructions had been given not to attempt the least resistance in the field.[2] But Saint Hilaire died suddenly a few months later and Turreau failed to re-open communications with the Canadian conspirators.

By a goodly majority of the French-Canadians, Craïg was undoubtedly viewed as a thorough-paced tyrant, but there seemed to be very little inclination on the part of their leaders to further endanger their liberty and perhaps their lives by open resistance, and the suppression of *Le Canadien* seemed to restore tranquillity for a time. In his proclamation he asserted that the "most base and diabolical falsehoods" had been insidiously promulgated and disseminated. "In one part," he continued, "it is announced as my intention to embody and make soldiers of you, and that, having applied to the late House of Representatives to enable me to assemble twelve thousand of you for that purpose, and they having declined to do so, I had therefore to dissolve them. This is not only directly false, such an idea never having entered into

---

1 Original letter in possession of Miss C. Claus, Niagara, Ont.

2 Faucher de St. Maurice.

my mind, but it is doubly wicked and atrocious because it has been advanced by persons who must have been supposed to speak with certainty on the subject and was therefore the more calculated to impose upon you. In another part you are told that I wanted to tax your lands and that the late House of Assembly would consent only to tax wine, and that upon that account I had dissolved the House. Inhabitants of St. Denis, this is also directly false. I never had the most distant idea of taxing you at all."

He appointed Hon. P. A. de Bonne to a vacant seat in the Executive Council and despatched Ryland, his private secretary, to England, to justify his policy to the ministry and recommend the repeal of the Constitutional Act, upon which the province would revert to the position of a Crown Colony.

Lord Liverpool, however, frankly told Ryland that even if the ministers were inclined to approve of such a drastic proposal, they would not dare to bring it before Parliament, and suggested a reunion of the provinces or a redistribution of constituencies to increase the number of English-speaking members in the Assembly. Referring to an intimation conveyed in one of Craig's despatches that the policy of the leaders of the opposition was inspired by the hope and desire of forcing themselves into office, he inquired whether some of them could not be "brought over." To this Ryland replied that this policy had already been adopted in several instances, but that there were very few posts of emolument at the disposal of the Governor-General.

The Attorney-General for Great Britain gave an opinion that Parliament possessed the authority to reunite the provinces, but not to alter the number of representatives of the boundaries of the electoral districts which could only be changed by the Legislature. He also held that the statements in *Le Canadien*, upon which the action of the Executive Council in the suppression of that newspaper was based, were not actually sufficient to justify a charge of treasonable conduct, but as they were undoubtedly designed to cause mischief, the publishers might be prosecuted for seditious libel.

During the summer, both Blanchet and Taschereau, humbly expressed regret for their conduct and were promptly released, but Bedard resolutely denied that he had committed any offence and demanded that he should either be released unconditionally or brought to trial. A writ of *habeas corpus* was refused, and he remained in prison. An attempt by his political associates to buy another printing press which was offered for sale in Montreal was thwarted by the vigilance of the Governor-General, who engaged a secret agent to outbid them and dispose of it again piecemeal to other printers.

But the elections of 1810 resulted in a more decisive victory for the opposition than ever before. Bedard was elected for the County of Surrey, and the English-speaking members were reduced to ten. This rebuff in conjunction with the total failure of Ryland's mission, persistent ill-health and the constant apprehension of a war with the United States, so effectually disheartened Craig that he tendered his resignation to Lord Castlereagh in a despatch dated 23rd November, 1810, declaring, however, his willingness to remain for some time longer if it was considered that his services were indispensable.

The session of the Legislature which began in December, 1810, and ended in March, 1811, was far quieter and more business-like than had been anticipated, although as Craig remarked, "the party which rules the House came down full freight with every hostile intention, and amply supplied as they imagined with subjects to exercise it." The Governor-General was equally determined to persist in his former line of policy. Papineau, the elder, had again been returned for the east ward of Montreal, and his influence had increased to the highest point although he was studiously moderate in his public utterances. Craig described him "as a man of sense, but extreme vanity, of great art but degenerating into a species of cunning which shows itself in spite of him, well calculated for a demagogue and little scrupulous in the means he employs. This person," he added, "had made his appearance in the House under professions of great moderation and a desire to allay the heat and animosities that existed in it. Under these, however, he was assiduously endeavouring to acquire the general confidence."

In a characteristically verbose speech, Craig directed the attention of the Legislature to the necessity of re-enacting the Acts respecting aliens coming into the province and for the better security of His Majesty's Government, which it had been the practice to pass annually, but which had lapsed as the last Assembly had failed to enact them before its sudden prorogation. In its reply, the House boldly announced its decided reluctance to pass the latter Act through "fears and apprehensions," that it might be misapplied. This was, of course, an unmistakable allusion to the recent arrests; and the prolonged imprisonment of Pierre Bedard, without trial, was accordingly one of the first matters they considered, and a committee of eight members, among whom were Joseph and his son, L. J. Papineau, was appointed to prepare and present to the Governor-General an address praying for his immediate release. The elder Papineau had, however, already committed himself the address voted by this House on 24th December last to His Excellency the Governor-in-Chief." Mr. Coffin moved in amendment, seconded by Mr. Bowen, to leave out all words after "that," and insert "the messengers be discharged from presenting the said message." Mr. Joseph Papineau moved, seconded by Mr. Debartsch, that the consideration of the main question and of the question in amendment be adjourned, and this motion was carried by sixteen votes to thirteen. No further action was taken. Joseph Papineau's conduct in this matter seems to have been perfectly straightforward and consistent, and nothing but his great personal influence and tact could have possibly averted another conflict with the Governor-General and a dissolution of the Assembly.

The Alien Act and the Act for the prevention of seditious practices recommended by the Governor-General were first introduced in the Legislative Council, by which they were promptly passed without discussion and transmitted to the Assembly. A new clause had been inserted in the latter Act, providing that no member of the Legislature should be imprisoned during a session unless the cause of his arrest had been previously made known to the House and its consent obtained. The opposition lacked the courage to resist this measure and it was passed without a division, although they had declared within twenty-four hours that it was "a subject of much apprehension in the province and required their most serious consideration." Dissensions soon arose in their ranks. They quarrelled bitterly amongst themselves and several of the strongest opponents of the Government returned to their homes in great disappointment before the session concluded. The behaviour of the remainder towards the English members became decidedly more friendly and even cordial.

"It has been observed," said Craig, "that their manner and deportment towards the English party has been in general very different this session from what it was during the two or three last meetings. Some few, however, of the most violent continued to observe the same distance, and among themselves the usual scenes of extravagance and indecorum have occurred even so far as to afford the spectacle of one member pursuing another around the Salle." [1]

After the prorogation of the Legislature the Governor-General's health failed so much that he determined to return to England by the first opportunity without waiting for permission. On June 19th, 1811, he accordingly embarked on the frigate *Amelia* amid the strongest expressions of esteem from the English population of Quebec, and the ad-

[1] Craig to Liverpool, 28th March, 1811, Canadian Archives, Q. 114, p. 12.

on this question by a public declaration that he considered Bedard's detention perfectly justifiable and was thus placed in an awkward position. To extricate himself, he solicited a private interview with the Governor-General, which was readily granted, although Craig suspected him of a design of intimidating or entrapping him into some rash declaration on this subject.

" He certainly said everything that could be said in its support and in every way in which it could be said," Craig reported. "The firm ground on which I stood gave me, however, every advantage over him and I did not hesitate to tell him that no consideration should induce me to consent to the releasing Mr. Bedard at the interference of the House or even during the period of its sitting, that I knew the general language of its members had encouraged the idea which generally prevailed in the province that the House of Assembly would release Mr. Bedard, an idea so firmly established that not a doubt was entertained upon it, that the time was therefore come when I felt that the security as well as the dignity of the King's Government imperiously required that the people should be made to understand the true limits of the rights of the respective parts of the Government, and that it was not that of the House of Assembly to rule the country.

" This gentleman took the next day the singular method for extricating himself from a dilemma into which he felt he had got by declaring in the House that he had had the honour of an interview with me, and that I had convinced him that the House ought not to interfere; and such was his influence that he actually prevented the resolutions from being presented though he had himself drawn them up and was of the committee appointed for the purpose of laying them before me, and though the subject was several times brought forward and a motion made to compel them to report, which though not negatived, was adjourned and suffered to die away." [1]

The minutes of the Assembly show that on January 5th, 1811, a resolution was adopted requiring the committee to acquaint the House with their proceedings on the following Monday. When the matter came up, Messrs. Bourdages, Debartsch, Bruneau, and Lee, members of the committee stated that the address had not been officially presented while Messrs. Viger, Bellet and L. J. Papineau, declared that they had never been required to wait upon the Governor-General for the purpose of presenting it.

Mr. Borgia then moved, seconded by Mr. Huot, that "an enquiry be made of the causes for which the messengers did not officially present

[1] Craig to Liverpool, 28th March, 1811, Canadian Archives, Q. 114, p. 12.

ministration of the Government again devolved upon Hon. Thomas Dunn as the oldest Protestant member of the Executive Council.

A despatch had been prepared by Lord Liverpool on the last day of May, authorizing Craig to turn over the Government to Sir George Prevost, the Lieutenant-Governor of Nova Scotia, who was at the same time directed to proceed to Quebec as soon as he was informed by Craig that he intended to resign. But these letters did not reach Canada until several weeks after Craig's departure, and consequently Prevost did not arrive at Quebec until September 13th, 1811.

III.—*An Adventurer from Hudson Bay.*

JOURNAL OF MATTHEW COCKING, FROM YORK FACTORY TO THE BLACKFEET COUNTRY, 1772-73.

Edited with Introduction and Notes by LAWRENCE J. BURPEE.

(Communicated by Dr. Wilfred Campbell and read May 26th, 1908.)

MATTHEW COCKING'S JOURNAL.

BEING THE JOURNAL OF A JOURNEY PERFORMED BY MR. MATTHEW COCKING, SECOND FACTOR AT YORK FORT, IN ORDER TO TAKE A VIEW OF THE INLAND COUNTRY, AND TO PROMOTE THE HUDSON'S BAY COMPANY'S INTEREST, WHOSE TRADE IS DIMINISHING BY THE CANADIANS YEARLY INTERCEPTING NATIVES ON THEIR WAY TO THE SETTLEMENTS, 1772-1773.

INTRODUCTION.

Matthew Cocking's narrative may properly be regarded as a companion document to the Journal of Anthony Hendry, edited for the Royal Society last year, and published in the Transactions for 1907. The two Journals are closely related, although the journeys they describe stand nearly twenty years apart. Not only were they both undertaken with the same objects—the exploration of the vast unknown region to the westward of Hudson Bay, and the persuading of the far western tribes to bring their furs down to the Bay; but they covered substantially the same ground. Both Hendry and Cocking started forth from York Fort, or York Factory as it is more familiarly known; both took the well-known Hayes route as far as Knee Lake, but from there struck off almost due west to Cross Lake on the Nelson, following a route evidently at that time familiar to the men of the Hudson's Bay Company, but afterward forgotten, so much so in fact that this strip of territory is to-day counted among the smaller unexplored areas of the country. From Cross Lake, both travellers followed the Minago River to Moose Lake, and thence smaller streams to the Saskatchewan. As a description of this portion of the route has already been given in connection with Hendry's Journal, it will not be necessary to repeat it here. Cocking, like Hendry, ascended the Saskatchewan to the mouth of the Pasquia—always an important point in the annals of the fur trade—and for a few miles farther their courses were identical, but at Saskeram Lake, to which Cocking applies the modest name of Maneneshahsquatanan Sakahegan, the two travellers took different roads. Hendry, it will be remembered, ascended Carrot River and then struck overland between Carrot River and the Red Deer, working around to the South Saskatchewan, which he crossed somewhere about Clark Crossing, north of the present town of Saskatoon, thence to the Elbow of the North Saskatchewan, and then over the Great Plain to the Red Deer branch of the South Saskatchewan, which he crossed somewhere about Kneehill Creek. Cocking, on the other hand, after trâversing Saskeram Lake, again entered the Saskatchewan, which he ascended to a point not many miles below the Forks. He notes in his Journal, "Formerly the French had a House here." He was evidently about where the present H. B. post, Fort à la Corne, stands, and where the French fur-traders had a small establishment before the cession of Canada. From this place Cocking travelled overland, in a general south-westerly direction, crossing the South Saskatchewan somewhere below Clark Crossing, but striking Hendry's old trail once more at or about the Elbow of the North Saskatchewan. Following the southern bank of the North Saskatchewan, Cocking "put up at a shallow creek named Mikisew or little Eagle Creek," and then, leaving the river, he "came to some high land named Mikisew Wache, or Eagle hills." Eagle Hill Creek enters the North Saskatchewan some distance above the Elbow, and the Eagle Hills still bear the same name; so that Cocking's position can be accurately placed at this time. From the Eagle Hills, he journeyed out into the plains, following an erratic course, and constantly looking out for indications of the Archithinue Indians, or Blackfeet, as one of the main objects of his journey was to induce this important tribe or confederacy to trade their furs with the Hudson's Bay Company. He finally joined a considerable body of Blackfeet, and although he failed, as Hendry had done many years before, to persuade them to bring their furs down to the Bay, he spent some time among them, and has left us an exceedingly interesting and valuable account of their character, manners and customs at the time of his visit. Here, again, Cocking's narrative may profitably be compared with that of Hendry, who also has much to say about this remarkable tribe.

It may be noted that in both Hendry's and Cocking's cases, one of the main incentives to their expeditions inland was the increasing pressure of the rival fur-traders from Canada, a pressure which eventually was to thoroughly awaken the Hudson's Bay Company from the dream of a peaceful and comfortable monopoly of the fur trade, and convince them that if they would hold their own they must no longer rest content with a string of posts around the shores of Hudson Bay, but must strike boldly inland and meet the enterprising and very energetic Canadian traders on their own ground. In Hendry's day the Canadian fur-traders whose competition was beginning to arouse the alarm of the Hudson's Bay Company were French. When Cocking went inland, a couple of decades later, Canada had changed hands; but although the traders who now roamed far and wide throughout the immense fur country west of the Great Lakes and Hudson Bay were British, like the Hudson's Bay men themselves, the competition was much more bitter and strenuous than it had ever been before—which was, of course, entirely in keeping with the whole history of mankind.

Although the Hudson's Bay men contemptuously styled the Canadian traders "pedlers," they were too shrewd to ignore the strength of their competition, and it was no doubt a direct result of this journey of Cocking's that the year after his return to York Factory he was sent inland again by Chief Factor Andrew Graham, with Samuel Hearne, to build Cumberland House on the Saskatchewan. When Alexander Henry visited Cumberland House, in October, 1775, he found it "garrisoned by Highlanders, from the Orkney Islands, and under the command of a Mr. Cockings, by whom, though unwelcome guests, we were treated with much civility." How long thereafter Cocking remained in charge of Cumberland House, or what his subsequent history may have been, there is no present means of knowing, nor is any information available as to his life previous to his remarkable journey from York Factory to the Blackfeet country.[1]

It may not be without interest to give two practically contemporary descriptions of the famous trading post of the Hudson's Bay Company which was the starting-point of Cocking's expedition, as of so many other remarkable journeys in the eighteenth and nineteenth centuries. The first of these is taken from Drage's "Account of a Voyage for the Discovery of a North-West Passage by Hudson's Straights, to the Western and Southern Ocean of America, performed in the Year 1746 and 1747;" and the second from Andrew Graham's account of the forts of the Hudson's Bay Company in 1771, as given in Dr. George Bryce's "Remarkable History of the Hudson's Bay Company," Chapter xiii.

"The situation of the Factory," says Drage, "is a clear Space made in the Woods, which surround it on three Sides, the Factory having an open Front to the Water, from which it stands a small Distance within the Bank; to the North and Eastward covered with a good Battery, and to the South-East is a Dock for building or repairing either Sloops or Boats; behind the Battery, and between that and the Dock, there is a Space of land which they call the Plantation, and here the Indians who come to the Factory pitch their Tents; and there is generally a Tent or two of old and infirm Indians, both Men and Women, who get their Maintenance from the Factory. This Part, which is on the Back of the Battery and Dock, and called the Plantation, is separated from the Factory by two Rows of high Palissades, between the first of which and the second are Store-houses, the Cookery and some Workshops, low built, and so placed as they would be of little Service to an Enemy to cover an Attack of the Place. Within the inner Palissades are small Spots of Turnips, Collards, Sallads, and other Garden Stuff, belonging

[1] Some further particulars as to Cocking and his expedition inland with Hearne, will be found in Agnes Laut's *Conquest of the Great Northwest*—published since the above was written.

gencies, tradesmen must work at anything. Killing of partridges the most pleasant duty. A ship of 200 ton burden, bearing provisions, arrives yearly in August or early September. Sails again in ten days, wind permitting, with cargo and those returning." After enumerating the several other posts on the Bay, Severn, Albany, Henley House, East Main House, and Moose Factory, Andrew Graham concludes: "All are under one discipline, and excepting the sub-houses, each factor receives a commission to act for benefit of Company, without being answerable to any person or persons in the Bay, more than to consult for good of Company in emergencies and to supply one another with trading goods, &c., if capable, the receiver giving credit for the same."

Ballantyne and other writers have described York Factory as it appeared at a later day, but that is not to the present purpose.

NOTE.—Since this introduction was written, the writer has had an opportunity of discussing Cocking's course with Mr. J. B. Tyrrell, who is thoroughly familiar with the ground. Mr. Tyrrell is of opinion that Cocking did not go through Knee lake, but left the Hayes route above that lake, paddled through Deer lake (which lies west of Knee lake), and up the river which flows into it, to Cross lake (Cocking's Pimochickomow), over Cross lake, up Nelson river, to the mouth of Kiskitto or Kiskittogisu river, up this river, which is easy travelling, and over a swampy portage into Minago river, up this latter river and over a portage to Moose lake (Cocking's Oteatowan Sockoegan).

JOURNAL.

June 27, 1772. Saturday. This day at noon took my departure from York Fort in Lat. 57° 00″. The Indians were unwilling to proceed, being such bad weather; and two of them becoming sickly so we put up for the night, four miles above the Fort.

28. Sunday. We did not proceed.

29. Monday. At 7 A.M. proceeded, but my Canoe mate died; we put up for the night.

30. We proceeded, tracking our Canoes at intervals against a strong current.

July 1. Wednesday. Proceeded tracking all this day; the water so shoal. Left Hayes river and entered Steel river, which bears about S.W. b.W. from York Fort, & 50 miles distant.

2. Thursday. Tracked all this day: In the Evening a few Canoes overtook us, prevailed with one of the natives to make a third person in my Canoe: passed the mouth of Chuckitanaw[1] river which empties itself into Steel river 40 miles South West from its entrance. From York Fort to the mouth of Chuckitanaw river Canoes may be navigated pretty easy; above this river the Water becomes shoal.

3. Friday. Tracked, dragged, and carryed the Canoes & Goods at intervals; Several Indians overtook us, they have left a few sick people behind; Course this day South 66° W. & distance 25 miles.

4. Saturday. Proceeded as yesterday; a strong current. Our course South 67° West, and distance 14 miles.

5. Sunday. Proceeded as yesterday, a Strong current; Our Course South 85° W. Distance 6 miles.

6. Monday. Paddled, dragged, & carryed the Canoes & Goods most part of this day; I laid by in the woods a small reserve of Tobacco, to smoke with the Natives on my return to the Fort. Course 52 West, 16 miles.

7. Tuesday. Proceeded as yesterday: We speared a few pike fish which were very plenty; also shot a few ducks. Course South 45 West, Distance 20 miles.

8. Wednesday. Paddled, dragged, & carryed the Canoes & Goods, at intervals, amongst rocky shoals & strong current. Course South 29° West, Distance 26 miles.

9. Thursday. Paddled in deep water and carryed the Canoes & Goods at intervals; Deer Lake is well stored with fish & Gulls; I laid bye a second store of tobacco. Course South 39° West. Distance 29

---

[1] Mr. J. B. Tyrrell identifies this as Brassy Hill river, flowing into Steel river near Brassy hill.

16 Thursday. Proceeded in the morning, but soon brought to: Men went a Moose hunting: at noon returned: no success. We proceeded, several of my Company sick. Paddled in Sequesew river South 32 West, 12 miles to-day; & in all South 25 West 52 miles: Deep water & little Current for that distance, when it becomes almost dry.

17 Friday. Did not proceed: The disorders of the Natives are pains in the breast & Bowels, attended with a cough, & spitting ill-coloured phlegm.

18 Saturday. Lay by.

19 Sunday. Proceeded in the morning, but soon after brought to at a Carrying place, to wait for several of our men that were gone in quest of game. They returned in the Evening. No success: Here are plenty of Pike Fish. Course in Sequesew river South [illegible] W[illegible] distance 8 miles & came near to a Carrying place where the river terminates.

20 Monday. Proceeded in the morning, passed over the Carrying place, & entered a river, good water, between the [illegible]: Dragged & paddled [illegible] Indians in a [illegible] which [illegible] [illegible] [illegible] [illegible] Paddled, Dragged & [illegible] South-Westerly and distance [illegible] miles.

21 [illegible] Paddled & [illegible] sometimes in small [illegible] Course South [illegible] [illegible]

[illegible]

Kaiskatchewan river [1] in sight: We killed eleven sturgeon & a few Tickomeg (i.e.) Guinaids [2] & one black Bear; A seasonable supply being greatly in want: The Pedlar, Mr. Currie [3] (who intercepted great part of York Fort trade this year).[4] is one days paddling below this river, at Cedar Lake: Laid up a fifth reserve of tobacco. Sounded 6 fathoms in Outeatowan lake on the N.W. side where we paddled about S.W. 27 miles, then came at a small river named Kippahagan Sepee (i.e) Shut up river and paddled a small distance in it: Course South 42 West, distance 30 miles.

24. Friday. We did not proceed: Busy killing Sturgeon: We are now recovering our spirits: The Natives inform me we will soon be where food of many kinds are plenty.

25. Saturday. We did not proceed: busy killing Sturgeon: In the Evening Lewis Primo [5] with 4 Canoes in Company came here: He informs me his Leader died on the road.

26. Sunday. We did not proceed.

27 & 28. Monday & Tuesday. Primow with his Company proceeded but we did not: The sick recovering & food plenty.

29. Wednesday. Proceeded: Paddled & Carried: Here are Grey Geese, Old & Young: After paddling about 4 miles W. b. S. from Outeatowan Lake in Kippahakan River. Carried our Canoes & goods over a neck of land into Saskatchewan River & paddled up it. Course West & distance 8 miles.

30. Thursday. Proceeded: Paddled & carried to & again between Saskatchewan River & a Shallow Lake, hunting Geese &c. on the South Saskatchewan river. Course South 81 West & distance 18 Miles.

31. Friday. Proceeded & came to Basquia.[6] Here at a small river where the Natives killed Guinaids with hand nets: Many Natives had been here lately: This is a long frequented place where the Canadians rendezvous & trade with the Natives: Many of their Superstitious & Fanciful marks are seen here: We met an Indian with his wife &

---

1 The Saskatchewan.

2 Whitefish. Captain Coats, in his "Geography of Hudson Bay," says "titimegg is a fish not unlike our largest white herrings."

3 Thomas Curry or Currie.

4 Andrew Graham, the factor at York Factory, notes: "Mr. Currie's encroachment was the reason I sent Mr. Cocking inland."

5 Dr. Elliott Coues notes one Joseph Primeau, interpreter of the North-West Company, at Fort des Prairies in 1804. Probably the same name, though not same man. Lewis Primo's connection with both Cocking and Samuel Hearne is made clear in Miss Agnes Laut's *Conquest of the Great Northwest*.

6 The Pas. See note to Hendry's Journal (R.S.C., 1907, II, 325).

Family, I present my pipe to him & make him a small present, & by strength of a little liquor prevailed on him to accompany us & hope to take him with me to the Fort next summer. He had been employed last summer & winter by the pedlars to procure them food. Our Course in Saskatchewan river Wt. 20° North, distance 20 miles.

N.B.—From York Fort to Basquia I make the Course South 46 West, Distance 450 miles.

August 1. Saturday. Proceeded: Paddled: saw several wild-fowl, & Basquia hills, also an old house formerly belonging to the Canadians.[1] Paddled in a branch of Saskatchewan River & in a Lake named Maneme-shahsquatanan Sakahegan [2] on the South of the main river. From the main river in the branch to the Lake is S. 76° West 5 miles and the Lake Wt. N. by 24 miles, then arrived at a river with a strong current, & paddled 5 miles W.S.W. Soly [3] in it. Course Corrected So. 76 Wt. 27 miles distance.

2. Sunday. Proceeded, & at noon brought to, Men went a hunting Moose, killed one, good food. In the above river paddled So. 66 Wt. distance 5 miles. N.B.—The Current continues strong & good water for canoes.

3. Monday. In the forepart of the day dryed our Venison; then proceeded; men hunting but without success. Course So. 46 Wt. and distance 4 miles.

4. Tuesday. Proceeded: Paddled, Dragged, & Carried our Canoes & Goods at intervals. Plenty of wild fowl: Here I met with a York Fort Leader who had not been down this summer. He denied having traded with the pedlars; but the Canadians goods that were in their possession contradicted his Assertion. Paddled about a mile West in the river, then came to Maneshashsquatanan lake again, and paddled about 2 miles N.W. in it; when after two Carriadges, & dragging Canoes thro' swamps 2 miles N.W. nearly, we entered Saskatchewan again, and paddled for about 12 miles in it W.S.W., then put up for the night. About a mile below which place, on the North side of the river, is a place where the Natives tell me that the Beaver Indians [4] carry their goods & canoes into a Lake named Menistaquatakow: [5] this Carrying place is named Menistick-Minikqueuskow. Course corrected North 84° West, distance 16 miles.

---

[1] La Vérendrye's Fort Poskoyac.

[2] Saskeram lake.

[3] Southerly, presumably.

[4] A tribe of the Athapascan family.

[5] Cumberland lake.

5. Wednesday. Proceeded: Paddled in the afternoon, met with 15 canoes who had traded all their furs with the Pedlars; they are laying by waiting for their friends. The Indians inform me that we are now arrived at the dry Country, no Lakes being on either side the river. Course South 68° Wt., distance 18 miles.

6. Thursday. Proceeded: we met a Canoe going down to the Natives we saw yesterday, informed us that a Canoe was waiting a little farther on to assist us; We expect to see them to-morrow. After paddling about 4 miles nearly S.W. We passed a branch of the river which runs W.b.S. & which the Natives say joins the river again a long way up the Country. It is named little Sturgeon river; We caught some here: a little before we put up for the night passed an opening bearing S.b. Wt. which joins the river a little above Basquia, being a small branch;[1] Course So. 32 Wt. distance 14 miles.

7. Friday. Proceeded; paddled, & tracked: at noon came up with the Canoe, our friends; They inform us that many Natives are gone to war, & others intended to go, for grieft at the loss of their friends. In Saskatchewan river. Our Course So. 48° Wt., distance 20 miles. N.B.—Passed an opening that bore S.b.E. (a little before we put up for the night) named Peatagow river.[2]

8. Saturday. Proceeded; & in the afternoon passed by an old Trading house,[3] belonging to the French pedlars before the conquest of Quebec: River as yet broad, has many Islands producing Pine & Willows: good water for Canoes. Course So. 79° Wt., 11 miles distance.

9. Sunday. Proceeded: Paddled, & tracked, the latter mostly; bad walking: Red Deer plenty hereabouts named Waskesew: passed another old house: One Mr. Finley from Montreal resided in it five years ago.[4] The river begins to grow shoal. Course Corrected So. 28° Wt., and distance 21 miles.

10. Monday. Tracked: In the Evening came to a tent of Natives; The current strong, & the depth of water barely sufficient for our Canoes in many places. Course corrected So. 62° Wt., 17 miles.

11. Tuesday. In the afternoon came to the Families Viz, seven tents of them. Here the Natives always wait for their Friends: Formerly the French had a House here.[5] Course corrected S. 39° Wt., 14½ miles distance. From Basquia to this place I make the Course to be So. 58° Wt., & distance 150 miles.

---

[1] Sipanok canal.

[2] Not to be confused with Hendry's Peatago river—the Carrot.

[3] One of the forts built by La Vérendrye or La Corne.

[4] James Finlay. See note to Hendry's Journal (R.S.C., 1907, II, 314).

[5] Fort La Corne. See Hendry's Journal (R.S.C., 1907, II, 311).

12. Wednesday. We did not proceed. I am informed that there are 18 tents of Natives a short distance off: I am also informed that Sesiwappew's son is grieved for the loss of his father, & is going to war to revenge his death: Such is the superstition & wild notions of the natives. The Natives rejoice that the journey from the Fort is ended; Indeed we have been forty-five days in performing what they used to be only twenty days other years, when healthful: Musquetoes hath been troublesome without intermission all the way, at the Carrying places especially; the Dress we were obliged to wear afforded us but little defence against them: I found it impossible to make any remarks of the force of the Currents, depth of water, &c., the Canoes not being constructed for such experiments: As to the Falls & Shoals, Vessels (i.e.) Large Canoes must be carried over: I have been particularly careful to be impartial in the account I have given, not exaggerating, but rather leaning to the favourable side.

13. Thursday. We travel to-morrow: A Child died this day. I laid by a sixth reserve of tobacco & a few ball.

14. Friday. We travelled 6 miles S.W.b.S. Country hilly, producing short Grass, low willows & ponds in places; also many vermin holes; our Course very uncertain; I found it inconvenient to use the Compass; Indian Leaders, whom the Natives say are intending to go to war, are many; but we expect to see some of them before the season for these expeditions; when I hope to prevail on them to desist. The Friends of the Child who died Yesterday, make great lamentation, pricking themselves with Arrows in the Arms, sides, thighs and legs & the women scratching their legs &c. with flints.

15. Saturday. Travelled over several hillocks named Birch-hills. Strawberries, Rasp and Hip-berries in abundance: Course S.W.b.S., distance three miles; more Hillocks in sight as per Course named Waskesew Hills: Indians killed 2 Waskesew.

16. Sunday. Travelled S.W.b.S. 9 Miles: Country as yesterday: Saw a few straggling Ducks in small ponds in the Valleys: Indians tell me that in Winter buffalo are plenty here, which is confirmed by the quantity of Dung on the ground. Natives killed 3 Waskesew.

17. Monday. Travelled 6 miles W.S.W. over a grassy, shrubby Country; Abundance of wild Wormwood, Mynth & other Herbs like Sage & Baum; but not of the same flavour.

18. Tuesday. We did not proceed: Women employed gathering small nuts: An Indian joined us who confirms the account that many Natives are preparing for War.

19. Wednesday. Travelled 6 miles S.W.b.S.: The Natives are very dilatory in proceeding; their whole delight is to sit smoking and feasting: Y sterday I received invitations to no less than ten feasts.

20. Thursday. Travelled 7 miles W.S.W.: A Branch of Saskatchewan River bears West; distance 2 miles.

21. Friday. Travelled 8 miles S.W.b.W., passed some Hillocks named Birch Hills, and Younger Brothers, that bore South; Woods appear to be growing on them: passed through some low swamps, Thickets & Ponds: Red Deer are numerous; also Grizzle Bears of the fierce kind; but as yet we have seen none. Buffalo dung very plenty: Natives killed many Red Deer: plenty of food; although the Red Deer is coarse food, it goes well down after feeding so long on fish.

22. Saturday. Travelled 9 miles S.W.b.S., came to a branch of Saskatchewan River,[1] where we put up. The River here is about fifty yards wide, & a strong current: It abounds with small fish named Wepitsesish, much like a Guiniad in size and shape; Another fish named Nonahchekesish or little sucking fish; & another kind about a foot long: They all readily take hook baited with flesh. They inform'd me of another fish named Mithcowepitesish, or red toothed fish, something like a trout. Here we met with a Leader named Commeseskew, with 14 tents full of natives; They heard of Buffalo up this branch.[2]

23. Sunday. Crossed the branch in temporary Canoes with bended sticks, & covered with parchment skins:[3] We put upon the opposite side: Hunters killed 2 Buffalo: The Natives all promise faithfully to go down to the Forts next year, & not to trade with the Pedlars: but they are such notorious liars there is no believing them. However, I shall preserve part of my goods until my return, to try what influence that will have: I find they consider an Englishman's going with them as a person sent to collect Furs; & not as an encouragement to them to trap furs, & come down to the Settlements.

24. Monday. We did not proceed: This day Hunters saw several Horses up the branch of the other side: They are all in general afraid, supposing the horses to belong to the Snake Indians[4] with whom they are always at variance.

25. Tuesday. We proceeded; Our course about S.W.b.S., distance 9 miles: Travelling through a hilly, short grass country: A few small

[1] South Saskatchewan river.

[2] Andrew Graham adds this note:—"The above Leader was at York Fort last summer with 4 canoes. Query. Where were the others. Answer: I suppose traded with the Canadians ,if they had collected any furs."

[3] "Bull-boats." See note to Hendry (R.S.C., 1907, II, 329).

[4] These could hardly be the true Snakes, or Shoshones, whose usual habitat was the Yellowstone country. Alexander Henry, the younger, refers to Snake Indians in the Red River country, and Dr. Coues suggests that these may have been Sioux. Possibly Cocking's Snakes may also respond to the same identification, though somewhat out of Sioux territory.

sticks and ponds in places, well stored with Ducks, abundance of stone currant trees, but no Rasp nor Strawberrie shrubs. We pitched on the edge of the barren ground; saw several Buffalo feeding; killed several with a Gun & Bow, &c. I saw two Snakes this day each about a yard long, quite harmless; The Indians handling them & putting them in their bosoms. Course & distance corrected for nine days past are as follows, Viz. Course South 35° west and Distance 61 miles.

26. Wednesday. We did not proceed: Hunters killed several Buffalo. This day I took an Observation per noon Altitude. Latitude 52° 37″ North.

27. Thursday. We did not proceed: A smoke seen the way we intended going; As they are uncertain whether it is made by Friends or Foes, Some Young men are going off to-morrow to reconnoitre. I have given a small present of Tobacco to be smoked if they are friends.

28. Friday. Travelled 12 miles W.b.S. Country rather leveller than before; very short grass, with plenty of Wild wormwood; Many Marmot[1] holes, the Indians killed several; & esteem them good eating; plenty of Buffalo in sight on all sides; Males and Females in separate herds; which the Natives inform me they always are, except in the covering season. No wood until we pitched in a long narrow ledge of small poplar.

29. Saturday. Travelled 5 miles W.S.W. along the ledge: At two miles off a narrow ridge of high land which bore North about 8 miles distant (A branch of Saskatchewan river runs on this side) named Menachinahshew Hills. They tell me of large lake on the other side, abounding with large Jack-fish named Menawow Sakahegan; near these Hills others, named Sacketagow Hills; where the Asinepoet natives go yearly for Birch-rind to cover their Canoes: There are many large Hills beyond those where the Beaver Indians reside: this high land is the termination of the barren ground that way; the Country beyond being woody, abounding in martins, Waskesew, Moose; & farther on, Beaver. This day I laid by a seventh reserve of tobacco & Shot of sizes; also other goods for Spring use at the building of canoes.

30. Sunday. We did not proceed: few Buffalo to be seen.

31. Monday. Travelled 5 miles W.S.W. Came to the other branch of Saskatchewan river[2] where we pitched: narrow with abundance of Flat Islands, but good water for Canoes, & no Falls. Saw several Buffalo on the other side coming towards us, some Young Men, who went off in the morning, driving them this way, by making several fires of Buffalo dung to windward.

[1] Spermophiles or "ground squirrels."

[2] North Saskatchewan, somewhere about The Elbow.

September 1. Tuesday. We travelled along the branch: Course W.S.W. & distance about 14 miles.

2. Wednesday. We did not proceed: A large drove of Female Buffalo from the Westward crossed the river near our tents, but were drove back by the Natives who killed several.

3. Thursday. We proceeded: Our Course S.W.b.W. distance 5 miles: travelling along the river. Here we met with a poor forlorn French-man, along with a few Asinepoet Natives. He tells me that He left Francois the French Pedlar [1] 7 years ago on account of ill usage; & hath been with the Natives ever since; I gave him a small supply of Tobacco & other necessaries. Course Corrected for five days past South 61° West, distance 41 miles.

4. Friday. Our Course about West, distance 9 miles: Travelled along the branch, put up at a Shallow Creek named Mikisew or little Eagle Creek: There we met with many Natives: The river full of small flats, very crooked, small poplars in places on the shores, and abundance of stone Currants; also small black-berries: The Natives gather abundance of both sorts drying them in the sun for winter use.

5. Saturday. We did not proceed: This day I smoked with the Natives: the Leader promised not to go to war; I also gave them a supply of goods.

6. Sunday. We proceeded all in Company: Our Course West, distance 12 miles. Leaving the river on one hand, came to some high land named Mikisew Wache, or Eagle hills.[2] where we pitched: Poplar & Birch about 4 feet diameter in places; but mostly very small: plenty of moose & Waskesew at times, but at present scarce: Several ponds well stored with Ducks and some Geese. N.B.—The Natives here all took tent-poles to carry with them.

7. Monday. We did not proceed.

8. Tuesday. We proceeded: travelling along the Hill-side: Our Course S.b.W. distance four miles.

9. Wednesday. Our course S.E.b.S. & distance 6 miles: several small ponds well stored with Ducks: We separated, part going Westerly towards Manito-Sakihagan & Assine-Wache.

10. Thursday. We did not proceed.

11. Friday. We did not proceed.

---

[1] Evidently one of the French traders who remained in the west after the conquest. It is not clear if the name Francois is the Christian name or the surname. Possibly may be a corruption of the French surname Francœur. A Joseph Francœur was a voyageur of the North-West Company in 1804. Not likely to be the same man, however.

[2] Eagle Hills and Eagle Hills Creek still known by same name. The latter empties into North Saskatchewan from the south, above the elbow.

22. Tuesday. This day the Natives pitched a very large tent. The men singing, &c., & the Women dancing; & all dressed in their most gaudy apparel: A cold collation of berries dressed up with fat.

23. Wednesday. Indians employed: Men conjuring, & Women dancing; All this is done for the recovery of the sick.

24. Thursday. Travelled 3 miles S.E.: the Asinepoet Natives that last arrived going N.W.: Others with Neheathaway Indians[1] going easterly: all to trap Wolves, & pound Buffalo; at present only eight tents.

25. Friday. We did not proceed: The Hunters saw several strange Horses; but they are such notorious liars, often giving false alarms, there is hardly any believing them.

26. Saturday. Plenty of provisions, so we did not proceed: The strange Horses that were seen yesterday proves to be a false alarm.

27. Sunday. Travelled twelve miles S.W.b.S. crossed Mikisew-Sepishish a third time: Buffalo feeding on all sides: Barren unlevel country.

28. Monday. Travelled five miles S.W.b.S. Country as before: A barren sandy soil, very little grass, mostly wild Wormwood which the Natives name Mustoose or Buffalo-liking: from that Animal being very fond of this Herb: Natives killed 4 Beaver.

29. Tuesday. We did not proceed: Hunters looking after Beaver, but had small success: A plentiful Country of provisions, for when the present stock is expended, an Indian need only mount his Horse, taking his Gun or Bow, & in a short time return with his Horse loaded with meat, supplying his neighbours also.

Sept. 30 & Oct. 1. Wednesday & Thursday. Snow at intervals.

2. Friday. Snow at times. We are preparing to proceed to-morrow when we shall separate for the winter-season: This day was spent in feasting on berries, which are now going out of season; & a farewell smoking.

3. Saturday. We did not proceed: Smoking the Grand Calimut & several speeches made by the Leaders: Two looking-glasses with several other trifles were presented: these were to be given to the ground to induce it to favour them with plenty of furs & provisions: They have a notion that these gifts have a great effect; & when anything happens contrary to their desires they commonly use this method to appease the ill Domon. When sick they are very foolish, for they throw away many necessaries, also present to others as payment for singing their god-songs

---

[1] Crees. In Henry Kellsey's journal the name is spelled Nayhaythaway. Edouard Umfreville, in his "Present State of Hudson Bay," gives Nehethawa.

that they may recover; so that if the sick person recovers, He is a poor wretched Creature having scarce any thing to cover his nakedness.

4. Sunday. We did not proceed: The men singing their Buffalo Pound songs.

5. Monday. We proceeded: two tents going Southerly: Our Course West & distance 14 miles: At present six tents: The country hillocks: soil sandy, & barren in the vallies. Saw a few Snow-buntings.

6. Tuesday. Travelled 8 miles W.b.N.: Country very barren: Saw several Stone heaps on the tops of the high hills; which the Natives say were gathered by the Archithinue Natives, who used to lie behind these heaps, reconnoitering the Country round: We pitched on the side of a lake, the water disagreeable, bitterish salt taste; salt laying on the surface an inch thick (A specimen of which I have preserved) & on the shore like rime in a frosty morning: We made use of Buffalo dung for fuel & it answered very well.

7. Wedneslay. We did not proceed: Buffalo at present very scarce. I found in an old tent-place belonging to the Archithinue Natives, part of an earthen vessel, in which they dress their victuals; It appeared to have been in the form of an earthen pan. Saw several Wolves.

8. Thursday. We proceeded: Our Course about W.b.N.½N. & distance 9 miles: Country very unlevel, but the Hills not so high: Saw two salt lakes: Fresh water scarce.

9. Friday. We did not proceed: A heavy rain last night: Male Buffalo our food at present; very poor excepting in the spring. N.B.—All over the Country where Buffalo resort are many hollow places in the ground,[1] made by the Bulls in the covering season.

10. Saturday. We proceeded: Our Course West & distance 2 miles, arriving at the ridge of small poplars where the Natives intend to trap the winter season. Two tents separated from us, going more northerly: We were obliged to dig in a low plot of ground to obtain water.

11 to 13. Sunday to Tuesday. We did not proceed: Busy building traps for Wolves; Numbers around us; so that we have the prospect of good luck.

14. Wednesday. This day an Indian Man, belonging to those who last separated from us, was brought to my tent, having fallen from his Horse & broke his leg: I did & shall do all in my power to get him well again.

15. Thursday. The Indians belonging to the lame man joined me.

---

[1] Buffalo wallows—they rolled in the wallows until caked with mud and so found a measure of protection from the assaults of flies and mosquitoes.

16 to 19. Friday to Monday. The lame man doing well: Busy trapping: good success: several Smokes near us which we suppose are our Friends the Archithinue Natives: The Natives shew me a tobacco plantation [1] belonging to the Archithinue Indians about 100 yards long & 5 wide, sheltered from the northern blasts by a Ledge of poplars; & to the Southward by a ridge of high ground.

20. Tuesday. We are preparing to proceed to-morrow, to be in readiness for pounding Buffalo at an Archithinue pound.

21. Wednesday. We did not proceed as intended, waiting to kill Buffalo which were seen in great droves this morning.

22. Thursday. We proceedel to the Pound: Course S.S.W. & distance 6 miles: The lame man on the mending hand. Course corrected since September 21st South 60° West & distance 48 miles. From York Fort to the Buffalo pound. Course by true Compass South 48 West. Distance 752 miles.

23. Friday. Every person repairing the Beast pound.[2] "It is a circle fenced round with trees laid one upon another, at the foot of an Hill about 7 feet high & an hundred yards in Circumference: the entrance on the Hill-side where the Animal can easily go over; but when in, cannot return: From this entrance small sticks are laid on each side like a fence, in form of an angle extending from the pound; beyond these to about 1½ mile distant. Buffalo dung, or old roots are laid in Heaps, in the same direction as the fence: These are to frighten the Beasts from deviating from either side. This pound was made by our Archithinue friends last spring, who had great success, many Skulls & Bones lying in the pound. Several Buffalo seen near at hand, & the Young men endeavoured to drive them beyond the pound but without success.

24. Saturday. Wolves, Foxes, the Roebuck; another Animal of the Deer kind named Pistaticoos,[3] but something less in size; plenty of Hares; pheasants; Crows; Magpies & small Birds of the same kind as to the Northward: Red Deer are scarce. Snow fell last night.

25 to 26. Sunday to Monday. Snow at times: Natives employed trapping & endeavouring to drive Buffalo to the pound but without success. We are not so expert at pounding as the Archithinue Natives.

27 to Nov. 3. Tuesday to Tuesday included the 3rd November. Snow all dissolved: Natives trapping & killing Buffalo with the Bow & Arrows: And in the Evenings Conjuring & feasting.

---

[1] On Indian tobacco, see Hendry's Journal, note (R.S.C., 1907, II, 339).

[2] See note on buffalo and buffalo pounds—Hendry's Journal (R.S.C., 1907, II, 333).

[3] Probably antelope.

4. Wednesday. The expectation of seeing the Archithinue Natives is lost, which is a great disappointment to my Companions, who used to trade Horses & Buffalo skin Garments, for winter apparel; also Wolf-skins & other furs. Showed me a Coat without sleeves six fold leather quilted, used by the Snake tribe to defend them against the arrows of their adversaries. I shall be sorry if I do not see the Equestrian Natives who are certainly a brave people, & far superior to any tribes that visit our Forts: they have dealings with no Europeans, but live in a state of nature to the S.W. Westerly: draw towards the N.E. in March to meet our Natives who traffick with them.

5 to 10. Thursday to Tuesday. Snow: Natives can make nothing of the pound, so are obliged to kill the Buffalo with the Gun, & Bow & Arrows. They have caught a few Wolves & Foxes, but not the number they might: They are an indolent thoughtless set of beings, never looking beyond the time present.

11. Wednesday. Most of the snow dissolved: Three tents of our Company unpitched this day, & proceeded back to Mikisew-Wachy: At present 3 tents of us: We are intending to remain here hoping to have greater success, now there are but few people. The Man who some time ago had his leg broke hath pitched from us, & is in a fair way of doing well. I get no rest at nights for Drumming, Dancing, &c.

12 to 20. Thursday to Friday. Freezing in the nights and thawing in the days; also snow at intervals: Saw a smoke to Southward, supposed to be the Snake Natives. We are expending our time in doing little more than feasting, &c.

21. Saturday. This day two Archithinue Natives came to us from the Southward: They left their friends 28 tents early this morning: They say their people will pitch this way now they are convinced we are friends: These are the people whose smoke we saw on the 12th instant.

22. Sunday. The two Archithinue Strangers left us to inform their Countrymen who we were: There are three Leaders amongst them. I sent a small present of tobacco.

23 to 30. Monday, &c. Snow. Weather so bad the Archithinue Natives cannot join us, several stragglers coming in. Frost as yet very moderate; Indeed when Winter is setting in it is disagreeable travelling.

Dec. 1. Tuesday. Our Archithinue friends came to us and pitched a small distance from us; on one side the pound 21 tents of them, the other seven are pitched another way. One of the Leaders talks the Asinepoet language well, so that we shall understand each other, as my Leader understands it also. This tribe is named Powestic-Athinuewuck (i.e.) Water-fall Indians. There are 4 Tribes, or Nations, more, which are all Equestrians Indians, Viz., Mithco-Athinuwuck or Bloody Indians, Koskitow-Wathesitock or Blackfooted Indians,—Pegonow or Muddy-water Indians & Sassewuck or Woody Country Indians.[1]

2. Wednesday. The Archithinue Natives repairing the pound, the repair we gave it on our arrival not being sufficient. Snow within the ledge about 8 inches deep in general.

3. Thursday. This day smoked with the Archithinue Natives & presented the Leaders & principal men with tobacco, &c., As far as prudence would permit; at the same time by the mouth of my Leader I endeavoured to persuade two of them to accompany me on my return to the Fort, where they would meet with a hearty welcome, & receive many presents: but they said that they would be starved & were unacquainted with Canoes & mentioned the long distance: I am certain they never can be prevailed upon to undertake such journies.

4. Friday. The Archithinue Natives drove into the pound 3 male & one female Buffalo, & brought several considerable droves very near: They set off in the Evening; & drive the Cattle all night. Indeed not only at this Game, but in all their actions they far excell the other Natives. They are all well mounted on light, Sprightly Animals; Their Weapons, Bows & Arrows: Several have on Jackets of Moose leather six fold, quilted, & without sleeves. They likewise use pack-Horses, which give their Women a great advantage over the other Women who are either carrying or hauling on Sledges every day in the year. They appear to me more like Europeans than Americans.[2]

5. Saturday. Our Archithinue Friends are very Hospitable, continually inviting us to partake of their best fare; generally berries infused in water with fat, very agreeable eating. Their manner of showing respect to strangers is, in holding the pipe while they smoke: this is done three times. Afterwards every person smokes in common; the Women excepted; whom I did not observe to take the Pipe. The tobacco they use is of their own planting, which hath a disagreeable flavour; I have preserved a specimen. These people are much more cleanly in their cloathing, & food, than my companions: Their Victuals are dressed in earthen pots, of their own Manufacturing; much in the same form as Newcastle pots, but without feet: their fire tackling a black stone used as flint, & a kind of Ore as a steel, using tuss balls as tinder, (i.e.) a kind of moss.

6. Sunday. No success in pounding: the Strangers say the season is past. A hungry prospect: Many of us and no great Store of provisions.

---

[1] See Introduction to Hendry's Journal (R.S.C., 1907, II, 316-318).

[2] That is, natives of America—Indians.

presents of Tobacco: they inform me that few are gone, or intend going, to war the ensuing summer; but are to collect Furs & go down to the Company's settlements.

9. Saturday. We proceeded, intending to go to a Beast pound. Our Course about N.E.b.N. & distance 6 miles: travelling within the wood: Snow about 18 inches deep. A young man joined us who says that he left Louis Primo well in Autumn.

10 to 18. Sunday, the 10th, to Monday, 18th. Freezing weather: Several Indians have had their toes frozen. Their method of cure is, by pricking the parts with an awl until the blood flows plentifully. We did not proceed. The winter is now set in; obliged to cloath accordingly.

19. Tuesday. We proceeded: Our Course about N.N.E. & distance 6 miles: leaving Mikisew-Wachee: travelling over barren ground, small plots of small woods in places: We crossed a branch of Kaiskatchewan river: Ice in the River 26 inches thick.

20. Wednesday. Snow: did not proceed.

21. Thursday. We proceeded: Our Course about N.N.E.½Et. & distance 3 miles; We went only this short distance, to make out a regular journey to-morrow over barren land.

22. Friday. Snow. We proceeded: our Course about N.b.E. & distance about 5 miles over barren & unlevel grounds: We put up in a ledge of poplars: The Natives say this place is the termination of the barren land this way. A female child born. A Young man joined us from the Beast pound to the Eastward of us, where we intended to go: He says the Buffalo are so scarce that the Indians are distressed for want of food; & therefore had unpitched intending to build a pound further on to the Eastward, where Buffalo are said to be numerous. Our Ammunition is turning scarce, and provisions must be collected & dried, to serve us on our long journey to the forts.

23. Saturday. Our Course N.E.b.½Et. & distance 3 miles: through straggling scrubby small woods.

24. Sunday. We did not proceed.

25. We proceeded. Our Course about N.N.W. & distance 3 miles; through straggling trees, & small poplars, very uneven ground. Strong gales in the night with snow & drift.

26 to 30. Tuesday, 26th, to Saturday, 30th. Freezing. A Horse died for want, & ourselves hard pinched for want of food. The Natives suffer hunger, &c., with surprising patience. Several stragglers from the Asinepoet Natives joined us, who all complain of want of food.

31. Sunday. We proceeded: our Course N.b.E. & distance 7 miles: Country as before: We are now entered on the side of Saketakow-Wachee. A Male child born. Hungry times.

23. Tuesday. This morning the Indian arrived from those we intend to go to, with information that all the Natives were pitched further on, towards Waskesew-Wachee, intending to build a Beast-pound there: my Leader with eleven tents of Asinepoet Natives unpitched intending to proceed there: but I with nine tents part; Asinepoet Natives lay still: they intend to build Canoes at Saketow-Wachee. The Neheathaway Natives intend to go to the pound but slowly; endeavouring to preserve provision by pitching after the Buffalo; fearing a scarcity at the Beast-pound: with these I intend to go. I expect that different tribes will be coming for supplies from the S.W. & Westward. I sent three presents of Tobacco by my Leader to the Natives at the Pound. I also sent off a Young fellow with presents of Tobacco to three Leaders in the Canadian interest, & who never have been at any of our Forts; desiring them to go down with me, where they would meet with kind treatment, & received in return more for their furs. I shall do all in my power for forwarding the Company's interest.

24. Wednesday. We proceeded: Our Course S.E. & distance 4 miles: crossed a branch of Saskatchewan river.

25. Thursday. We did not proceed: waiting to hunt. Two Natives joined us from the Westward: they came to know where we intend to build Canoes: they say that Female Buffalo are plenty with them & that they abound in provisions.

26. Friday. Young men abroad Hunting: The Young fellows returned to their friends: sent a supply of tobacco & Ammunition to the Leaders.

27 to March 2. Saturday to Tuesday. Lay by: Hunters hath middling luck. Information from the Beast pound that they have also middling success.

3. Wednesday. I with part of our Company 6 tents proceeded; Course East, distance 2 miles: The others gone to Sakitakow-Wachee.

4 to 26. Thursday, 4th, to Friday, 26th. Freezing in the nights & thawing in the days. Nothing material happened us. Young men employed in Collecting food & myself doing all in my power, to persuade the Natives to go with me to the Fort, & not to trade their Furs with Francois, nor Curry, whom we cannot avoid seeing on our way down: Notwithstanding all their fair promises, I am credibly informed that several hath been trading with the above two pedlars for Ammunition; & in sound policy they preserve their stock of Liquor, to intercept us on our way to the Settlements: I also heard the same from the Canadian Louis Primo who is in our service. I am certain he hath a secret kindness for his old Masters, & is not to be depended on. A melancholy affair hap-

9. Friday. We proceeded: Our Course about S.W. & distance 4 miles: arriving at the place we left on the 27th ult., where we intend to continue, until we embark for our voyage to York Fort: Returned Louis Primo's two Natives, & sent by them two presents of Tobacco to two valuable Leaders. Much water running over the ice in the river, & blowing up in holes in places.

10 to 19. Saturday, 10th, to Monday, 19th instant. All hands employed collecting materials & building Canoes. No Snow on the ground, but what is in the Woods. Indian Visitors coming & going; whose people generally employed as we are, preparing Canoes.

20. Tuesday. River broke up, & much ice came down. A young Buffalo seen, but too swift to be overtaken on foot.

21. Wednesday. Three tents of Asinepoet Natives unpitched and went Northwards.

22 to 24. Thursday to Saturday. Ice mostly drove past us. & the Currant somewhat abated: Several Young men crossed the river in a temporary Canoe covered with skins. Frogs croaking.

25. Sunday. One tent of Indians came to us from the Eastward; provisions hath been scarce with them: Many Natives below us hath been in at Saswee, alias Francois, & traded part of their most valuable furs. I find the liquor attracts them: Gratitude for favours received, being a virtue the Natives in general are unacquainted with.

26 to May 1. Monday to Saturday. Busy with the Canoes. Mosquitoes plenty.

2. Sunday. Sent two Young men to the Natives down the river with a present of tobacco, with orders to desist going to the pedlars.

3 to 4. Monday. Our Canoes are in great forewardness.

5. Wednesday. An Indian came from those down the river: Informs me that many are sickly, & that we are much forewarder than they in building our Canoes; that they have been fighting, occasioned by the liquor presented to them by the pedlars.[1]

6 to 15. Thursday, 6th, to the 15th instant. Musquitoes plenty & troublesome: after a shower of rain intolerable: Canoes ready; & we propose setting out to-morrow for York Fort. We have a good stock of food, Viz., Buffalo flesh & several bladders of fat.

16. Sunday. We embarked & paddled a small distance; stopping to kill Buffalo & Waskesew: Several grazing in sight.

17 to 18. Monday & Tuesday. Paddled down the river slowly.

---

[1] Andrew Graham notes:—"My Opinion is, that in order to have prevented the Natives from visiting the Canadians, Mr. Cocking should have taken a Station underneath all his Natives."

19. Wednesday. Paddled down the river & came to seven tents of Natives embarking: Entered the joining of the branches:[1] By marks we find the Natives up the other branch, have not passed downwards yet.

20. Thursday. Arrived at Francois Settlement, where we landed: found Louis Primo tented on the Plantation, with 5 tents of Natives. I am informed that 30 Canoes are gone on before, & are to wait for us: they have traded the richest furs here. On our arrival the French man introduced the Natives unto his house, giving about 4 inches of tobacco; Afterwards they made a collection of furs, by the bulk about 100 Beaver; presenting them to the Pedler: who, in return, presented to them about 4 Gallons liquor, Rum adulterated: also cloathed 2 Leaders with a Coat & Hat. I endeavoured all in my power to prevent the Natives giving away their furs, but in vain; Liquor being above all persuasion with them: Francois informs me, that he shall embark very soon with his furs, having expended almost his goods. His House is a long square; built log on log: half of it is appropriated to the use of a kitchen: the other half used as a trading room, & Bed-room; with a loft above, the whole length of the building where He lays his furs: also three small log houses; the Men's apartments: the whole enclosed with ten feet Stockades, forming a Square about twenty yards. The Canoes are each 24 feet long: extreme breadth 5 quarters; and 22 inches deep: I believe Francois hath about twenty men, all french Canadians.

21. Friday. We did not proceed: None of the Indians are trading with Francois, for this reason; He hath no goods left: but His Servants enter our tents with Baubles, &c., which the Natives (children like) purchase at any rate. An Indian gave four Wolves for a Tomahawk: Another a Beaver, for a small tin Breakfastplate; & a third a Beaver for ½ yard of worsted lace. A General Smoking with the Natives, when I advised them to embark; which they promised to do to-morrow. I shall remain here a few days, in hopes to see some of the Natives who have not yet come down.

22. Saturday. The Natives were unwilling to embark without me, therefore I promised to proceed to-morrow: the major part with Louis primo set off. I have been twice into Saswee's dwelling house by invitation, to eat with him; which I did not think necessary to refuse: He is an old ignorant Frenchman: I do not think that he keeps a proper distance from his men; they coming into his apartment & talking with him as one of themselves. But what I am most surprised at, they keep no watch in the night; even when the Natives are lying on their plantation..

---

[1] Forks of the Saskatchewan.

23. Sunday. In the morning I embarked according to my promise, & paddled down the river: All the Natives in company except two, who are waiting for their Friends that are not yet arrived. I left with them three considerable presents of tobacco, to be given to the Natives who are to follow us; at the same time to be as speedy as possible, as I shall wait for them below: I left behind three tents of Natives, who had expended their furs. In the afternoon met with ten Canoes coming up the river, who had traded their furs at the settlement below.

24 to 25. Monday & Tuesday. Paddling down the river: We were joined by 6 Canoes, supposed to have traded with the Pedlars; having no furs.

26. Wednesday. We proceeded in the morning & soon arrived at the noted Fishing place for Pike, &c. Here we met with 8 tents of Strangers; also our Indians who set off before me: The Strangers hath traded their furs with the Pedler who resides on this side Basquia. I observe plenty of french goods amongst them. It surprises me to perceive what a warm side the Natives hath to the French Canadians.

27. Thursday. Proceeded; & in the afternoon arrived at Basquia, where were six tents of Indians; also the Pedler mentioned yesterday lying in a tent with four Canadians, all French extraction: He hath only one large Canoe full of Furs: have sent two down to the Grand portage: he is going down himself in a few days: Louis primo tells me he is going down also, to see his friends: I told him that he was doing wrong as he was under a written contract to serve the Company: but all to no purpose.

28. Friday. We proceeded with all the Natives that had furs.

29. Saturday. We proceeded & arrived at Kippahagan Sepee, which we entered, leaving Saskatchewan River. Here we pitched our tents. We found one tent of Natives here who have traded all their Furs with the Canadians one days journey from here, & ten Canoes are gone by the Lake Winnipeg all bound for York Fort.

30. Sunday. Proceeded & entered Oateatawan Lake, arrived at the Fishing place, where we killed a few large Pike & *Buddagh trout*, each weighing above *Thirty pounds weight*. Afterwards we proceeded & lay on one of the Islands. A Great Swell in the lake.

31. Monday. Paddled over the Lake & came into Manihagow River. We passed over the Carrying places. The Natives are very brisk not stopping to hunt.

June 1 to 18. Tuesday. Nothing material occurred; at York Fort with my Company where we found all well.

INDEX.

IV.—*History of the Queen's Rangers.*

By JAMES HANNAY, D.C.L.

(Read May 26, 1908.)

I.

Of the forty or more battalions of Loyalists which enlisted in the service of the Crown during the Revolutionary war, none has been so widely celebrated as the Queen's Rangers. This, no doubt, is partly due to the fact that they found a historian in Lieut.-Col. Simcoe, their commanding officer, who wrote a book to chronicle their achievements; yet after making all allowance for this advantage, it must be admitted, without detriment to the other Loyalist corps, that the Queen's Rangers exceeded them all in length and variety of service. What the famous Light Division was in Wellington's Peninsular Campaigns the Queen's Rangers became to the British army in America; whenever there was an enterprise that demanded celerity and daring, the Queen's Rangers were selected for the service, if they happened to be at all near the place where it was to be performed. Their six years of active service in the war made them veterans, and their peculiar organization enabled them to accomplish feats which would have been quite beyond the power of an ordinary battalion of the line. There can be little doubt that during the last campaigns of the war the Queen's Rangers was the most efficient regiment in the British service in America.

The name "Rangers," a survival of the old French war, is that by which they were almost universally known, although in official documents they appear occasionally as the "King's First American Regiment;" an honorable distinction granted them in 1779. In the French war Major Robert Rogers, of New Hampshire, was commander of a corps known as Rogers' Rangers, which did good service prior to the fall of Quebec. When the Revolutionary troubles arose Rogers received a commission from the Crown as Colonel, and proceeded to enlist men to serve against the Revolutionary armies. This was the beginning of the Queen's Rangers, whom Rogers naturally enough named after his own old corps. The Rangers were enlisted in the summer and autumn of 1776 in Connecticut and the vicinity of New York. They mustered at one period above four hundred men, all Americans and all Loyalists. Recruiting for the Queen's Rangers was a service of no small danger, as may be inferred from the fact that Daniel Strang, who, early in 1777, was captured near Peekskill with a paper in his possession, signed by

Col. Rogers, authorizing him to enlist men for the Queen's Rangers, was tried by an American court martial and hanged. As the war advanced, the composition of the Queen's Rangers very materially changed, and the native American element seriously diminished in proportion to the other nationalities which went to form the regiment. This was due to various causes, the principal, no doubt, being that the Rangers was the only Loyalist Regiment that was authorized to enlist Europeans. The Rangers gradually grew to be more a European than an American Regiment. To illustrate this fact, it may be stated that on the 24th August, 1780, according to the muster rolls, in which, contrary to the usual course, the nationality of the officers and men was given, the Rangers—officers, non-commissioned officers and men—were found to be composed as follows:—

Irish	219
Americans	158
English	132
Scotch	64
Foreigners	30
	603

Of the 40 commissioned officers attached to the Queen's Rangers at this period, 19 were Scotch, 9 Americans, 8 Irish, 3 English and a foreigner. Of the non-commissioned officers at the same date, 24 were Irish, 27 Americans, 13 English, 7 Scotch, and 2 foreigners. Of the privates, therefore, 187 were Irish, 122 Americans, 116 English, 38 Scotch and 27 foreigners. These figures show that the Americans formed, at that time, only about 25 per cent of the rank and file of the Regiment. Colonel Rogers did not long remain in command of the Rangers, but early in 1777 was succeeded by Colonel French. The latter in his turn was succeeded by Major Wemyss.

On the 27th August, 1776, General Howe, in command of the British army, defeated the Americans under Washington at the battle of Long Island and took possession of Brooklyn. A few days later the Americans were driven from New York and the British army occupied it, an occupation which was maintained for seven years, two months, and ten days, or until the last band of Loyalists which came to St. John in the fall fleet bade it adieu on the 25th November, 1783. The Queen's Rangers then formed a part of General Howe's army, which began a series of operations resulting in the capture of Fort Washington and the flight of the whole American army into New Jersey.

Prior to this, however, and while the American army still occupied the strong position on the heights west of the Bronx on the night of the 21st October, 1776, the Queen's Rangers under Colonel Rogers were lying at Mamaronec on Long Island Sound, a few miles to the north of New Rochelle. Here they were surprised by a force of Delaware and Maryland troops under Colonel Haslet, and a number of them killed or captured. The Americans claim that the Rangers on this occasion lost almost eighty men and sixty stand of arms, but very little reliance is to be placed on American accounts of the losses of their enemies in the war of the Revolution. In the action at Spencer's Ordinary in which the Rangers were engaged in 1781, the Americans returned a British loss of 60 killed and 100 wounded, the actual loss as shown by the official returns being 33 killed and wounded. We may conclude, therefore, that the loss of the Rangers at Mamaronec was probably much exaggerated. I have not been able to discover any British account of this affair, which in the presence of the larger operations which Howe was carrying on would hardly be regarded as worthy of notice.

The Queen's Rangers at this period and for a long time afterwards formed a part of General Knyphausen's command. This general was a German Baron, a native of Alsace, the son of the Colonel of the German Regiment of Dittforth, which served under the Duke of Marlborough. General Knyphausen was bred a soldier, and saw much service in the Prussian army. When the British Government hired twelve thousand German troops for service in America, he came in command of the force, and continued in America until the end of the war. He was about sixty years of age when he came to America. John J. Watson, author of the annals of Philadelphia, says of him: "General Knyphausen was much of the German in appearance; not tall but slender and straight. His features were sharp; in manner he was very polite. He was gentle and much esteemed."

Fort Washington was captured by the British on the 16th November, 1776, its reduction being effected with a loss to the British of 78 killed and 380 wounded. The Americans had 54 killed and 93 wounded and 2,818 of them surrendered as prisoners of war. In the operations which led to the capture of Fort Washington, the Queen's Rangers had a share, but naturally enough, as a newly levied force, their part was not an important one. They continued with Knyphausen as part of the force which guarded New York on the land side, but took no share in any important engagement for several months. In this period, however, they became efficient soldiers and fitted themselves for the conspicuous part they had to play in future actions with the enemy.

In July 1777 the British army, under General Howe, sailed from New York, and landing at the head of Chesapeake Bay commenced a victorious march towards Philadelphia. This movement brought on the battle of Brandywine which was fought upon the 11th September, General Washington being in command of the Americans, and the result being their total defeat. The Queen's Rangers formed part of General Howe's army on that memorable day, and covered themselves with glory. They were then under the command of Major Weymss and were with the right wing of the army, which was commanded by Knyphausen. The Brandywine is a small river which flows into the Delaware from the north, entering the latter near Wilmington. It is fordable in several places, yet it seemed to offer such advantages for defence that Washington took up a position behind it with a view to check the British in their advance on Philadelphia. Washington, who had been on the western bank of the Brandywine, with his headquarters at Washington, crossed to the east bank by Chad's Ford before daylight on the morning of the 9th September, and established his headquarters at a house about a mile to the eastward of the Brandywine. The British, the same evening, moved forward in two columns, Knyphausen with the left and Cornwallis with the right. On the morning of the 10th they united at Kennet Square, a small village about seven miles west of the Brandywine. That evening they advanced two miles farther or to within a mile of Welsh's tavern, and about five miles west from Chad's Ford.

On the morning of the 11th September, the day of the battle on the Brandywine, the main body of the American army was posted on the heights, east of Chad's Ford and commanding the passage of the river. The brigades of Muhlenberg and Weeden, which composed General Greene's division, occupied a position directly east of the ford. Wayne's division and Proctor's artillery were posted upon the brow of an eminence near Chad's house, immediately above the ford; and the brigades of Sullivan, Sterling and Stephen, which formed the right wing, extended upwards of two miles up river from Chad's Ford. At Pyles' Ford, two miles below, General Armstrong was posted with one thousand Pennsylvania Militia; and General Maxwell with upwards of one thousand light troops took post on the heights on the west side of the river about a mile from Chad's Ford to check the advance of the British towards that crossing place.

General Howe's plan of attack was similar to that adopted in the battle of Long Island and involved a circuitous march for the purpose of getting on the enemy's flank and rear. At daybreak the column of Cornwallis, which was composed of two battalions of Grenadiers, two of light infantry, the Hessian grenadiers, part of the seventy-first regiment, and two British brigades, in all about 10,000 men, moved northward along the Lancaster road which runs for several miles parallel to the Brandywine, but distant from it some three miles. A dense fog shrouded the landscape and the movement of Cornwallis was not perceived by the Americans, until between nine and ten o'clock in the morning, when some American light horse under Colonel Bland, discovered a part of Cornwallis's division marching towards the west branch of the river at Trimble's Ford, about seven miles above Chad's Ford, where the bulk of the American army was. This news did not reach Washington until nearly noon, by which time Cornwallis had made a circuitous march of seventeen miles, crossing the west branch of the Brandywine at Trimble's Ford and the east branch at Jeffries's Ford, and was within two miles of the right flank of the American army, where General Sullivan was resting at his ease in utter ignorance of the fact that Cornwallis had moved at all.

At nine o'clock when Cornwallis had been several hours on the march, Knyphausen moved forward towards Chad's Ford with his division which consisted of Hessians and the Queen's Rangers, in all about 4,000 men. His orders were to amuse the Americans with feigned efforts to make passage at Chad's Ford until the cannon of Cornwallis announced that he had got in the rear of Washington's army. Maxwell with his light troops vainly attempted to oppose his advance. He occupied a wooded height near the river and a furious contest ensued before he was dislodged. The worst of the fighting fell upon the Queen's Rangers, then about 400 strong, and a detachment of riflemen under Major Ferguson of the 71st Regiment. Maxwell and his light infantry were driven across the river and Knyphausen, from the heights on its western bank, commenced a cannonade of the American position. About two o'clock in the afternoon Cornwallis, who had got into the rear of the American army made a vigorous attack upon it, and soon afterwards Knyphausen began to force a passage across the Brandywine at Chad's Ford where he was opposed by the American troops under General Wayne. The attempt to stop the victorious British was futile, Wayne was defeated and his guns captured and at the same time Cornwallis broke the American right and their whole army was soon flying in every direction. The Americans retreated to Chester in the utmost disorder and if General Howe had been prompt in pursuit, Washington's army would have ceased to exist as a military body.

The British loss in the battle of Brandywine was 70 killed, 488 wounded, and 6 missing. Of this loss about one-fifth fell upon the Queen's Rangers who had one-third of their total number killed or wounded. Of the twenty-one commissioned officers of the Queen's

Rangers engaged at the battle of Brandywine, 14 were either killed or wounded. There can be no better proof than this statement affords of the closeness and severity of the fighting in which they were engaged in this famous battle. That their merits were duly appreciated is shown by the following notice which appeared in the Philadelphia Ledger of December 3rd, 1777, evidently from an official source:—

No regiment in the army has gained more honor in this campaign than the Queen's Rangers; they have been engaged in every principal service and behaved nobly; indeed, most of the officers have been wounded since we took the field in Pennsylvania. General Knyphausen, after the action of the 11th September, at Brandywine, despatched an aide-de-camp to General Howe with an account of it. What he said concerning it was short but to the purpose. "Tell the General," says he, "I must be silent as to the behaviour of the Rangers, for I want even words to express my own astonishment to give him an idea of it." The following appeared in orders: "The Commander in Chief desires to convey to the officers and men of the Queen's Rangers his approbation and acknowledgement for their spirited and gallant behaviour in the engagement of the 11th inst., and to assure them how well he is satisfied with their distinguished conduct on that day. His excellency only regrets their having suffered so much in the gallant execution of their duty."

The American loss in the battle of Brandywine amounted to 300 killed, 600 wounded and 400 taken prisoners. They also lost ten field pieces and a howitzer. Many French officers were engaged in this action on the side of the Americans, and one of them, the Baron de St. Ouray, was taken prisoner. Had Brandywine been followed up as it should have been, it would have became the decisive battle of the war.

The battle of Brandywine opened the way to Philadelphia which was occupied by General Howe on the 26th September. When he first took possession of the city the British general stationed the main division of his army at Germantown which is about eight miles to the north of Philadelphia. Washington encamped about twenty miles from the Pennsylvania Capital, at Pennibecker's Mills, between the Perkimony and Skippack Creeks. By the beginning of October Washington's army had been considerably reinforced while General Howe's was much weakened by the absence of the detachments which had been sent for the purpose of reducing Billingsport and the forts on the Delaware. Washington was aware of this and conceived the design of surprising the British force at Germantown and destroying it before it could be reinforced. Judge Jones in his history of New York asserts that General Howe was informed of this design, but he thought so little about the matter that he never thought proper to let the commanding officer at Germantown know that he possessed such information. The consequence was that in the early morning of the 3rd October, while Washington with his whole army was stealing silently upon the British, the latter were sleeping unconscious of danger, and in fancied security.

The British line of encampment at Germantown crossed the village at right angles, near its centre, the right wing extending westward from the town towards the Schuylkill. The main position was covered in front by the German Chasseurs, some mounted and some on foot. The British right extended eastward from the village, and was covered in front by the Queen's Rangers. The American plan of attack, which was decided upon at a council of officers called by Washington, gave every promise of success. It was arranged that the divisions of Sullivan and Wayne, flanked by Conway's brigade, were to make a front attack, entering Germantown by way of Chestnut Hill, while General Armstrong with the Pennsylvania Militia should get on the left and rear by the Manatawny road. At the same time the division of Greene and Stephen, flanked by McDougall's brigade, were to make a circuit by way of the Lime Kiln road, and attack the British right, while the Maryland and Jersey Militia under Generals Smallwood and Forman were to march by the old York road and fall upon the rear of the British right. Lord Sterling with the brigades of Nash and Maxwell formed the American reserve.

After dark, Washington with his army moved silently from his camp towards Germantown. He accompanied the column of Wayne and Sullivan in person. A little before sunrise, his army emerged from the woods in front of the British pickets at Chestnut Hill. Shortly before that time his approach had been discovered by the British patrols who gave the alarm. Such troops as could be got together were hurriedly sent forward to Mount Airy, a position about a mile north of the village of Germantown. At seven o'clock, Sullivan's advanced party, drawn chiefly from Conway's brigade, fell upon the British pickets and drove them back to the main body which consisted of a part of the Fortieth Regiment and some light infantry. Sullivan's main body now moved to the right through the fields, and forming in a lane leading towards the Schuylkill attacked the British on the left flank in such overwhelming numbers that they fell back towards Germantown. Colonel Musgrave thus furiously attacked threw himself with five companies of the Fortieth Regiment into a large stone house, owned by Judge Chew, and checked the pursuit of the enemy. Such a tremendous fire of musketry was kept up from this building that the further progress of the Americans in the centre was stopped. Cannon were brought to blow in the house, but so strong were its walls and so high the courage of its garrison that it was found impossible to dislodge them. The attempt to capture Chew's house caused many of the American troops to halt and brought back Wayne's division which had advanced far beyond it. Sullivan's left flank was thus uncovered and his plans totally disconcerted. It was the crisis of the battle.

While this attack was in progress, General Greene with his heavy force had attacked the British right wing, in which were the Queen's Rangers, and attempted to occupy the village. In this object Greene was foiled, for General Grey, at this moment finding his left secure, marched to the assistance of his centre and right. Colonel Matthews with a detachment of Greene's column after capturing about one hundred British near Chew's house, was surrounded by the British right wing and compelled to surrender. A strong British force was sent forward to relieve Colonel Musgrave in Chew's house. The Americans were defeated at all points and fled from the field leaving their dead and wounded behind them. Their well planned attack had ignominiously failed.

Although the battle of Germantown lasted only two hours and forty minutes, the loss was large for the numbers engaged. The Americans had 152 killed, 521 wounded, and upwards of 400 were made prisoners, so that their total loss was about 1,100. The British loss was 535, of whom less than 100 were killed. Germantown reflected the greatest credit on the British troops engaged in it, and no corps in the field that day fought better than the Queen's Rangers, although badly reduced in numbers. The list of casualties made up on the 24th November, 1777, shows that in the preceding three months the Rangers had lost 141 men, or more than one-third of their strength. A recapitulation of these losses will show more vividly than anything else the various reductions of its strength to which a regiment is exposed:—

Dead	23
In hospital	79
Discharged, unfit for service	13
Prisoners with the enemy	7
Deserted	19
Total	141

At the same date the effective strength of the Queen's Rangers, after having received a reinforcement of more than 100 recruits, was only 329 rank and file, in addition to 42 absent on duty or on leave. In addition to the list of casualties above given, there were many men slightly wounded at Brandywine and Germantown who had returned to their duty prior to the 24th November, 1777, the date of the return from which I have been quoting.

The Queen's Rangers after the battles of Brandywine and Germantown, consisted of eleven companies of infantry; to wit, a grenadier and light company, eight battalion companies, and a Highland company with the national dress and a piper. The uniform of the Rangers was a dark green, with dark belts and accoutrements, this being the best colour for the kind of campaigning in which they were engaged. After Simcoe became commanding officer of the Rangers in October, 1777, he found that their efficiency would be greatly increased by the addition of a few cavalry. Sir William Erskine offered to supply him with dragoons whenever he needed them, but their dress was so different from that of the Rangers, being of red with white belts, that Simcoe deemed them unsuitable. He suggested that it would be better to mount a dozen soldiers of his regiment, and Sir William Erskine approved of this idea and sent a suitable number of horses, saddles and swords. This little body of mounted Rangers was placed under the command of Benjamin Kelly, a sergeant of distinguished gallantry, who deserted from the American army. The appearance and accoutrements of these troopers became the subject of a good deal of ridicule, especially by the officers of the regular army, but they speedily became so useful that other bodies of mounted men were raised for similar services in other corps. The Queen's Rangers—Hussars, as they were termed—were in December placed under the command of Lieut. Wickham, an officer of quickness and courage, and soon afterwards, when their number was increased to 30, Ensign Procter was added. In 1778, the Hussars were formed into a troop of 40, rank and file, with Wickham as captain, Allan McNab (father of the celebrated Sir Allan McNab), lieutenant, and Quartermaster Spencer of the 16th Dragoons as cornet. The strength of the Queen's Rangers at that period was 388 rank and file. In the summer of 1779, a troop of Buck's County (Pa.) Light Dragoons, under the command of Capt. Sandford, was attached to the Queen's Rangers. In October of this year the strength of the Rangers was 443 rank and file of infantry and 96 of cavalry, including 41 Buck's County dragoons; so that the total strength of the Queen's Rangers proper, was just 498 rank and file.

In the summer of 1780, two new troops of cavalry were formed—one under the command of Captain David Shank, with George Spencer as lieutenant, and William D. Lawler as cornet; and the other under the command of Captain John Saunders (afterwards Chief Justice of [illegible] with John Wilson, lieutenant, and Thomas Merritt, cornet. In December of this year the strength of the Queen's Rangers was eleven companies of infantry numbering [illegible] rank and file, and [illegible] troops of cavalry numbering [illegible] rank and file—a grand total of [illegible] exclusive of commissioned officers. Early in December, 1780, a fourth troop of cavalry was formed and placed under the command of Captain Thomas [illegible], who had been a lieutenant in the 17th Dragoons. This troop was recruited in New York. William D. Lawler became its lieutenant, and [illegible] cornet. In April, 1781, a troop of German Hussars, under the command of Lieutenant George [illegible], was attached to the Rangers, which then consisted of eleven companies of infantry and five troops of cavalry. That year the Rangers were engaged in active service in the South from the beginning of January until the surrender of Cornwallis's army in the latter part of October. They were continually engaged and suffered heavy losses, yet their strength on the 24th June, 1781, was 447 rank and file of infantry and 163 cavalry, or 610 in all, exclusive of Capt. Saunders' troop, which was then at Charleston, S.C., and from which we have no returns. On the 24th August of the same year, the strength of the Rangers was of infantry, 372 rank and file, and of cavalry 155, exclusive of Capt. Saunders' troop and also of the German Hussars, which were still serving with them. In the preceding two months the strength of the regiment had been reduced by just 50 men, and the muster rolls show that 18 had been killed, 31 were in hospital wounded, 20 were prisoners, and 14 had deserted. The next two months saw the end of the active service of the Queen's Rangers, for they were included in the surrender of the army of Cornwallis at Yorktown, which took place on the 19th October, 1781. Their losses had in the meantime been heavy, no less than 30 having been killed or died from the 24th August to the 24th October, and the number of wounded and sick being very large. At the latter date the infantry numbered 333 rank and file, and the cavalry, exclusive of Capt. Saunders' troop and the Germans, 179, a grand total of 512. Some idea of the waste of war may be formed from the fact that the Queen's Rangers in 1781, although they had more than 150 men added to their number by enlistment and the return of men who had been imprisoned, came out of that campaign nearly 100 weaker than they entered it. Their losses, therefore, in 1781, must have been fully 250 men, of whom nearly 100 were killed or died of their wounds.

On the 15th October, 1777, Major Weymss having retired from the regiment, John Graves Simcoe, who was a captain in the 40th Regiment of the line, was appointed to the Queen's Rangers with the rank of

Major Commandant. A fuller account of Simcoe will be given further on. It is sufficient to say here that he was a most active and vigilant officer and that in his hands the Rangers became, to use the words of an American historian of the war, "a model of order, discipline and bravery." A great many of the original officers of the regiment, who were found to be unfit for the positions they occupied, had been dismissed and their places filled mainly by gentlemen from the southern colonies who had joined Lord Dunmore in Virginia and distinguished themselves under his orders. To these were added some volunteers from the army, "the whole," as Simcoe remarks, "consisting of young men, active, full of love of the service, emulous to distinguish themselves in it, and looking forward to obtain, through their actions, the honour of being enrolled in the British army."

Officers of the Queen's Rangers in 1777.

The following abstract from the muster rolls of the Queen's Rangers of the 24th November, 1777, after the battles of Brandywine and Germantown, shows the officers and non-commissioned officers attached to the several companies at that date, or the causes of their absence. It will be observed that several resignations, transfers, deaths and promotions are recorded:—

Capt. Saunders' Company.

Major commandant—James Weymss, resigned 15th October.

Major—John Grymes, resigned 20th October.

Major commandant—John Graves Simcoe, appointed 15th October.

Captain commandant—Arthur Ross, appointed 16th October.

Captain—John Saunders, sick in quarters.

Lieutenant—Abraham Close, resigned 17th September.

Lieutenant—John Whitlock, transferred from Capt. McCrea's Company 11th November.

Ensign—William Atkinson, promoted 20th September, to be lieutenant.

Ensign—George Procter, appointed 17th September.

Adjutant—George Ormond.

Quartermaster—Alexander Matheson.

Surgeon—Alex. Kellock.

Surgeon's mate—Isaac Ball, resigned 24th October.

Sergeant—Peter Newton.

Sergeant—Jacob Revere.

Sergeant—Solomon Stevens.

Corporal—John Dwyer, killed 12th September.

Corporal—John Frederick Pickert.
Corporal—Nicholas Sumondyke.

Captain Armstrong's Company (Grenadiers).

Captain—Richard Armstrong.
Lieutenant—John McGill, promoted to captain 19th October.
Lieutenant—James King, sick in Philadelphia.
Lieutenant—Samuel Smith, wounded.
Sergeant—Thomas Dwyer.
Sergeant—Peter Gray.
Sergeant—John McPherson.
Sergeant—John Lynch, sick in New York.
Corporal—John Johnston, promoted 18th October.
Corporal—James Kidd.
Corporal—Robert Richey.

Captain Mackay's (Highland) Company.

Captain—John Mackay, sick in quarters.
Lieutenant—Aeneas Shaw, promoted 1st November.
Ensign—Alex. Matheson.
Sergeant—James Machardy.
Sergeant—Malcolm Bue, sick in quarters.
Sergeant—Geo. Hamilton, sick in quarters.
Corporal—Donald Macdonald.
Corporal—John Macdonald.
Corporal—John King.

Captain Stephenson's Company.

Captain—Job Williams, died of his wounds, 19th September.
Captain—Francis Stephenson, transferred from Capt. Murray's Co.
Lieutenant—James Murray, promoted, 12th September, to be captain.
Lieutenant—Beasly Joel, transferred to Capt. Kerr's Co.
Lieutenant—Alex. Wickham, transferred from Capt. Agnew's Co.
Lieutenant—Hector McKay, transferred from Capt. McKay's Co.
Sergeant—Simeon Merill.
Sergeant—Robert Gardner, transferred to Capt. Murray's Company.
Sergeant—John Ladan, transferred from Capt. Murray's Company.
Sergeant—Wm. Whitley.
Corporal—Charles White, killed 11th September.
Corporal—Miles Swinny.
Corporal—Wm. Clinton.

CAPTAIN DUNLOP'S COMPANY.

Captain—James Dunlop, absent on leave in New York.
Lieutenant—George Ormond, removed to Capt. Agnew's Company.
Ensign—Charles Fraser, appointed October 19th.
Lieutenant—Allan McNab, promoted October 17th.
Sergeant—Nathaniel Munday.
Sergeant—Isaac Gilbert.
Sergeant—William Frost.
Corporal—Morris Hichok.
Corporal—Johnson Raymond.
Corporal—William McLaughlan.

CAPTAIN MCCREA'S COMPANY.

Captain—Robert McCrea, prisoner with the rebels, 24th October.
Lieutenant—David Shank.
Ensign—Samuel Bradstreet.
Sergeant—Stephen Wainwright.
Sergeant—Robert Chandler.
Sergeant— — Nelson, killed 11th September.
Sergeant—Duncan McPherson, promoted 28th October.
Corporal—James Smith.
Corporal—Thomas Gould, killed 11th September.
Corporal—James Tabourt, sick in New York.

CAPTAIN MURRAY'S COMPANY.

Captain—Francis Stephenson, transferred to Light Company 14th October.

Captain—James Murray, transferred from Light Company 12th September.

Lieutenant—David Shank, transferred to Capt. McCrea's Company.
Lieutenant—Nathaniel Fitzpatrick, promoted 19th September.
Ensign—John Wilson, appointed 12th September.
Sergeant—Joseph Adam, sick in hospital.
Sergeant—Benjamin Fowler.
Sergeant—Elnathan Appleby.
Corporal—John Ledann.
Corporal—Thomas Holland.

CAPTAIN AGNEW'S COMPANY.

Captain—Stair Agnew, sick in Philadelphia.
Lieutenant—George Ormond.
Ensign—Charles Dunlop, sick in New York.

Sergeant—Daniel Purdy.
Sergeant—Thomas Pryor.
Sergeant—John Finch.
Corporal—James Brown.
Corporal—Benjamin Kelly.

CAPTAIN KERR'S COMPANY.

Captain—Robert Murden, died of his wounds 12th September.
Captain—James Kerr, promoted to be captain 20th September.
Lieutenant—Stair Agnew, promoted to be captain 27th September.
Lieutenant—Beasly Joel, wounded at New York.
Ensign—Simon Bradstreet.
Sergeant—Hacabah Carhart.
Sergeant—Henry Gass, taken prisoner.
Sergeant—John Johnson.
Corporal—Terrance Martin.
Corporal—Thomas Shannon.
Corporal—John Cunningham, in hospital at Philadelphia.

CAPTAIN SMITH'S COMPANY.

Captain—John F. D. Smith.
Lieutenant—Thomas Murray.
Sergeant—James Dow.
Sergeant—Samuel Burnet.
Sergeant—John Gee.
Sergeant—James McComb.
Sergeant—John Hutchison.
Sergeant—Gilbert Garland.
Sergeant—Solomon Wright.
Sergeant—William Taylor.
Sergeant—John Bull.
Sergeant—John Shea, in hospital at Philadelphia.

CAPTAIN McGILL'S (LIGHT) COMPANY.

Captain—John Mackay, transferred to late Capt. McAlpine's Co.

Captain—John McGill, promoted October 19th, and transferred from Capt. Armstrong's Company.

Lieutenant—James Kerr, promoted to be captain, September 20th,

Ensign—George Pendrid, appointed September 20th.

Lieutenant—William Atkinson, transferred from Capt. Saunders' Company.

Ensign—Hector McKay, transferred to Captain Stephenson's Company.

Sergeant—Jacob Jones, in hospital, Philadelphia.

Sergeant—Stephen Jarvis, in hospital, Philadelphia.

Sergeant—James King.

Corporal—Andrew Curties.

Corporal—John Galloway.

Corporal—Joseph Dunahow.

Of the commissioned officers in the above list who survived the war, Captains Saunders, Armstrong, Mackay, McCrea, Agnew and Kerr, came to New Brunswick at the peace, as did Lieutenants Whitlock, Ormond and McNab, Ensign Dunlop, and the great majority of the non-commissioned officers and privates, who were left at the surrender of Cornwallis.

II.

When Simcoe took command of the Queen's Rangers in October, 1777, he at once proceeded to organize them for that active kind of warfare in which they afterwards became so famous. Their strength at various periods and their composition have already been referred to; it now only remains to describe their system of drill and the tactics they employed. "A light corps," as Simcoe observes, "augmented as that of the Queen's Rangers was and employed on the duties of an outpost had no opportunity of being instructed in the general discipline of the army, nor indeed was it very necessary; the most important duties, those of vigilance, activity and patience of fatigue, were best learned in the field; a few motions of the manual exercise were thought sufficient; they were carefully instructed in those of firing, but above all attention was paid to inculcate the use of the bayonet and a total reliance on that weapon. The division's being fully officered and weak in numbers was of the greatest utility, and in many situations was the preservation of the corps. Two files in the centre and two on each flank were directed to be composed of trained soldiers, without regard to their size or appearance. It was explained that no rotation, except in ordinary duties, should take place among light troops, but that those officers would be selected for any service, who appeared to be most capable of executing it. It was also enforced by example, that no service was to be measured by the numbers employed upon it, but by its own importance, and that five men, in critical situations or employment, was a more honorable command than one hundred on common duties. Sergeants' guards were in a manner abolished, a circumstance to which may in a great measure be attributed that no sentinel or guard of the Queen's Rangers was ever surprised; the vigilance of a gentleman and an officer being transcendantly superior to that of any non-commissioned officer whatsoever." Such is Simcoe's account of the system he pursued in training his famous corps, and nothing need be added to it, beyond quoting his remarks on the spirit that pervaded the corps after the battle of Brandywine. "If," says he, "the loss of a great number of gallant officers and soldiers had been severely felt, the impression which that action had left upon their minds was of the highest advantage to the regiment. Officers and soldiers became known to each other; they had been engaged in a more serious manner and with greater disadvantages than they were likely again to meet with in the common chance of war; and having extricated themselves most gallantly from such a situation they felt themselves invincible. This spirit vibrated among them at the time Major Simcoe joined them, and it was obvious that he had nothing to do but to cherish and preserve it. Sir William Howe, in consequence of their behaviour at Brandywine, had promised that all promotions should go in the regiment, and accordingly they now took place."

On the 19th October, 1777, the British army marched to Philadelphia, the Queen's Rangers forming the rear guard of the left column, and in their encampment their post was on the right of the line in front of the village of Kensington; the army extending from the Delaware to the Schuylkill. The post of the Rangers was several times attacked by American patrolling parties who could come, by means of the woods, very near it without being discovered. The greatest vigilance was therefore necessary on their part and the whole corps was always under arms before daylight. The mounted men of the Rangers here made themselves very useful in discovering the enemy's patrols. An American post at Frankfort was surprised by the Rangers about this time and an officer and twenty men taken prisoners. Pulaski, who commanded a large body of American cavalry, made an attempt on the Rangers late in October, but was repulsed. On the 5th December the army marched against Washington at Whitemarsh, and on the 8th the Rangers were engaged in an attack on the enemy, in which the Americans lost about one hundred men, with hardly any loss to the British. When the army returned to Philadelphia the Rangers resumed their old post at Kensington. Some idea of the severity of the service in which the Rangers were engaged may be gathered from the fact that, as Simcoe says, "The 4th January, 1778, was the first day since their landing at the head of Elk that any man could be permitted to unaccoutre." The landing at the head of Elk took place on the 25th August, four and a half months before.

A considerable portion of the duty of the Queen's Rangers during the winter was to secure the country and facilitate the inhabitants in bringing their produce to market for the supply of the army. This was a very important duty, as it was above all things necessary to assure the country people of protection in order that the army might be properly fed. Simcoe so gained the confidence of the people that they were always ready to give him every information of the enemy's movements. The American patrols who came to stop the markets were considered by the country people as robbers; and private signals were everywhere established, by which the smallest party of the Rangers would have been safe in patrolling the country. "The general mode adopted," says Simcoe, "was to keep perfectly secret the hour, the road and the manner of his march; to penetrate in one body about ten miles into the country. This body generally marched in three divisions, one hundred yards from each other, so that it would have required a large force to have embraced the whole in an ambuscade, and, either division being upon the flank, it would have been hazardous for an enemy so inferior in every respect but numbers, as the Rebels were, to have encountered it; at ten or twelve miles the corps divided and ambuscaded different roads, and at the appointed time returned home. There was not a bye-path or ford unknown, and the Hussars would generally patrol some miles in front of the infantry. The market people, who over night would get into the woods, came out on the appearance of the corps and proceeded uninterruptedly, and from market they had an escort, whenever it was presumed that the enemy was on the Philadelphia side of Frankfort to intercept them on their return into the woods. The infantry, however inclement the weather, seldom marched less than ninety miles a week; the flank companies, Highlanders and Hussars, frequently more. These marches were by many people deemed adventurous and the destruction of the corps was frequently prophesied. The detail that has been exhibited and experience takes away all appearance of improper temerity; and by these patroles the corps was formed to that tolerance of fatigue and marching, which excelled that of the chosen light troops of the army, as will hereafter be shown."

Parties of the Queen's Rangers were almost every day at Frankfort where, since the surprise already mentioned, the Americans did not keep a fixed post. Simcoe had trained his men to quick and energetic movements with the bayonet, and his standing order was, "Take as many prisoners as possible, but never destroy life unless absolutely necessary." On one occasion a patrolling party of Rangers approached Frankfort undiscovered by an American sentinel on the bridge. They were so near that they might have easily killed him, but a boy was sent to warn him to run for his life. He did so and no more sentinels were posted there afterwards, "a matter of some consequence," says Simcoe, "to the poor people of Philadelphia, as they were not prevented from getting their flour ground at Frankfort Mills."

Towards the end of February the Queen's Rangers and 42nd Regiment crossed the Delaware and marched to Haddonfield to intercept a convoy of cattle which General Wayne was taking to Washington's army at Valley Forge. Wayne got his convoy to a safe place before their arrival, but Simcoe was detached with his Rangers to Timber Creek, where he captured several militiamen, a quantity of stores, a number of boats and one hundred and fifty barrels of tar which were sent to the fleet. He then went to Egg Harbour, where he captured a quantity of rum, which was destroyed, and some cattle. The Rangers then returned and Wayne's troops gathered in force to follow. The march back from Haddonfield was performed in an extremely bitter storm of cold sleet, and the night, which was extremely cold, was passed without a fire. At dawn next day, Capt. Kerr was detached with fifty of the 42nd and his company of Rangers to a place three miles and a half distant to escort some wagons of forage which were to be brought in. Lieut. Wickham, with ten Hussars, patrolled in his front towards the enemy, which were but a few miles off in force. Word was sent to Kerr, who got off his detachment in safety, and Wickham did his part so well that he escorted the enemy to the very outposts. They were at once attacked by the Rangers and 42nd Regiment and driven back, both infantry and cavalry; the latter were under Pulaski, whose horse was shot as he retreated. Col. Sterling, of the British army, who commanded the detachment, made a most flattering report of the conduct of the Rangers on this occasion to the Commander-in-chief.

In March the Queen's Rangers, with the 27th and 46th Regiments and New Jersey Volunteers, went down the Delaware and landed at the mouth of the Aloes Creek to forage. At Hancock's and Quintin's bridges on this creek, were posted large bodies of American militia behind breastworks. Col. Mawhood, who commanded the detachment, masked these bridges and foraged in their rear. The officer who commanded these troops in front of Quintin's bridge, which consisted of seventy of the 27th Regiment, sent word that the enemy were in great force there and acted as if they meant to pass over the bridge when he quitted it, in which event he would be in great danger. Mawhood marched with the Queen's Rangers to his assistance. They got near the bridge without being perceived by the enemy, and halted in the wood. A beautiful trap was now set for the Americans. Capt. Stephenson's light company of Rangers was got into a public house close to the bridge and by the side of the road, which went straight away from Aloes Creek. Two companies under Capt. Saunders were placed in ambush close to the road, and the remainder of the corps remained hidden in the wood. The detachment of the 27th Regiment which was posted near the house then called in their sentinels and marched in full sight away from the creek. A large body of the enemy followed in pursuit, passed the house where Stephenson's company were ambushed and would also have passed Capt. Saunders's men without seeing them had it not been that one of them was heard stifling a laugh. The Americans then fled in every direction, but about one hundred of them were taken or drowned in the creek; among the prisoners was the French officer who commanded them. The only loss of the Rangers was one hussar, who was shot and mortally wounded by a man to whom he had given quarter.

As the enemy were reported to be in force at Hancock's bridge, Simcoe was sent with his Rangers to make a night attack upon their post. Unfortunately for the complete success of the enterprise, the main body of the Americans had been withdrawn. Only thirty men had been left, and these were in Hancock's house, a large brick building near the bridge. Capt. Dunlop's and Stephenson's companies attacked those in the house with such fury that every man in it was killed. This was a lamentable occurrence and has enabled American writers to assert that these men were massacred, but it must be remembered that it was a night attack and that Simcoe's Rangers, instead of this insignificant detachment, expected to meet a force of at least 700 or 800 men, and, of course, a desperate resistance was expected. A patrol of seven men that had been sent down the creek were also surprised by the Rangers and all but one killed.

Two days after this, the Queen's Rangers patrolled to Thompson's bridge, also on Aloes Creek, but it was deserted. The militia were so thoroughly demoralized by the affairs at Quintin's and Hancock's bridges, that on the previous evening when a cow was leisurely approaching Thompson's bridge it was taken for an enemy, fired at and wounded. The American militia, however, did not wait for its onslaught, but took to their heels and never halted until they had placed several miles between themselves and the dangerous bovine. The Rangers returned to Philadelphia on the 31st March. Shortly after this a large drove of fat cattle intended for Washington's army was captured by a clever ruse. They were met about thirty miles from Philadelphia, between the Delaware and Schuylkill, by a friend of the British who passed himself upon the drovers as an American Commissary, billeted them at a neighboring, farm, and immediately galloped to Philadelphia, whence a party of dragoons was sent out for the cattle.

Intelligence was received that General Lacey, with a large force of Pennsylvania militia, was to be at the Crooked Billet, twenty-five miles from Philadelphia, on the 1st May. Simcoe proposed that he should march against him with the Queen's Rangers, and it was arranged that he should be accompanied by a detachment of light infantry and cavalry under Lieut.-Col. Abercrombie. The march, which was a long and severe one, was made at night, and it was planned that the Rangers should make a circuit and get in the rear of Lacey's quarters. Simcoe had arrived at a point where he quitted the road, in order to make the last circuit and get behind the enemy's quarters, and was explaining to his officers the plan of attack—which was that each was to be guided by circumstances, except Capt. Kerr's division, which was to force Lacey's quarters and barricade them for a point to rally at in case of misadventure—when an alarm shot was heard. Abercrombie's cavalry had been discovered by the enemy, who at once decamped. The Rangers cut off some smaller parties, but the main body of Lacey's troops ran so fast that by no efforts could the infantry of the Rangers reach them. Sixty of the Americans were killed or taken, with all their baggage. This flight of Lacey's is what an American historian of the war, Lossing, calls, "cutting his way through." The guides of the Rangers computed their march on this expedition at fifty-eight miles. They lost none in killed and only a few of the men were wounded. Captain McGill's shoe buckle stopped a bullet which might have cost that valuable officer his foot. "This excursion," says Simcoe, "though it failed in the greater part, had its full effect, of intimidating the militia, as they never afterwards appeared but in small parties and like robbers."

On the 11th May, 1778, Sir Harry Clinton succeeded Lord Howe as Commander-in-Chief and received instructions from the Government to evacuate Philadelphia. Simcoe was at this time raised to the rank of Lieut.-Colonel. On the 17th June, Col. Simcoe in public orders complimented the Rangers on their bravery and good conduct. The British army evacuated Philadelphia on the 18th June, and the Queen's Rangers marched to Haddenfield as part of General Leslie's division, forming the advance of the left column of the army. They experienced no interruption until the 23rd when at Crosswick's they had a skirmish with the enemy, who attempted to dispute the passage of a bridge, the planks of which they had taken up. The Rangers crossed on the stringers of the bridge, Capt. Armstrong gallantly leading the way with his Grenadiers. On the 24th, the army marched to Allentown, the Rangers still leading the column. There the order of march was changed, and, as

Washington's army was following, the German Yagers, the Queen's Rangers, Light infantry and Dragoons formed its rear guard. That day after the troops had encamped, Simcoe and Lieut. Wickham, while out patrolling, fell in with two Americans, who, deceived by their green clothes, took them for fellow-countrymen. Wickham pretended to be an American officer and introduced Simcoe as Col. Lee. One of the Americans was very glad to see him and said he had a son in his corps, and gave him a full account of the movements of the American army, from which Simcoe said he had been detached for two days. The other man proved to be a committee man from New Jersey. They pointed out the encampment of the British army and were completely deceived, until having told all they knew, and the committee man having said, "I wonder what Clinton is about," Simcoe replied, "You shall ask him for yourself, for we are British." The next day the army marched to Monmouth, and on arriving there the Rangers covered headquarters while the army halted for a day and foraged.

On the 27th June, Colonel Simcoe, with twenty of his Hussars and the grenadier company of infantry, under Captain Armstrong, was ordered to try to cut off a reconnoitering party of the enemy, supposed to be under the command of Lafayette. While advancing Simcoe fell in with a large body of the enemy, who, after firing a volley, fled in a panic, the Baron Steuben who was with them losing his hat in the confusion. A second body of the enemy advanced in force under the command of a general officer, but they were checked and two prisoners taken. Colonel Simcoe received a painful wound in the arm and three of the infantry and two of the Hussars were also wounded, one of the latter mortally. The force that was thus handsomely defeated by sixty of the Rangers consisted of eight hundred New Jersey militia, under General Dickenson. As Simcoe observes, "The American war shows no instance of a larger body of men being discomfited by so small a number."

On the following day the battle of Monmouth was fought. Simcoe being disabled and unable to lead his men, the Queen's Rangers was commanded on that famous day by Capt. Commandant Ross, who had been an officer of the 35th Regiment. He was detached with the Light Infantry under Col. Abercrombie to turn the enemy's left; went through the whole fatigue of that hot day, and although the corps had been under arms all the preceding night, it there gave a striking and singular proof of the vast advantages of its severe training at Philadelphia, by not having a man missing or any that fell out of the ranks through fatigue, yet on that day more than fifty British soldiers died of the heat without receiving a wound. At Monmouth the Americans were badly defeated and only saved from a great disaster by the timely arrival of reinforcements under Washington. During the day the Rangers as usual distinguished themselves, and when the army resumed its march towards Sandy Hook they had the honor of forming its rear guard. The army arrived at Sandy Hook on the 5th of July and there embarked for New York, and Simcoe could boast that in the whole of the arduous march from Philadelphia he had not lost one man by desertion.

III.

After the return of the British army to New York, the Rangers were encamped at King's Bridge, on the Harlem River, and with them were Emmerick's corps of Chasseurs and the three Provincial corps of Hovenden, James and Sandford, most of whom afterwards were affiliated with Tarleton's Legion. The Rangers had previously been supplied with a gun, a three-pounder, and now an Amuzette and three artillery men were added, so that the corps had become a miniature army consisting of horses, foot and artillery. The post they occupied was a very extensive one, much exposed and liable to attack, and as Washington's army was encamped at White Plains, the Rangers had full employment. The American advance corps under General Scott, occupied from Phillip's Creek on the north to New Rochelle on the East River, and sometimes they came in force to Valentine's Hill, which was not more than two miles from Simcoe's camp. The Rangers ambuscaded one of these parties of the enemy and caused them some loss, and there was hardly a day in which they were not actively engaged. Tarleton took command of Hovenden's and James' Provincial corps and became an active colleague of Simcoe in the operations around King's Bridge. Early in August the Rangers and cavalry of Tarleton's Legion penetrated several miles into the enemy's lines, and at Mamaronec captured the guard there, two or three commissaries who were in a fishing party, and forty horses, and returned without accident. This, like most of the Rangers' affairs, was a night attack, and although the results seem small there was no bolder or more remarkable operation in the whole war.

At this time the Americans were joined by a party of sixty Stockbridge Indians and they speedily made their presence known by an attack on one of Emmerick's patrols beyond King's Bridge. Simcoe rightly judged that the Indians and American light troops would be likely to make another attack next day and he resolved to lie in ambush for them. His idea was that as the enemy moved forward he would be able to gain the heights in their rear and attack them. In pursuance of these intentions, Lieut.-Col. Emmerick was detached with his Chasseurs and ordered to post himself in a house designated, but he unfortunately mistook a nearer house for the one at a greater distance of the same name and this error nearly spoiled the plan. Emmerick then sent forward a patrol. Lieut.-Col. Simcoe, who was half-way up a tree, on the top of which was a drummer boy, saw a flanking party of the enemy approach. The troops had scarcely fallen into their ranks when a smart firing was heard from the Indians, who had lined the fences of the road and were exchanging shots with Emmerick, whom they had discovered. The Queen's Rangers moved rapidly to gain the heights and Tarleton immediately advanced with the Hussars and Legion cavalry. Not being able to pass the fences in his front, he made a circuit to return further on their right, which being reported to Simcoe he broke from the column of the Rangers with the Grenadier Company and directing Major Ross to conduct the corps to the heights, advanced to the road and arrived without being perceived within ten yards of the Indians, who now gave a yell and fired upon the Grenadier Company, wounding four of them and Simcoe. The Indians were driven from the fences and Tarleton got among them with the cavalry and pursued them rapidly down Courtland Ridge, while Simcoe joined the battalion and seized the heights. An American captain of light infantry and some of his men were taken, but a body of them under Major Stewart left the Indians and fled. Forty of the Indians were killed or desperately wounded, among the former being the Chief Nimham. The Indians were so demoralized by this affair that a large number of them who had intended to join Washington's army gave up their design. The Legion cavalry had one man killed and one man wounded; several of the Rangers were wounded, two of them being Hussars.

Col. Gist, who commanded a light corps of Americans, was posted at Babcock's house near Yonkers and from thence made frequent patrols. Simcoe resolved to attack him and if possible capture his party, and made such dispositions of the Rangers, Tarleton's Legion, Wreden's German Yagers and Emmerick's infantry as seemed likely to effect that object. Gist would certainly have been captured with his whole force, for the Rangers had passed all his sentinels and got in his rear, but for the blunders of a portion of the German Yagers who were to have seized a bridge, but neglected to do so, the only one by which Gist could have escaped. Gist got away, but one of his patrols was captured and his camp destroyed, and soon afterwards Washington quitted White Plains with his army, a result which was largely due to the continual checks which his light troops had received.

In the latter part of September, the British outposts were advanced and the Queen's Rangers with Delancey's, Emmerick's, and the Legion

Cavalry, all under Col. Simcoe, formed a flying camp between the Bronx River and Chester Creek. As this corps was liable to be struck at, it seldom camped two days and nights in the same place and constantly occupied a strong position. In October, Gen. Grant being about to embark for the West Indies, was so well satisfied with the Queen's Rangers that he offered to take with him that corps among the number of chosen troops destined for that service.

This highly-flattering offer was declined by Simcoe from a feeling that to accept it would not be just to the native American non-commissioned officers and soldiers. Major Ross, however, went on the expedition as Brigade Major and was killed at St. Christopher. Capt. Armstrong of the Grenadiers became major in his room.

The last exploit of the Queen's Rangers this year was the capture of Col. Thomas, a very active partizan of the enemy, and the breaking up of a post of dragoons. These services, which involved a march of fifty miles, were successfully accomplished, and on the 19th November the Rangers went into winter quarters at Oyster Bay, Long Island. This post was greatly exposed to attack, there being no available support nearer than Jamaica, thirty miles distant, where the British Grenadiers lay. Simcoe elaborately fortified his post and arranged a general plan of defence in case of attack. No attack, however, was made, although several were contemplated by the enemy. The Hussars of the Rangers, who had heretofore belonged to the several infantry companies, were now formed into a separate troop, and Lieut. Wickham became their captain. The situation of Oyster Bay was well calculated to secure the health of the soldiery; the water was excellent, vegetables and oysters were abundant, and the Rangers were kept in a high state of efficiency for the field. New York being in great want of forage, Oyster Bay became a central place of deposit for it, and, frequently, expeditions towards the eastern and interior parts of the island were made to enforce the orders of the Commander-in-Chief. Excursions were also made frequently to execute other orders relative to the intercourse with the inhabitants within the American lines, and to escort messengers between Sir William Erskine, who commanded on the east end of the island and Jamaica. On one of these expeditions, on the 11th April, 1779, Capt. Kerr, together with Sergeant James McHardy and privates John Stokes and Henry McBroon of his company, were captured by the enemy.

During the winter the corps was constantly exercised in the firing motions and charging with bayonets, upon their respective parades. As the season opened they were assembled together and trained to attack a supposed enemy posted behind fences, a common position of the Americans. They were instructed not to fire but to charge bayonets with their muskets loaded. The light infantry and Hussars were put under the direction of Capt. Saunders, who taught them to gallop through woods, and, acting together, the light infantry learned to run by holding the horses' manes. The cavalry were also instructed, as the infantry lay flat on the ground, to gallop through their files. The captains of companies were forbidden to teach their men to march in slow time, and the orders were, "to pay great attention to the instruction of their men in charging with the bayonet, in which case the charge was never to be less than three hundred yards, gradually increasing in celerity from its first onset, taking great care that the grand division has its ranks perfectly close and the pace adapted to the shortest men."

On the 2nd May, 1779, the Queen's Rangers was by general orders styled and numbered "The First American Regiment," and its officers declared to be entitled to have their rank permanent in America and to receive half-pay in case the regiment was disbanded. "The Queen's Rangers," says Simcoe, "consisting of 360 rank and file, in great health and activity, left their cantonments on the 18th May, and by a given route arrived at King's Bridge, and encamped there on the 27th, and formed the advance of the right column of the army which marched from thence on the 29th to a position extending from Phillip's house to East Chester heights. The Rangers marched on June 3rd to Croton Bridge, where the enemy had been collecting the cattle of the country, seized them, took some prisoners, and returned to their quarters. On the 24th they again advanced to Croton Bridge and took a considerable number of prisoners. They were actively engaged in various services in the advance of the army until late in July, when they again occupied their old post of the previous year at King's Bridge. On the 5th August, at midnight, word was brought to Simcoe that a party of American dragoons had surprised and captured a large number of Loyalists at West Chester. He at once started in pursuit with the Rangers, leaving orders for the Legion and Emmerick's corps to follow. The cavalry pursued the enemy so expeditiously that most of the Loyalists whom they had taken escaped, and at New Rochelle the Americans were overtaken. Colonel White, who commanded them, abandoned his infantry and fled with his cavalry, the infantry throwing themselves behind a stone wall, from which they fired a volley at Simcoe's Hussars as they attempted to rush past, killing or wounding four of them and then taking to their heels. Col. Diemar, who commanded an independent troop of hussars which followed the Rangers, pursued them across the creek, the losses of the enemy's infantry amounting to twelve, of whom several were drowned in the creek. The enemy's cavalry were pursued to Byram's Bridge, dropping the remainder of the captured Loyalists in their flight. On the 8th August, the light troops fell back to the redoubts and a grand guard being in advance, the Rangers were, for the first time since they left their winter quarters on the 18th May, permitted to take off their coats at night.

The Buck's County Dragoons and Capt. Diemar's Hussars were placed now under Simcoe's orders and on the 13th August the corps marched for their old post, Oyster Bay, where they arrived on the 17th. This movement was made because it was thought the enemy contemplated an attack on some of the British posts on Long Island. In October, the Rangers marched to Richmond on Staten Island, where they relieved a regiment that had been very sickly while there. Simcoe immediately ordered their huts to be destroyed and encamped his corps.

From this point Simcoe and his Rangers performed one of the most remarkable exploits of the whole war. He had information that fifty flat boats on carriages, capable of holding 100 men each, were on the road from Delaware to Washington's army, and that they had been assembled at Van Victor's Bridge on the Raritan. Simcoe proposed to the commander-in-chief to burn them, and the plan was approved and ordered to be put into execution. On the night of the 25th October, the troops detailed for the service, consisting of the Queen's Rangers, both cavalry and infantry, Stewart's New Jersey Cavalry and Capt. Sandford's troop, embarked at Billop's Point. At Elizabethtown Point the infantry were landed and ambuscaded every avenue of the town. The cavalry then marched for Van Victor's Bridge, Major Armstrong of the infantry being ordered to re-embark as soon as the cavalry left, land at South Amboy and proceed to South River Bridge where he was to lie in ambush. Simcoe with his cavalry proceeded to Van Victor's Bridge, everywhere passing themselves off as belonging to Lee's American Legion. They destroyed the boats at Van Victor's bridge, captured a number of prisoners, and then, as the country was beginning to assemble in their rear, returned. They burnt Somerset court house and liberated some Loyalist prisoners there. In passing an ambuscade formed by a body of men under one Mariner, Simcoe's horse was killed and he so severely stunned by the fall that he was made prisoner. Three of his men were also made prisoners from the same cause, but the rest got off in spite of all the efforts made to intercept them, dispersed all the militia they fell in with, killed some, among others a Captain Vorhees, and captured others, and at South River joined Major Armstrong, whose infantry had taken several prisoners. The Queen's Rangers returned to Richmond that evening, the cavalry having marched upwards of eighty miles without having refreshment, and the infantry thirty. Col. Harry Lee, father of the late General Lee, in his memoirs of the war, gives an account of this remarkable expedition, in which he pays a handsome compliment to Simcoe and his Rangers, the more valuable as it is the testimony of an enemy. He says:—

"This officer commanded a legionary corps called the Queen's Rangers and had during the war signalized himself on various occasions. He was a man of letters and, like the Romans and Grecians, cultivated science amid the turmoil of camps. He was enterprising, resolute and persevering; weighing well his project before entered upon, and promptly seizing every advantage which offered in the course of execution. Geo. Washington, expecting a French fleet on our coast in 1779-80, and desirous of being thoroughly prepared for moving up on New York in case the combined force should warrant it, had made ready a number of boats which were placed at Middlebrook, a small village up the Raritan River, above Brunswick. Sir Henry Clinton being informed of this preparation, determined to destroy the boats. The enterprise was committed to Lieut.-Col. Simcoe. He crossed from New York to Elizabethtown Point with his cavalry, and setting out after night, he reached Middlebrook undiscovered and unexpected. Having executed his object he returned by a circuitous route. Instead of turning towards Perth Amboy, which was supposed to be the most probable course, keeping the Raritan on his right, he passed that river, taking the direction towards Monmouth County leaving Brunswick some miles to his left. Here was stationed a body of militia who, being apprised (it being now day) of the enemy's proximity, made a daring effort to stop him, but failed in the attempt. Simcoe, bringing up the rear, had his horse killed, by which accident he was made prisoner. The cavalry, deprived of their leader, continued to press forward under the second in command, still holding the route to English Town. As soon as the militia at Brunswick moved upon the enemy, an express was despatched to Lieut.-Col. Lee, then posted in the neighbourhood of English Town, waiting for the expected arrival of the French fleet, advising him of this extraordinary adventure.

"The Legion Cavalry instantly advanced towards the British horse, but notwithstanding the utmost diligence was used to gain the road leading to South Amboy (which now was plainly the object) before the enemy could reach it, the American cavalry did not effect it. Nevertheless the pursuit was continued, and the Legion horse came up with the rear soon after a body of infantry sent over to South Amboy from Staten Island by Sir Henry Clinton to meet Simcoe, had joined and gave safety to the harassed and successful foe.

for the Hussars of the Rangers to go with a convoy to New York. Simcoe, however, took two hundred infantry with him to surprise an enemy's post at Woodbridge, leaving Major Armstrong with some infantry and the cannon on the heights at the Old Blazing Star to cover their return. The depth of the snow prevented the men from marching, except on the beaten road; no post was found at Woodbridge, and the posts further on, to which he advanced, were alarmed and the surprise failed. An attempt was made to stop the Rangers on their return, but they scattered the enemy's militia like chaff and got back to Staten Island with the loss of one man, who was killed by a chance shot of the sentinels.

Nothing of moment occurred until the 23rd March, 1780, when the infantry of the Rangers received orders to embark for Charlestown, S.C., which they did on the 4th April. Capt. Wickham was left with the Hussars in the town of Richmond and a detachment of the 82nd Regiment occupied the redoubts. The Hessian Regiment of Ditforth, Queen's Rangers, Volunteers of Ireland, and Prince of Wales Volunteers, under the command of Col. Westerhagen sailed on the 7th. The Rangers arrived at Stony Inlet on the 18th, and, passing the Ashley river, arrived at camp before Charlestown on the 21st, where they covered the troops employed in the siege of that place, by extending between the Ashley and Cooper rivers. The infantry consisted of 400 rank and file, and there was not a sick man among them. The soldiers were new-clothed and accoutred and the regiment was greatly congratulated on its fine appearance. Charlestown, which was defended by General Lincoln, surrendered to the British on the 12th May, and immediately after the capitulation the Rangers marched to Dorchester, from which they returned to Charlestown and on the 31st May embarked for New York.

Capt. Wickham, with the Queen's Rangers, Hussars, who were left at Richmond, had in the meantime not been idle. On the 15th April, the cavalry on Staten Island, consisting of Cornet Tucker, and 20 of the 17th Regiment of light dragoons, Capt. Wickham with his troop of 45 Queen's Rangers, and Capt. Diemar with his troop of 40 Hussars, crossed at Cole's ferry and were joined hy Major DuBuy with 300 of the Regiment DeBoise and 50 of Col. Beverley Robinson's corps, the Loyal American Regiment. At New Bridge, Sergeant McLaughlan, with six of the Rangers in advance, fell in with and either killed or captured the whole of a small American outpost. Leaving fifty infantry to guard the bridge, the detachment continued their march to Hopper Town where they designed to surprise Col. Bailey who was stationed there with 300 soldiers. Cornet Spencer, with twelve of the Rangers' Hussars, and Cornet Tucker, with the same number of the 17th Dragoons, formed the advance guard; then followed Capt. Diemar with his troop; the infantry and the remainder of the cavalry closed the rear. Hopper Town was a straggling village a mile long, Col. Bailey's quarters being at the further end. The nearest building was the Court House which contained an officer's piquet of 20 men, and covered the bridge over which the troops must pass. The advance was ordered to force the bridge, which they did in gallant style, and pushed forward through the town at full speed; while the rest of the cavalry dispersed to pick up the fugitives and take possession of their abandoned quarters. Cornet Spencer, on arriving at Bailey's post with six men only, the rest not being able to keep up, found twenty-five men drawn up on the road opposite to him, on the further side of the hollow, with Bailey's quarters on the right and a strong fence and swamp on their left. The officer in command, who was afterwards discovered to be Bailey, retreated with his men to the house, which was of stone. Cornet Spencer, with his party, now augmented to twelve, passed the ravine and, taking possession of the angles of the house, ordered some of his men to dismount and attempt to force one of the windows. Some servants from a small outhouse commenced a fire; Corporal Burt, with three men was sent to them, broke open the door, and took nine prisoners. Cornet Spencer made several offers to parley with those who defended the house, but to no purpose; they kept up a continual fire; and finding it impossible to break open the door or force the windows, he set fire to one angle of the roof, which was of wood. He again offered the inmates quarters if they would surrender, but they refused. By this time some of the speediest of the cavalry had come to his assistance and firing ceased. Captains Deimar and Wickham, who had collected a great number of prisoners, now joined the advance. Col. Bailey, as he opened the door to surrender was most unfortunately shot by one of Diemar's Hussars, so that he died three days afterwards. Of the Rangers' advance guards, two men were killed and two wounded, and one man of the 17th Regiment was also killed. In this house Col. Bailey, two captains, three subalterns and twenty-one soldiers were taken, and in all twelve officers and one hundred and eighty-two men were made prisoners. Major DuBuy gave the Rangers the highest praise for their gallant services on this occasion.

On the 21st June the infantry of the Rangers landed on Staten Island and marched to Richmond Redoubts. At midnight Simcoe received orders to proceed instantly to Elizabethtown Point, where General Knyphausen's army was encamped. There the Hussars of the rangers joined the regiment. Lieut. McNab, who commanded them, had found an opportunity of distinguishing himself by the intrepidity with which he advanced into Elizabethtown, amidst the fire of the enemy, in order to entice them into an ambuscade which had been laid for them but which they were too cautious to fall into. That evening the Queen's Rangers and the Yagers attacked the enemy's advance post, for the purpose of taking some prisoners who might give intelligence, in which they succeeded, with the loss of two men, killed.

On the 23rd June, General Matthews with a division of the troops, marched before day to Springfield; the Rangers making the advance guard. The enemy's smaller parties fell back upon a larger one, which was well posted on an eminence, covered on the right by a thicket and on the left by an orchard; the road being in a deep hollow between them. While the battalions of General Skinner's brigade who flanked the march, were exchanging shots with these troops, Lieut.-Col. Simcoe closed the companies of the Rangers and directed them to rush down the hollow road in column without firing, and then by wheeling to the right, to ascend to the orchard and divide the enemy's parties. This was done and Capt. Stephenson, who led both the riflemen and light infantry company, obtained the ground on their flank without loss, making several prisoners. The enemy fled and the Rangers pursued closely on the right. On the left, the enemy finding themselves liable to be outflanked by the Rangers, also retired and crossed the bridge at Springfield, where they had some cannon. They fired a few shots by which two of the Rangers were killed as they slept. General Matthews then halted until the arrival of Gen. Knyphausen with the main body of the army. A very heavy fire being heard from this column, the Rangers proceeded, unopposed, over the brook and attacked the enemy on the heights, dispersing them without loss. The column then marched to Springfield, but while about to execute another forward movement, Gen. Knyphausen received orders from the commander-in-chief to return immediately to New York, news having been received that a French armament, destined for Rhode Island, was about to land. Two or three hours were given for refreshments and then the orders were given to march back to Elizabethtown Point. The Rangers were ordered to cover the retreat of the army, and, to deceive the enemy as to the intended movement, took up their position in an old orchard which enabled them to interdict the passage of the river. The American General Greene, with the bulk of his army, occupied a strong position on the hills and despatched two or three field pieces to the right flank of the British, but their cannonade had little effect. His light troops and militia, in great numbers, came as close to the front as the intervening thickets could shelter them and kept a constant (though irregular fire on every side. Most of these shot passed over the heads of the Rangers or dropped with little effect in the hollows which concealed them. On their right ran a rivulet forming small and swampy islets, covered with thickets. Assisted by the irregularity of the ground, the enemy were gradually approaching; Lieut.-Col. Simcoe waded to one of these islets with Captain Kerr, whom with his company he left in ambuscade, with orders if the enemy advanced to give them one well-directed fire, and immediately to recross to the regiment. "Capt. Kerr," says Simcoe, "executed his orders judiciously; many of the enemy were seen to fall; the thicket he quitted was not again attempted by them, but it became the centre to which the principal part of their fire was directed." The army, having rested three hours, marched towards Elizabethtown, and the retreat was not discovered by the enemy for some time. They retired in two columns, the Rangers closing one and the Yagers the other. The latter were attacked, but the Rangers went to their assistance and the enemy retired. In these operations, for which they received a great deal of praise, the Rangers had two men killed and ten wounded.

The army having returned to New York the Rangers proceeded to Odle's Hill and took their post in front of the line. Simcoe was obliged to go to New York to recover his health, and the regiment was in general very sickly. He returned to his corps on the 19th July, and proceeded with it to Long Island. He marched to Huntingdon, where one hundred of the militia cavalry of the Island joined him. This corps being destined to preserve communication overland between the fleet, which lay off the eastern end of Long Island and New York. Simcoe, at this time through the Adjutant-General, Major Andre, communicated his wishes and his hopes to the Commander-in-Chief, that in case of any attack on Rhode Island, he would employ the Rangers in it; to which Major Andre replied, "The general assures you, that the Rangers shall be pitted against a French regiment, the first time he can procure a meeting."

The Queen's Rangers remained at the east end of Long Island until the 9th August, when they fell back to Coram, from whence they returned eastward on the 15th, being joined by the King's American Regiment. They returned to Oyster Bay on the 23rd August, after a fatiguing march of three hundred miles in very hot and sultry weather. Immediately after this the Rangers were augmented by two troops of dragoons, which were placed under the command of Captains Saunders and Shank, whom Simcoe describes as "officers of distinguished merit."

Simcoe was entrusted with a knowledge of the negotiations, which culminated in Arnold's treason and also in the death of Major Andre, who was his personal friend, and for whom the Rangers went into mourning. They were to have been entrusted with a very hazardous service in connection with these events had occasion called for it, such was the esteem in which they were held by the army and the Commander-in-Chief. On the 8th October the Rangers resumed their old post at Richmond, Staten Island, and shortly afterwards Captain Saunders with his Lieutenant Wilson and Cornet Merritt, embarked for Virginia in the expedition with General Leslie. Captain Agnew, who had been practically unfit for service for three years, owing to a wound received at the battle of Brandywine, also went with Leslie, and his father, John Agnew, the Chaplain of the regiment.

In the latter part of October it was generally supposed that the enemy meditated an attempt upon Staten Island. Lafayette, with an army, was in the neighbourhood, and had been heard to boast that he would plant French colours on Richmond redoubts. This boast was read to the Rangers in public orders and excited great indignation. The Highland company immediately assembled and marched to the redoubt, which in the distribution of posts was allotted to them and, displaying their national banner, with which they were accustomed to commemorate St. Andrew's day, fixed it on the ramparts saying, "No Frenchman or rebel shall ever pull it down." The Rangers were prepared to repel any attack which might be made upon their redoubts. About this time a false alarm, which was given by an armed vessel stationed at Newark Bay, occasioned a considerable movement in the army, and troops from New York embarked to reinforce Staten Island; the post at Richmond being supposed to be the object of attack. On the first gun being fired, patrols had been made on all sides by the cavalry, and the infantry slept undisturbed, Lieut.-Col. Simcoe apprehending the alarm to be false. The Rangers were very alert on guard and proud of their regimental character, of not giving false alarms or being surprised; and "the sentinel," as Simcoe remarked in orders, "felt a manly pleasure in reflecting that the lives and honour of the regiment was entrusted to his care, and that under his protection his comrades slept in security." But greater events than any attack that Lafayette could make were on the carpet. The regiment early in December was ordered to Virginia and was about to enter upon the last and most brilliant of its six campaigns, a campaign in which it proved its enormous superiority to any troops, whether French or American, that were in the field opposed to it.

V.

The expedition for Virginia on which the Queen's Rangers had embarked, was under the command of General Benedict Arnold. They embarked on the 11th December, 1780, and with the Rangers, went Captain Althouse's company of York Volunteers and Captain Thomas of the

Buck's County Volunteers. Captain Evan Thomas, it may be stated here, went to New Brunswick after the war and died at Pennfield, Charlotte County, in 1835, at the age of 90, leaving many descendants. Captain Althouse also went to that province, was a grantee of St. John, and died in New Brunswick, where no doubt some of his descendants still reside. The commander-in-chief had directed Simcoe to raise another troop of dragoons, the command of which was given to Lieut. Cooke of the 17th Dragoons, who remained in New York to recruit. Before Arnold embarked he issued an order against depredations in the country to which they were bound. The expedition arrived in the Chesapeake on the 30th December, but several ships were missing. Arnold did not wait for them, but pushed up the James River, capturing a number of small American vessels on the way. The enemy had a battery at Hood's Point and seemed disposed to bar the passage of the river. Simcoe landed with 130 of the Rangers and the Light Infantry and Grenadiers of the 80th Regiment to attack this battery, but the enemy fled and abandoned it. The guns were then dismounted and the troops re-embarked and were taken up the river as far as Westover, where they were again landed. From Westover, to Richmond, the capital, was a distance of thirty miles, and as Arnold's force did not number 800 men, he was in doubt as to the propriety of advancing as far as Richmond. Simcoe, however, persuaded him to undertake the enterprise, and the troops marched towards the capital of Virginia, that goal which the Northern troops were four years trying to reach during the late Civil War. On the second day's march a number of prisoners were taken, and when within seven miles of Richmond a patrol of the enemy appeared and immediately fled at full speed. Jefferson was at Richmond and had called out the militia of the State to defend the capital. The American militia were drawn up on Richmond Hill, on the south side of Shakoe Creek. Simcoe, with his Rangers, advanced to dislodge them. He marched his infantry up the hill to the right in small detachments, and brought his cavalry up in front, although the ground was so steep that the men had to dismount and lead their horses. The militia fled to the woods in great confusion, and the American militia in the town of Richmond also made their escape. The enemy were pursued by Simcoe's cavalry, with Captain Shank and Lieutenant Spencer, for four or five miles, and they captured a number of them, with their horses. On his return to Richmond, Simcoe received orders to set out immediately for Westham, six miles from Richmond, where the Americans had a magazine and cannon foundry. The Rangers immediately started on this new enterprise, destroyed all the cannon they found there, burnt down the foundry and threw the powder into the river. They returned towards Westover, the march being a very severe one owing to the rain.

On the night of the 8th January, Simcoe made a patrol from Westover to Long Bridge, with forty of his cavalry. Before they had advanced two miles they fell in with two of the enemy's videttes, one of whom they captured, and also a negro, whom they had intercepted while on his way to the British, and freedom. From these people they learned that the enemy were assembled at Charles City Court House, and that the corps which had appeared that day, opposite Westover, to the number of nearly 400 men, lay about two miles in advance of their main body and on the road to Westover. Simcoe immediately resolved to march towards them, the negro guiding the party by an unfrequented pathway between the 400 of the enemy thought to be in advance and the main body at Charles City Court House. It turned out, however, that the advance party had gained the main body; Simcoe, therefore, met with no interruption until he got near the Court House, when a vidette gave the alarm. Simcoe at once made a rush for the enemy at the Court House. A scene of indescribable confusion followed. After firing a few shots the militia fled and dispersed, many of them not stopping until they reached Williamsburg. It appeared that there were eight hundred of these heroes at the Court House, all under the command of General Nelson. Some of them were taken, others wounded and a few drowned in the mill pond. The Rangers had four Hussars wounded, one of them, Sergeant James Adams, mortally. Simcoe relates that this gallant soldier, sensible of his condition, said, "My beloved Colonel, I do not mind dying, but for God's sake, do not leave me in the hands of the Rebels." Sergt. Adams, who was an Englishman, died at Westover on the 7th and was buried in the colors which had been displayed and taken from Hood's battery. This night attack on Charles River Court House, by which 800 men were defeated and dispersed by 40 Queen's Rangers, was one of the most daring exploits of the war and shows how little account that splendid regiment made of their enemies.

Arnold having been joined by the remainder of his expeditionary force, which had been delayed by the non-arrival of the vessels in which it was embarked, dropped down to Flour de Hundred, where Simcoe was ordered to land and surprise a body of American militia at Bland's Mills. Simcoe took the infantry of the Rangers with him and Col. Beverley Robinson's Loyal American regiment. The detachment had not proceeded above two miles when the Loyal Americans, who were in front, received a heavy fire. There was no room to extend the front, as the road ran through a thick wood. The troops were ordered to charge and the enemy, although strongly posted, fled. The Loyal Americans had twenty killed or wounded; among the latter was Captain Christopher Hatch, who afterwards settled in New Brunswick and died at St. Andrews, where some of his descendants still reside. Beverley Robinson, Colonel of the regiment, was a member of the first Council of New Brunswick, but never took his seat. The Lieutenant-Colonel, Beverley Robinson, Jr., also went to that province and was a member of its Council for many years, and his descendants still live there. John Robinson, brother of the last mentioned Beverley, was a lieutenant in the same regiment and also settled in New Brunswick. He was father of the late Beverley Robinson, treasurer of that province, and of the late John M. Robinson, barrister of St. John. There were no less than five Robinsons in the Loyal American Regiment, the others besides those already named being Christopher and Robert Robinson, near relatives of Col. Beverley Robinson. Robert Robinson, who was a lieutenant, was the grandfather of Thos. M. Robinson, late manager of the Western Union Telegraph Office of St. John. He retired with the half-pay of a Captain and settled in Wilmot, N.S., and afterwards removed to Digby, where he died. Christopher was the father of Sir Beverley, Chief Justice of Upper Canada, who died in 1863, and grandfather of Sir Lucan Robinson, who resided in England.

Arnold, having removed the guns from Hood's batteries, dropped down the river to Harding's Ferry and from thence marched to Springfield. Simcoe and his Rangers then proceeded to M'Kie's mills, where he attacked and dispersed a considerable force of the enemy; he next captured an officer and 12 men and, by means of the former, induced the whole body of militia to surrender on parole. The next day the army continued its march and the Rangers went to Portsmouth, where they arrived on the 11th January, after capturing or dispersing two or three detachments of Americans on the march.

Simcoe in his work gives an incident which occurred at this time, which presents, although told in the simplest language, a vivid picture of the horrors of war. "On the 25th," says Simcoe, "Col. Dundas, with a party of the 80th and a detachment of the Queen's Rangers crossed Elizabeth River and went into Princess Ann. This party returned at night, and on its arrival at the ferry an account came from General Arnold that some of the artillery, who had been foraging on the road to the Great Bridge, had been attacked, their waggons taken and the officer killed. The general ordered a detachment to be passed over from Norfolk to endeavour to retake the waggons; the troops had just arrived from a fatiguing march; the night was closing in and it began to rain tremendously. Lieut.-Col. Simcoe ferried over, as ordered, to Herbert's Point, 14 Yagers and Rangers; they were joined by the conductor of the artillery, who had escaped, and from his account it appeared that the officer was not dead, and that the enemy were but few in number. After the party had advanced a mile, an artilleryman, who had escaped and lay hid in the bushes, came out and informed him that Lieut. Rynd lay not far off. Lieut.-Col. Simcoe found him dreadfully mangled and mortally wounded; he sent for an ox-cart from a neighboring farm, on which the unfortunate young gentleman was placed. The rain continued in a violent manner, which precluded all pursuit of the enemy; it now grew more tempestuous and ended in a perfect hurricane, accompanied with incessant lightning. This small party slowly moved back towards Herbert's ferry; it was with difficulty that the drivers and attendants on the carts could find their way; the soldiers marched on with their bayonets fixed, linked in ranks together, covering the road. The creaking of the wagon and the groans of the youth added to the horror of the night; the road was no longer to be traced when it quitted the woods; and it was a great satisfaction that a flash of lightning, which glared among the ruins of Norfolk, disclosed Herbert's house. Here a boat was procured which conveyed the unhappy youth to the hospital ship, where he died next day."

On the 29th January, Simcoe was sent to fortify the post at Great Bridge, which was accomplished in a few days. The Americans, who no longer dared to meet the Rangers in battle, continually fired at night upon their sentinels, until Simcoe dressed up a figure with a blanket coat to represent a sentinel, at which they fired half the night, the real sentinels being concealed. This shamed them out of their unsoldier-like practice.

On the 5th February, the works at Great Bridge being completed, the Rangers were relieved and marched to Portsmouth, taking some prisoners on the way. On the 10th they were detached to Kemp's Landing and dispersed a marauding party under a New England officer named Weeks, the latter being driven into a swamp and escaping with great difficulty. On the 6th March, Quarter-Master McGill and 12 Hussars of the Rangers accompanied Lt.-Col. Dundas and part of his regiment to Hampton, where they destroyed some stores and boats. On their return they found 200 American militia drawn up behind a wet ditch to dispute their passage. McGill with his Hussars, a few Yagers and the mounted officers, 26 in all, charged them and broke them, and the infantry coming up, they fled in all directions, with the loss of 60 killed, wounded or taken. Capt. Stewart, of the 8th, was killed in this gallant charge and Lieut. Salisbury, of the navy, who had come for sport, was wounded.

On the 11th March a detachment of the Rangers, under Lieutenant St. John Dunlop, surprised a party of Weeks' men and killed or captured ten of them, and received the thanks of Simcoe for their exploit in public orders. Soon after this, Captain McCrea, of the Queen's Rangers, having command of the post at Great Bridge, sallied out against a party of the enemy that had frequently fired upon his sentinels, surprised them, put them to rout and pinned a label upon one of the men who had been killed, threatening to lay in ashes any house near his front that they should harbour in.

On the 18th March, Lafayette, with an American army, appeared before Arnold's works at Portsmouth, Simcoe and his Rangers being at that time detached on a foraging expedition. The post at Great Bridge was threatened by General Gregory with 1,200 men, but the Americans were never too eager to attack a work which was held by any part of the Queen's Rangers, so that the demonstration ended in nothing. On the 27th March, General Phillips arrived at Portsmouth and took command of the British forces there, which were now largely augmented. The light infantry went into cantonments at Kemp's and the Queen's Rangers at Newtown, with instructions to hold themselves ready to move at the shortest notice. The Rangers had now added to them Captain Diemar's troop of Hussars, then at New York, and which were placed under the command of Captain Cooke.

An active campaign was now in contemplation and General Phillips gave his final orders preparatory to taking the field. On the 18th April the troops embarked at Portsmouth and fell down to Hampton Roads. The object of the expedition was the surprise of a body of the enemy at Williamsburgh and in this movement the Rangers were attached to Arnold's division which was to land below Williamsburg. The troops arrived off Burrell's ferry on the 19th. There the enemy had thrown up entrenchments, which appeared to be fully manned. As soon as Simcoe landed the enemy fled and with 40 cavalry he immediately proceeded to Yorktown, while the infantry of the Rangers marched with the army to Williamsburg. Next morning Simcoe galloped into Yorktown with his Hussars, surprised and secured a few of the artillerymen, drove the others off, and burnt the barracks. At Williamsburg the army had met with no resistance, the only skirmish being one that Quartermaster McGill, of the Queen's Rangers, and his Hussars had with a Rebel patrol, which he defeated and dispersed.

The army proceeded up the James River for the purpose of destroying the enemy's stores at Petersburg, the advance guard being formed of the Queen's Rangers, Yagers and Althouse's rifle company. On the 24th April the troops landed and passed the night at City Point and next day they marched towards Petersburg. When within two miles of that place the army halted until the troops in the rear closed up. The enemy were seen at a distance, but upon being approached gave one volley and fled. A sergeant with the party of Yagers got upon their flank and fired upon them with great effect as they retreated. The artillery were brought up and fired upon the enemy, who were drawn up a quarter of a mile away. Simcoe and his Rangers passed through the wood, to gain the enemy's flank, while Col. Abercrombie advanced in front against the enemy, who fled so rapidly that the Rangers could not get an opportunity of closing with them. The Americans, who were commanded by Baron Steuben, finally got across the Appamotox River, destroying the bridge behind them, with the loss of one hundred killed and wounded. The British loss was one man killed and ten wounded. Steuben and his forces retired to Chesterfield Court House, ten miles distant.

Next day the bridge was repaired and the Rangers crossed the river. Gen. Phillips, with one division of the army, went to Chesterfield Court House, while the Rangers, the 80th and 76th regiments went to Osbourne's where the enemy had some shipping. The first notice they had of the approach of the British was the firing of their cannon. Arnold, who commanded, sent a flag of truce to the enemy, offering half the contents of their cargoes in case they did not destroy any part, but they answered that they were determined to defend their ships and would sink rather than surrender. An immediate attack was made and one of the ships which was fired upon by the Rangers with musketry, and one boat's crew that was trying to escape, surrendered to Lieut. Spencer. Lieut. Fitzpatrick of Capt. Kerr's Company and Volunteer Andrew Armstrong with 12 of the Rangers, took the boat and boarded the ship, of which he took possession. The Highland Company were then sent on board the captured frigate and Fitzpatrick immediately rowed to the most distant ship of the fleet. A scene of great confusion followed. The enemy had scuttled several of their ships; others, boarded by the intrepid Fitzpatrick, were on fire, and though cannon and musketry from the opposite shore kept up a smart fire upon him, he still rowed on. He put three men on board one ship and cut her cable, and he left Volunteer Armstrong with three men in another, while he himself attended the headmost, the guns of which he turned upon the enemy. One ship was blown up and set fire to, the frigate "Tempest," the ship first taken; the Highlanders with difficulty succeeded in extinguishing the flames. "To add to the horror," says Simcoe, "Volunteer Armstrong, finding the ship he was on board of in flames, beyond his power to master, had swam on shore to procure a boat to bring off the men he had with him;

and the only one in the possession of the troops was despatched for that purpose; he had just time to save his men when the vessel blew up." The whole of the enemy's fleet was either taken or destroyed. The vessels safely secured consisted of one ship of 20 guns, one brig of 16 guns, two smaller brigs and a sloop. The vessels destroyed consisted of one 20-gun ship and several smaller armed vessels. This is Simcoe's statement, but American historians put down the number of vessels destroyed at fifteen. They also say that two thousand hogsheads of tobacco were taken or destroyed, and that four hundred hogsheads were destroyed at Petersburg.

The troops remained in the same vicinity until the 29th when they marched towards Manchester, from which they had a view of Lafayette's army encamped on the heights of Richmond. At Bermuda Hundreds the Rangers collected a quantity of cattle for the army, and on the evening of May 2nd the whole army embarked, the captured ships being convoyed down the river by the Queen's Rangers.

On May 6th, when the British were a little below Burwell's ferry, they were met by a boat from Portsmouth, bearing a messenger with intelligence for General Phillips that Cornwallis was on his way north and wished to form a junction with him at Petersburg. The army immediately returned up James River and late at night on the 9th again entered Petersburg. So secret was their entrance that ten American officers, who were there to prepare boats for Lafayette, were captured. General Phillips who had been taken ill with bilious fever on this march was taken to the house of a Mrs. Balling, where he died four days afterwards. The day after the arrival of the British, Lafayette's army appeared on the other side of the river and cannonaded the British quarters, particularly the house where General Phillips lay dying. They had already been informed by a flag of truce of the condition of the British General, so that their conduct may fairly pass for a specimen of French and American chivalry during the war. Lafayette after this exploit, by which he succeeded in killing an old negro woman, a servant of Mrs. Balling, marched off to Osbourne's.

Simcoe and his Rangers marched with all speed to Nottaway River, twenty-seven miles from Petersburg. There, leaving his infantry, he pushed on with the Hussars, captured Col. Gee, a militia officer, and also a militia captain and 30 men. After communicating with Cornwallis and capturing two or three officers with dispatches, Simcoe returned to Petersburg, and Lord Cornwallis's whole army reached there on the 20th May. The army having marched to Bottom Bridge on the 28th, Simcoe patrolled to Newcastle, where he captured a number of American officers. Capt. Cooke's troop of Hussars at this time joined from New York. The Rangers continued on patrol duty for several days, capturing several parties of the enemy, and then were ordered to march against Baron Steuben, who was at the head of James River at the Point of Fork. As the Rangers—owing to the severity of this service, having been constantly in the field for six months—had scarcely more than 200 infantry and 100 cavalry fit for duty, 200 of the 71st Regiment were ordered to join them. The incessant marches of the Rangers and their distance from stores had so worn out their shoes that nearly fifty of the men were absolutely barefooted. Simcoe assembled them, told them they were wanted for active employment and said that those who chose to stay in the army might do so; but there was not a man who would remain behind the corps. The Rangers then marched against Steuben, Lt. Spencer with 20 Hussars forming the advance guard. They advanced with such celerity that they captured many prisoners and the enemy had no intimation of their approach. They learned that Baron Steuben's force amounted to 900 effective men, exclusive of militia. At Napier's ford on the third day's march, Lt. Spencer, accompanied by the Hussars, approached the house of a Col. Thompson and leaving his two men behind the wall, entered the garden, where the colonel and four militia were, and asked in a very familiar manner the road to the Baron's camp. The party did not like Spencer's looks, innocent as he seemed, and immediately bolted, leaving five good horses behind them. The Hussars next captured a patrol of Dragoons within two miles of the Baron's encampment, which was at the further side of Fluvanna. The Rangers captured 30 of Steuben's people, who had got over, and then encamped for the night, the men having marched nearly 40 miles and being greatly fatigued. Elaborate preparations were made to resist a night attack, which was expected, Steuben being the more than double in his strength, but the Baron apparently did not relish being in the vicinity of the Rangers, and at midnight marched off, leaving a vast quantity of arms and ammunition behind him, which fell into Simcoe's hands. The booty included a 13-inch mortar and 9 brass cannon, 2,500 stand of arms, a large quantity of gunpowder and shot, several casks of saltpetre, sulphur and brimstone, 60 hogsheads of rum and brandy, several chests of carpenter's tools, 400 entrenching tools, casks of flints, sail-cloth and wagons, and a great variety of small stores for the equipment of cavalry and infantry, besides a large quantity of provisions.

Simcoe, on the 9th June, was again detached with his cavalry and destroyed 150 barrels of gunpowder and a large quantity of tobacco at Seven Islands, capturing, also, a party of militia. The army, on the 13th removed to Richmond, the Rangers forming its rear guard. On the 24th, the army being at New Kent Court House, Simcoe marched towards the Chicahominy, destroying a large quantity of public property as he went. He encamped at Cooper's Mills on the night of the 25th, and, after sending out a man whom he knew to be a rebel to give false information to the enemy, marched at 2 o'clock in the morning with his whole force to Spencer's Ordinary. A large number of cattle were in that neighborhood, and Captain Branson, with his people, was sent to collect them. Capt. Shank, who commanded the cavalry, was feeding his horses at Lee's farm and Simcoe and Armstrong were with the infantry. At that moment, the trumpeter, Black Barney, who had been posted as a vidette, saw the enemy's cavalry approach and gave the alarm, galloping back to the troop by a circuitous route so as to deceive the enemy. Shank led his men to the charge with such fury that the enemy's cavalry were completely broken and their leader, Major Macpherson, dashed to the ground and stunned. The enemy's infantry then appeared and a lively battle took place which would require more space to describe properly than we can afford. The enemy were in great force, more than 1,200 strong (more than three times Simcoe's strength), but so admirable were his tactics and so steady his troops that he forced them to retire, which they did in much confusion. The enemy, who were commanded by Lafayette, lost heavily in killed and wounded and 32 of them were taken prisoners. The Rangers lost 10 killed and 23 wounded, and the Yagers one killed and three wounded. The principal loss fell upon the Hussars, of whom Cornet Jones was killed, and on the Grenadier and Light Companies. Lafayette, to make his defeat appear as satisfactory as possible, reported the British loss at 60 killed and 100 wounded; the muster rolls, however, speak for themselves and show the loss to have been as above stated. Simcoe considers that the battle at Spencer's Ordinary was the most creditable action in which the Rangers were ever engaged. He says:

"As the whole series of the service of light troops gives the greatest latitude for the exertion of individual talents and of individual courage, so did the present situation require the most perfect combination of them; every division, every officer, every soldier had his share in the merit of the action; mistake in the one might have brought on cowardice in the other, and a single panic-stricken soldier would probably have infected a platoon, and led to the utmost confusion and ruin. So that Lieut.-Col. Simcoe has ever considered this action "the climax of a campaign of five years, as the result of true discipline acquired in that space by unremitted diligence, toil and danger, as an honorable victory earned by veteran intrepidity."

Two hours after the battle was over, Cornwallis came up with the main army; and the Queen's Rangers, in public orders, received his handsome acknowledgments on their victory. On the 4th July the army marched to Jamestown for the purpose of proceeding to Portsmouth. What the Americans term the battle of Jamestown was fought on the 6th July; the Rangers were with the army but were not engaged. All the American fine writing about this alleged battle is simply bunkum. The truth of the matter is summed up by Simcoe in a couple of pregnant sentences. "M. de Lafayette," says he, "attacked Cornwallis's army, mistaking it for the rear guard only. The affair was almost confined to the 80th and 76th Regiments, under the command of Lieut.-Col. Dundas, whose good conduct and gallantry were conspicuously displayed on that occasion. M. de Lafayette was convinced of his error by being constantly repulsed and losing what cannon he had brought with him."

It would take too much space to narrate in detail the numerous services of the Queen's Rangers during the eventful three months which followed. Although not in any considerable battle, they were every day engaged in some important duty and their losses were heavy both from battle and from sickness. Simcoe himself fell ill, and Captain Shank was left in command of the cavalry, and Major Armstrong of the infantry.

Lord Cornwallis, either from his own bad generalship, or the want of support from Sir Harry Clinton, suffered himself to be cooped up at Yorktown with a French fleet in front of him and a combined French and American army of nearly thrice his strength behind him. There was no alternative for him but to surrender, the British fleet being unable to relieve him. Simcoe offered to take his Rangers, cross the Chesapeake, and make his escape into Maryland, where he felt no doubt of being able to save the greater part of his corps and carry them to New York, but Cornwallis would not permit the attempt to be made, saying that the whole army must share the same fate. The Rangers, therefore, were included in the surrender of Cornwallis, which took place on 10th October, 1781. The number of Rangers who surrendered is put down by American authorities at 320, which is probably nearly correct. A number of them who had deserted from the Americans, were sent to New York in the British sloop of war Bonetta, which was allowed to depart unexamined under the terms of capitulation. By the muster rolls of the 24th December, 1781, it appears that 282 of the rank and file of the Rangers were prisoners with the enemy, and that 224 of them were either not prisoners at all or were prisoners on parole. These figures do not include Captain Saunders's troop, which was in the south with General Leslie. Simcoe, who was very ill, went to New York in the Bonetta and thence to England. Captain Saunders, arriving from Charlestown, took command of that part of the corps which had come to New York

INFANTRY.—CAPTAIN MACKAY'S COMPANY.

Lieut.-Colonel—J. Graves Simcoe.
Major—Richard Armstrong.
Chaplain—John Agnew.
Adjutant—George Ormond.
Quarter-Master—Alexander Matheson.
Surgeon—Alexander Kellock.
Surgeon's Mate—James Macaulay.
Captain—John Mackay.
Ensign—John Ross.

Sergeants.

Donald MacDonald,	John MacDonald,	George Sutherland.

Corporals.

George Walker,	James Gun,	John Brady.

Drummers.

William MacKay, ——— Sampson.

Privates.

John Palmer,	Angus MacDonald,	Lauchlan MacKinnon,
John Craigie,	Hugh Mackinlay,	Charles Dixon,
Alex. Macklinnon,	Murdock MacLeod,	Alex. MacClure,
Patrick Cotter,	Alex. MacDonald,	Alex. Curry,
Alex. MacLean,	Thomas MacPhaddan,	Wm. Smyth,
Roger MacDugal,	John Reagan,	John MacGlachlan,
	Jacob Shifford.	

CAPTAIN STEPHENSON'S (LIGHT) COMPANY.

Captain—Francis Stephenson.
Lieutenant—Alex. Matheson.
Lieutenant—Geo. Pendrid.

Sergeants.

Wm. Whitley,	John Lydan,	Simon Merrill.

Corporals.

Michael Burns,	Andrew Warwick,	George Miller.

Drummer—John Williams.

Privates.

Carbray Burns,
William Crisholm,
Abner Sowers,
James Sharples,
Thomas Bane,
Richard Doyle,
Michael Cooney,
Thomas Lane,
William Flood,
John Low,
David Oliver,
John White,
William Bass,
Nathaniel Ayers,
Thos. Porter,
John Williams, Jr.,
Richard Jordan,
James Dawson,
John Hendricks,
Thomas Sherry,
James Dyer,
Adam Ryan,
Richard Hennasay,
James Sparks,
Jesse Creekmore.

CAPTAIN M'CREA'S COMPANY.

Captain—Robert McCrea.
Lieutenant—Charles Dunlop.
Ensign—Creighton McCrea.

Sergeants.

William Pike, William Burnett, Lot Patterson.

Corporals.

Benjamin Fowler, Benjamin Brundage.

Drummers.

Richard Lakeman, Barney Heartley.

Privates.

John Gready,
Hugh Hughes,
Digory Sparks,
Samuel Thomas,
Daniel Elmore,
Samuel Pearie,
Mayer Fletcher,
Stephen Sands,
Jacob Turner,
William Donaldson,
Michael McIntyre,
George Jackson,
William Turner,
Jonathan Hilton,
James Smith,
Joseph Roberts,
Conrad Harps,
Gabriel Barton,
George Hoar,
Michael McDonald,
Peter Whood,
Henry Davis,
William McGinn,
Nathaniel Weeks,
John Brown,
Thomas Robertson.

CAPTAIN MURRAY'S COMPANY.

Captain—James Murray.
Lieutenant—Caleb Howe.
Ensign—Edward Murray.

Sergeants.

Miles Sweeney, James McComb, Samuel Burnet.

Corporals.

John Keaton, William Cooley, John Gee.

Drummer—Charles Dudgion.

Privates.

John Mabrook, Hugh Donnaly, William Gerrard, Nathaniel Huston, Jeremiah Lawless, James McEwin, John Shevere, George Thomas, John Burns, William Dunnagan, Thomas Holden, William Kirk, Thomas Moor, Josiah Readon, John Gilby, Michael Rodgers, John Conner, Daniel Downs, Edward Hefferman, Isaac Laffely, Marmaduke Megion, Alexander Ross, James Grenner, John B. Miller, James Brown.

CAPTAIN KERR'S COMPANY.

Captain—James Kerr.
Lieutenant—Nathaniel Fitzpatrick.
Ensign—Creighton McCrea.

Sergeants.

Alex. Russel, Gilbert Garland, Alexander Bates.

Corporals.

Patrick Lidir, John Stokes.

Privates.

Terrance Martin, David Barry, John Wall, James Condey, Edward Aldred, James Cochran, Thomas Hawney, Henry Soley, Edward Marshal, Patrick Read, William Armstrong, John Brown, Jonathan Bilings, John Collins, Levi Porter, John Dowling, Francis Higgins, Thos. Williams, John Cuffy, Francis DeRana, Joseph Howard, Thomas Ryan, John Wells, Barnabas Kelly.

CAPTAIN AGNEW'S COMPANY.

Captain—Stair Agnew.
Lieutenant—Hugh Mackay.
Ensign—Swift Armstrong.

Sergeants.

Elnathan Appleby, Robert Gardner, Robert Kearne.

Corporals.

William Bready, John Lightfoot, Jeremiah Johnson.

Drummer—Andrew Ellis.

Privates.

James Britt,
George Thomas,
John Buckett,
Thomas Smith,
Daniel McConnel,
William Gill,
John Baswell,
George Wilson,
John Harris,
James Flint.
Thomas Armstrong,
James Reynolds,
John Tuttle,
Robert Lisack,
John Walters,
John Taylor,
Joshua Hunt,
Charles Cox,
John Wise,
John Summer,
John Miller,
George Grimes,
John Colgan,
John Reynolds,
Thomas Batty.

CAPTAIN MCGILL'S GRENADIER COMPANY.

Captain—John McGill.

Lieutenants.

George Ormond, Adam Allan.

Sergeants.

Thomas Dwyer, Robert Richey, John Nills.

Corporals.

William Shelley, George Churge.

Drums and Fifes.

John Helsey, Edward Smith.

Privates.

Patrick Allen, Timothy Coyne, James Cutter, Peter Lawlers, John Stilwell, Henry Hoar, James Brown, Michael Creely, George Duke, George Lidwell, John Wells, Thomas Collins, William Willis. William Clift, Andrew Curtis, James Kirkpatrick, William Scoby, James White, Patrick McCaffrey.

CAPTAIN SMITH'S COMPANY.

Captain—Samuel Smith.
Lieutenant—Richard Holland.
Ensign—Andrew Armstrong.

Sergeants.

Solomon Stevens, Jeremiah Hopkins, Peter Mewton.

Corporals.

John Dolittle, Abraham Brown.

Drummers.

Joseph Shelvey, Joe. Corolinia.

Privates.

William Peek, William Hippit, William Burns, John Haragen, William Simonds, John White, Lewis Smith, John Thomson, Jacob Burr, William Price, James Nash, John Kendrick, James Thorp, William Graham, Peter Dickey, John Murphy, Jacob Revere, Andrew Rainier, Patrick McAnelly, Henry Robinson, John Thomas, Peter Drost, John O'Brien, John Parsons, Jeremiah Conner, Alex. Johnson, Harmon Schuyler, Thomas Butler, Francis Sweetman.

CAPTAIN WHITLOCK'S COMPANY.

Captain—John Whitlock.
Lieutenant—William Atkinson.

Sergeants.

Daniel Morehouse, William Clinton, John King.

Corporals.

James Pennington, Jacob Smith.

Drummer—Daniel McKay.

Privates.

Thomas Ackley,	Charles Boyd,	Richard Castiloe,
Patrick Dennison,	John Dunn,	Edward Field,
William Hynds,	John Jackson,	Jacob Jones,
Peter Lavongue,	Charles McKinley,	John O'Bryan,
John Oran,	Stephen Prussia,	William Williams,
Henry Adam,	Thomas Young,	Mark Quiour,
James Verity,	Jacob Messeck,	James Hunt,
Edward Cosgrave,	William Hall,	George Smith,
Dennis Creed,	Richard Garret,	Lewis Florence.

CAPTAIN SHAW'S COMPANY.

Captain—Æneas Shaw.
Lieutenant—Andrew McCan.
Ensign—Charles Matheson.
Sergeant—Nathaniel Bloodworth.

Corporals.

James Brown, Aaron Olmstead, Josephus Broomhead.

Drummer—Black Prince.

Privates.

John Finch,	John Bard,	John Dayton,
Joseph Dayton,	Thomas Dean,	James Dunn,
Charles Hazelton,	James McFarland,	John Hamilton,
Daniel Macnahon,	William Kelly,	George Myers,
Hugh Morris,	George Murdoch,	Thomas O'Neal,
Adam McColgan,	William Parr,	Daniel O'Hara,
John Scriver,	Thomas Patterson,	George Smith,
John Smith,	George Tucker,	William Surral,
	Thomas Crawford.	

CAPTAIN WALLOP'S COMPANY.

Captain—Bennet Wallop.
Lieutenant—St. John Dunlop.
Ensign—Nathaniel Munday.

Sergeants.

John Goreham, Isaac Gilbert.

Corporal—James Shean.
Drummer—Chas. Moarning.

Privates.

Daniel Lackerman, Andrew Haynes, Christopher Evear, Gehardus Cromwell, Stephen Budd, John Stump, James Bentley, Philip Blizard, Richard Williams, Thomas Bagnel, Philip King, John Miles, William Raymond, Stephen Fountain, Moses Walker, Christopher Jones, Willet Carman, Jacob Bond, William Mathew, Bryan Sweeney, John Richards.

CAVALRY.—HUSSAR TROOP: LATE WICKHAM'S.

Lieutenant—Allan McNab.
Cornet—B. M. Woolsey.
Quarter-Master—John McGill.

Sergeants.

Wm. McLaughlan, John Galloway, Benj. Kelly.

Corporals.

Mathew Carty, Joseph Parlow, John Barnett.

Trumpeter—Arthur French.

Privates.

Thomas Shannon, Michael Hagan, Henry Seymore, Robert Ferguson, Joseph Cole, Michael McGinnis, Isaac Horton, William Cornwall, Joseph Callaghan, William Ellison, Robert Lewis, John Smith, Michael Harttman, John McCarey, William Dillon, John McConnell, Samuel Lindsay, David Lindsay, Andrew Shields, Humphrey Cochran, David Mitchell, Charles Malloy, George Hobble, William Ensley, Daniel Daley, Edward Conner, John Costoloe, Jeremiah Owens, John Stephens, William Winslow, James Campbell, George Killan, Duncan Campbell, John Munroe, Samuel Hopper, Joshua Peck, Roger O'Bryan, Isaac Tuttle, Richard Airiss, John Stanton, Lawrence Hughes, Patrick Gantly.

CAPTAIN SHANK'S TROOP.

Captain—David Shank.
Lieutenant—George Spencer.
Quarter-Master—Hacabah Carhart.

Sergeants.

David Osburn,	William Tully,	Timothy Russiquie.

Corporals.

Richard Steers,	Philip Beasley,	Ebenezer Scrivener.

Trumpeter—Black Barney.

Privates.

Angus McIntire,	John Litton,	Israel Wessell,
Makepeace Colby,	Richard Williams,	James Mitchell,
Richard Benett,	Garrat Ruddle,	Frederick Miller,
Thomas Oakley,	David Nelson,	Jacob Delue,
Anthony Manwell,	James Johnson,	Patrick Connely,
William Brown,	William Purk,	Archibald McKinley,
Richard Cantwell,	Thomas Mesharall,	Owen Curley,
William Perry,	Thomas Thornton,	William Herbert,
Nathaniel Gladston,	Jesse Langford,	Thomas Whalley,
Robert Dukes,	Robert Paul,	John Lawrence,
James Townsend,	Andrew Briggs,	John Clark,
William Silwood,	James Stiles,	John Rickhow,
John Houston,	Peter Williams,	John Colstone.

To complete the list of the personnel, I give the names of the officers and soldiers of the three troops of cavalry which were in the South in the autumn of 1781 and which were not included in the surrender of Yorktown. This list was taken from a return dated the 2nd March, 1783.

CAPTAIN SAUNDERS' TROOP.

Captain—John Saunders.
Lieutenant—John Wilson.
Lieutenant—Thomas Merritt.
Quarter-Master—Richard Payne.

Sergeants.

John Brit,	James Hill,	Theobald Franks.

Corporals.

John Higgins, Sr., John Haney.

Trumpeter—John Porter.

Farrier—Jacob Iden.

Privates.

Samuel Arbuckle,	Jonathan Blair,	John Barry,
Richard Brown,	Humphrey Cockran,	Joseph Cole,
James Campbell,	William Cornwall,	Makepeace Coleby,
Robert Carson,	Jesse Creekmore,	John Doherty,
Jacob Delieu,	Matthew Gallant,	Isaac Horton,
Jacob Inglis,	Lewis Florence,	John Higgins, Jr.,
John Leighton,	David Lindsay,	William Mitchel,
John McConnel,	David Mitchel,	John Monsoe,
John Maize,	Anthony Manuel,	Frederick Pickart,
John Sparks,	Alexander Simpson,	Barney Slack,
Thomas Shannon,	William Surrels,	Henry Seamore,
John Barrett,	Samuel Bates,	John Costeloe,
Richard Steers,	John Stevens,	Thomas Whaley,
	John Newbury.	

CAPTAIN COOKE'S TROOP.

Captain—Thomas Ive Cooke.

Lieut. and Adjt.—William D. Lawler.

Cornet—Samuel Clayton.

Sergeants.

Morris Haycock, Daniel Keep, Edward Wright.

Corporals.

Richard Cantwell, William Whiting, Thomas French.

Trumpeter—George Johnson.

Privates.

Thomas Rumbold,	Benjamin Robinson,	William Payne,
John Lint,	William Sharp,	John Ketch,
Jacob Peele,	William Kemplin,	Henry Peters,
John Ormston,	James Carty,	John Jackson,
Patrick McNamara,	Thomas LeGrange,	John Fowler,
Lawrence Neele,	John Dalton,	Patrick Kirkin,
William Preston,	John Dexter,	William Davis,
Joseph Thomas,	George Stewart,	John Dunlap.

Lieutenants, 17; Cornets and Ensigns, 14.
Chaplain, 1; Quarter-Master Infantry, 1.
Quarter-Masters Cavalry, 5; Surgeon, 1.
Surgeon's mate, 1; Sergeants, 41.
Corporals, 28; Trumpeters and Drummers, 14.
Privates, 305; Women, 60; Children, 70.
Total, 575.

The Queen's Rangers did not leave New York for Nova Scotia, until more than five months had elapsed from the date of this memorandum. In the mean time their numbers had been reduced in various ways. Many of the officers had gone to England and some of the privates had deserted. The final order to embark for the St. John River, which was then in the Province of Nova Scotia, was as follows:—

New York, Sept. 12th, 1783.

Sir:—

You are to take command of the British and British American Troops mentioned in the Margin, and which are to proceed to the River St. John's in the Bay of Fundy in Nova Scotia. On your arrival there you will see that the stores intended for them are duly delivered, and you will take such steps as shall be necessary for the several corps proceeding immediately to the places allotted for their settlement, where they are to be disbanded on their arrival, provided it does not exceed the 20th October, on or before which day Capt. Prevost, Deputy Inspector of British American forces, has directions to disband them, for which purpose you will give him the necessary assistance wherever you may happen to be at the time, adhering strictly to the King's instructions published in the order of the 17th August last.

The disembarkation of the troops must not be delayed as the transports must return with all possible dispatch. Directions have been given to Mr. Colville, assistant agent of all small craft at the River St. John's, to afford every assistance in his power to the corps in getting to their places of destination, and the commanding officers of corps will make application to him for that purpose.

I am, etc.,
GUY CARLETON.

LIEUT.-COL. HEWLETT.

The names of corps placed in the margin of the preceding letter were as follows:—

The Queen's Rangers.

King's American Regiment.
Detachment of the Garrison Battalion.
New York Volunteers.
First DeLancey's Battalion.
Second DeLancey's Battalion.
Loyal American Regiment.
First Battalion New Jersey Volunteers.
Second Battalion New Jersey Volunteers.
Third Battalion New Jersey Volunteers.
Prince of Wales, American Regiment.
Pennsylvania Loyalists.
Maryland Loyalists.
American Legion.
Guides and Pioneers.
Detachment King's American Dragoons.
Detachment North Carolina Volunteers.

The fleet containing this large representation of the Loyalists who entered the service of the Crown, reached St. John on the 27th September with the exception of the transport ship "Martha," which was wrecked on a ledge of rocks between Cape Sable and the Seal Islands. The "Martha" had on board the Maryland Loyalists and part of the Second Battalion of DeLanceys. Of the 174 persons on the "Martha," 99 perished and 75 were saved by fishing boats and taken to St. John.

The Queen's Rangers and the other corps under the command of Lieut.-Col. Hewlett were disbanded at St. John on the 13th October. The men received grants of land in the county of York, in the parish of Queensbury, which was named after them and the officers went on half pay. A return made on the 25th September, 1784, by Thomas Knox, Deputy Commissioner of Musters, shows that the number of persons connected with the Queen's Rangers who were settled in the province of Nova Scotia at that date was 361, consisting of 210 men, 64 women, 64 children, and 23 servants. Although sadly reduced in numbers they formed the largest body of militant Loyalists that settled in Nova Scotia.

It was one of the grounds on which Sir Henry Clinton, the Commander-in-chief in America, recommended that the Queen's Rangers should be enrolled in the British Army that this step should be taken "in justice to his country, that in case of future war it might not be deprived of the services of such a number of excellent officers." It would indeed have been difficult to find in any regiment so admirable a body of gentlemen, as the officers of the Rangers, inured as they were to the hardships of war by so many successive campaigns and so intelligently trained to rely on each other in times of danger. Simcoe throughout his work has words of high praise for nearly every officer in his corps he happens to mention, but no words of censure for any of them. While there are some officers whose names necessarily came more prominently forward in his book, such for instance as the officers of the Hussars, the Grenadier, Light and Highland Companies, who are naturally more frequently named than the officers of the battalion companies, there is no reason to believe that there was a weak spot anywhere in the regiment, or that if there had been a weak spot it would have been suffered to exist long. Simcoe had so high an opinion of his officers that he considered them fit for any position, and he regarded it as an insult and a stigma upon them when Sir Guy Carleton, as he says, appointed "a very young officer, who had not seen any service," from another corps to a troop vacant in the Queen's Rangers. The officer referred to was Morris Robinson who, on the 24th April, 1783, was promoted from the Loyal American Regiment. His appointment was probably due to the influence of Oliver DeLancey, then Adjutant General of the British Army. It was from DeLancey's office that the insulting proposal emanated on the 31st March, 1783, that Lieut.-Col. Thompson, who was then completing a regiment, should be allowed to enlist men belonging to the Queen's Rangers, and Simcoe was actually asked to encourage his men to enlist in this new corps, which he peremptorily refused to do, characterizing the order as "unjust, humiliating and disgraceful." The matter came to nothing, as the peace was very near. The Lieut.-Col. Thompson referred to was the person afterwards known as Count Rumford.

Having said so much in regard to the character of the officers of the Queen's Rangers as a whole, I propose below to give such an account of them individually as can be collected at this late day, and invite our friends who may be descended from them to supply us with such additional particulars of their worthy ancestors as I have not been able to gather.

LIEUTENANT-COLONEL SIMCOE.

John Graves Simcoe, the commander of the Queen's Rangers from October, 1777, to the close of the war, was a native of England, his father being a captain of the Royal Navy, who died on board his ship, the "Pembroke," in the Gulf of St. Lawrence, while the fleet was on the way to the siege of Quebec in 1759. Simcoe was educated at Eton and Oxford, and was a hard student. At the age of nineteen he obtained an ensign's commission in the 35th Regiment and landed at Boston on the very day of the battle of Bunker's Hill. He acted for a time as adjutant of the regiment and then became, by purchase, a captain in the 40th Regiment. But he aspired to independent command, and wished above all things to become the commander of a partizan corps of Light infantry. His ambition was finally gratified by his appointment to the command of the Queen's Rangers with the rank of major in October, 1777. His services in the Rangers have been fully detailed in this paper. The severe work of campaigning greatly injured his health and he went to England after the surrender of Cornwallis. In 1790 he was elected a member of Parliament and took part in the debates on the Quebec Bill. He was appointed Lieutenant-Governor of Upper Canada and took an active part in the settlement of that province. He held the office for five years and in that time made Upper Canada so thoroughly British that the subsequent attempts of the Americans in 1812 to shake the allegiance of the people were wholly futile. In 1794 Simcoe was made a Major-General and in 1796 was appointed Commander-in-Chief in San Domingo which had been taken possession of by the British. He returned to England in 1797, and the following year was made a Lieutenant-General. He was appointed to an important command in connexion with the defence of England in 1801 when Napoleon was threatening invasion and in 1806 was sent to Portugal to arrange a scheme of defence for that country. He was, however, taken ill on the voyage, and was obliged to return immediately to England where he died a few hours after he landed. He was then only 54 years of age, and the appointment of the chief command of the British forces in India had just been conferred upon him. Of Simcoe and his regiment, Sir Henry Clinton wrote in May, 1780, to Lord George Germaine:—

"Lieut.-Col. Simcoe has been at the head of a battalion since October, 1777; and since that time has been the perpetual advance of the army. The history of the corps under his command is a series of gallant, skilful and successful enterprises against the enemy, without a single reverse. The Queen's Rangers have killed or taken twice their own numbers. Col. Simcoe himself has been twice wounded; and I do not scruple to assert, that his successes have been no less the fruit of the most extensive knowledge of his profession which study and the experience within his reach could give him, than of the most watchful attention and shining courage."

Yet this handsome compliment was written before his two last and most brilliant campaigns.

MAJORS.

James Wemyss became commander of the Queen's Rangers in 1777 and led them at the battles of Brandywine and Germantown. He resigned his command on the 15th November, 1777, and was succeeded by Simcoe. He afterwards commanded a body of cavalry which was attached to Tarleton's Legion, and was a very active and energetic officer. In November, 1780, he was severely wounded and taken prisoner in South Carolina and sent to Charleston on parole. He probably remained in the South after the war.

John Randolph Grymes was a native of Virginia, and one of the officers who, in 1776, joined Lord Dunmore. He belonged to an ancient and opulent family, and he was himself a man of honour and courage. While with Lord Dunmore, he commanded a troop of horse, and afterwards became Major in the Queen's Rangers. At the battle of Brandywine, by his decisive and bold exertions, he extricated the Rangers from a very disadvantageous situation, and both Simcoe and the corps greatly regretted his resignation, which took place on the 26th October, 1777. He went to England, and was elected ensign of a company of Loyalists, which was formed there for the purpose of resisting a threatened French invasion. In 1788 he was agent for prosecuting the claims of the adherents of the Crown in his native state. He finally returned to Virginia.

Arthur Ross was a lieutenant in the 35th regiment and was appointed captain commandant of the Rangers. In 1778 he became major of that corps, but in the latter part of that year embarked for the West Indies as brigade major of the expedition with General Grant and was killed at St. Christopher's. He was much regretted by Simcoe, who speaks in warm terms of his intrepidity and zeal for the service.

Richard Armstrong was a captain in the Queen's Rangers prior to the battle of Brandywine and commanded the Grenadier Company until the 25th October, 1778, when he was promoted to be major. He was a very able and efficient officer and saw a vast deal of service. All through his work, Simcoe speaks highly of his efficiency. After the war was ended he continued in command of the regiment in the absence of Simcoe, until it was disbanded on the St. John River on the 13th October, 1783. He settled in New Brunswick, having received a large grant of land at the mouth of the Nacawick. He became a magistrate and lieutenant-colonel of the York County Militia, and he finally rose to be a lieutenant-general in the British army. He died at Fredericton, to which place he had removed in 1817.

THE CHAPLAIN.

Rev. John Agnew belonged to an ancient and highly respectable family of Wigtonshire, Scotland, where he was born. He was rector of the Established Church of Suffolk, Virginia, but was obliged to leave owing to his Loyalist principles. He became chaplain of the Queen's Rangers, but in 1781 was with his son, Capt. Agnew, taken prisoner by the French and taken to France where he was confined in the Castle of St. Malo until the peace. He finally settled in New Brunswick and was a member of the House of Assembly for the County of Sunbury. He died near Fredericton in 1812, aged eighty-five.

THE CAPTAINS.

John Saunders was a Virginia gentleman of wealth and came from a good English family. He took the Loyalist side and joined Lord Dunmore with a troop of horse which he had raised himself. He afterwards became an officer of the Queen's Rangers and was a captain, first of infantry and afterwards of cavalry, in that distinguished corps. He was a great favourite of Simcoe and receives high praise in his book as a valuable officer. He was twice wounded. After the peace he went to England, became a member of the Middle Temple and commenced the practice of the law. In 1790 he succeeded Judge Putnam on the bench of the Supreme Court of New Brunswick and in 1822, on the death of Judge Bliss, became Chief Justice. He died at Fredericton in 1834, aged 80. Col. Saunders was a man of small size, but very active and courageous. His only son, Hon. John Simcoe Saunders, filled many important public positions and at the time of his decease was President of the Legislative Council of New Brunswick. Col. John Saunders, of the King's County Cavalry, was grandson of Chief Justice Saunders. A grand-daughter married the late Professor Campbell of the University of New Brunswick.

James Kerr was a native of Dumfriesshire. He removed with his family to New York State sometime before the Revolutionary troubles. He embraced the cause of the Government and raised a half company of the Queen's Rangers, receiving a commission as lieutenant in November, 1776. He was wounded in the battle of Brandywine and his captain, Robert Murden, was killed, so that he was promoted to captain on the 12th September, 1777. He fought all through the war and was one of the corps that was surrendered at Yorktown. After this he returned to Scotland, but afterwards settled in Nova Scotia, first for a time at Cornwallis and afterwards in Parrsboro. The following notice of his death is taken from the "Royal Gazette" of June 23rd, 1830:—

"At Amherst, N.S., on Sunday the 6th inst. (June, 1830), James Kerr, Esq., in the 76th year of his age. Colonel Kerr was a native of Dumfriesshire, and served as a captain in the Queen's Rangers on the Continent of America during the revolutionary war, during which he was distinguished by repeated acts of bravery and by his friendship and confidence of the highest officers in that service. He subsequently settled in King's County, Nova Scotia, where he was appointed a Colonel of Militia, and where his memory will long be cherished with the greatest respect. He lost two sons in the Army and Navy, and has left a wife and eleven children to mourn the loss of an affectionate parent."

Colonel Kerr and his wife Eliza Brown, had sixteen children, eight sons and eight daughters, who arrived at maturity. One of his sons, Thomas, was an ensign in the Royal Newfoundland Regiment and was mortally wounded at the battle of Frenchtown in the war of 1812. Another son, James, died in the navy on board the Royal William, about the time when he was passed as lieutenant. Another son, John, became an eminent and wealthy merchant of St. John, N.B. Joseph was an extensive mill owner and merchant in Wallace, N.S., and David Shank was a leading member of the Bar of New Brunswick. Five of his sons and all of his daughters married and left numerous descendants.

John McGill was a native of Scotland and was a lieutenant in Armstrong's company at the battle of Brandywine. He was promoted to be captain in October, 1777, and on Armstrong's promotion to be major, in October, 1778, became captain of the Grenadier company, which he gallantly led during the remainder of the war. He went to St. John at the peace, and was a grantee of that city and also of Parrsboro, but afterwards removed to Upper Canada where he became a person of note. He died at Toronto in 1834, aged 83. He was appointed Commissary of Stores under Simcoe in 1791. At the time of his death he was a member of the Legislative Council of Upper Canada.

Stair Agnew, son of the Rev. John Agnew, was born in Virginia. He was lieutenant in the Queen's Rangers at the battle of Brandywine and was then promoted to be captain, but was so severely wounded that he was unfit for active duty during the remainder of the war. Lieut. Wickham commanded his company in his absence, and afterwards Lieut. Hugh MacKay. In the autumn of 1780, when somewhat recovered, he went with General Leslie to Virginia. He followed the movements of General Leslie in South Carolina, and General Arnold having taken Portsmouth, Capt. Agnew and his father were going by sea to that place, when they were captured by a French frigate and taken to France. They were confined in the castle of St. Malo until the peace. Capt. Agnew settled in York County, near Fredericton, and was a member of the New Brunswick House of Assembly for thirty years. He was also a judge of the Inferior Court of Common Pleas for York. He died in December, 1821, at the age of 63. Some of his descendants are still living in New Brunswick.

David Shank went to England at the peace. In 1791 he went to Upper Canada as major in command of a new corps named the Queen's Rangers which was enlisted in England for the protection of that province of which Lieut.-Col. Simcoe was then governor. In 1812 he was a major-general and in command of the Canadian Fencible Infantry. Before his death he had attained the rank of lieutenant-general.

James Murray drew a lot in Parrsboro, Nova Scotia, close to the lot of his old companion-in-arms, Capt. Kerr, but he either did not settle on it or did not remain there long.

Robert McCrea was an American and fought at Brandywine as captain, but was taken prisoner on the 24th October, 1777. He soon resumed duty with his regiment and fought gallantly through the war. He probably settled in Nova Scotia at the peace although our information in regard to this officer is incomplete.

James Dunlop was an Irishman, and was a captain at Brandywine. He seems to have gone south with General Leslie and was killed on the 25th March, 1781.

Hon. Bennett Wallop, an Englishman, succeeded Captain Dunlop in the command of his company in March, 1781. He became Brigade Major of Provincial Troops in 1782. There were persons of this name residing in St. John after the war, but whether connected with this Captain Wallop or not we do not know. In 1813 B. W. P. Wallop, probably a son, was a captain in the Nova Scotia Regiment of Fencible Infantry.

Æneas Shaw went to New Brunswick in 1783 and became Major of York County Militia. He afterwards settled in Upper Canada. In the winter of 1791-92, he performed the remarkable feat of marching a detachment of a new corps, also called the Queen's Rangers, from New Brunswick to Montreal on snowshoes. At the beginning of the war of 1812, he proffered his services to Major General Brock in any capacity that he might be found useful. He was consequently appointed to command the first division of Militia, with the rank of colonel, and afterwards served as Adjutant-General of Militia. The hard work and fatigue proved too much for the general at his age, and caused his death in 1815. All of his sons served in the army. The eldest, Alexander, was a captain in the 25th and 69th Regiments, and was present at Alexandria, Maida, Calabria, Naples, Corunna, Walchern, Flushing and Waterloo. Charles was a lieutenant in the 52nd, John a captain in the 49th and Æneas a lieutenant in the Glengarry Fencibles. Richard and George were captains in the militia.

Thomas Ive Cooke returned to England, his native country. In 1785 he was seeking to obtain a grant of land in New Brunswick, but it was refused on the ground that he was not a resident of the province. He probably remained in England.

Morris Robinson who was appointed to the Queen's Rangers Hussars in April 1783, received his commission in direct defiance of an arrangement which had been made, that all appointments should go in the corps. Morris Robinson was an outsider who had nothing to do with the Queen's Rangers and never served with them. His appointment was due to the favour of Sir Guy Carleton who, for some reason or other, was unfriendly to the Queen's Rangers. Morris Robinson came to New Brunswick after the peace.

John Whitlock settled in New Brunswick in Queen's County and in 1791 was lieutenant-colonel of the militia of Queen's and a justice of the peace.

Alexander Wickham commanded a troop of Hussars. He was attached to the Queen's Rangers as early as November, 1776, when he was made a lieutenant. He was promoted to be captain in November, 1778, and retired from the service June, 1781. He does not appear to have come to Canada.

William Sutherland who was in command of the German Hussars is stated in a return of 2nd March, 1783, to have not joined his company since his appointment. We have no further information in regard to this officer. As the war was over at that time he apparently did not take any part in the services of the Queen's Rangers.

John Mackay, a native of Scotland, was captain of the Highland Company of the Queen's Rangers, and fought through the whole war. He distinguished himself greatly, and received great praise from Simcoe for his conduct and courage. At the peace he went to New Brunswick and settled in York County, where he died in 1822. His wife was a sister of Captain Saunders.

Capt. Francis Stevenson went to England at the peace, but settled in Upper Canada in the Niagara district, where he was living in 1807, aged 56.

LIEUTENANTS.

Allan McNab was attached to the Light Dragoons of the Queen's Rangers and settled in Upper Canada after the war. He was the father of the more celebrated statesman Sir Allan McNab.

Hugh Mackay was gazetted an ensign in the Queen's Rangers, May 21st, 1778, and was promoted lieutenant in 1779. He came to New Brunswick in 1783 and settled at St. George, where he soon became a leading man in the affairs of Charlotte County. In 1792 he was elected a member of the House of Assembly, and continued a representative for more than thirty years. He was gazetted Colonel of Militia, November 1st, 1793, and retained the position many years. He was the only "full colonel" in the province. He engaged quite extensively in milling and lumbering. He was for a long time senior Justice of the Court of Common Pleas for the County of Charlotte. He died in 1843 at the great age of 97 years.

Adam Allan settled in New Brunswick in 1783, in the County of York. He became a lieutenant in the King's New Brunswick Regiment which was raised in 1793 and was disbanded in 1802. Lieut. Allan died in 1823.

CORNETS.

William Jarvis went to England at the peace and afterwards went to Upper Canada in 1791, when Simcoe was made Governor. He received the appointment of Secretary of Upper Canada which he held for 25 years. His oldest son, Colonel Samuel Peters Jarvis, was attached to the 41st Regiment during the war of 1812 and was present, as lieutenant, at Queenston Heights, Stoney Creek and Lundy's Lane.

Thomas Merritt served first in Emmerick's Dragoons, but was appointed to the Queen's Rangers Cavalry in 1780. He was a native of Westchester, New York, and was educated at Harvard. At the peace he went to New Brunswick, but eventually took up his residence in the Niagara Peninsula where he died on the 12th May, 1842. During the war of 1812, he raised the Niagara Dragoons and commanded them at the battle of Queenston Heights. His son, William Hamilton Merritt, who was a captain in his father's corps and was taken prisoner at Lundy's Lane, was well known as a public man and was the projector of the Welland Canal.

B. M. Woolsey settled in New Brunswick and was in 1792 Major of the King's County Militia.

QUARTER-MASTERS.

Quarter-Master Edward Wright was residing in Upper Canada in 1807 on half pay, aged 64 years.

Daniel Morehouse settled in Queensbury and died there on the 20th January, 1835, in the 77th year of his age.

William McLaughlan died in the Parish of Northampton, Carleton County, New Brunswick, on August 19th, 1827, in the 75th year of his age.

ROYAL SOCIETY OF CANADA

TRANSACTIONS

SECTION III.

MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

PAPERS FOR 1908

I.—*Note on an Improvement in the Method of Determining of Visibility Curves.*

By C. S. WRIGHT, B.A.,

1851 Exhibition Scholar, 1908, University of Toronto.

(Communicated by Prof. J. C. McLennan, and read May 26, 1908.)

One of the chief objects of Michelson in designing the interferometer which bears his name, was to analyse the source of light, and determine, if possible, the distribution of intensity in that source. This is arrived at by estimating the visibility of the fringes formed by the interference of the two beams of light in the interferometer for various differences in path of the two rays.

The method of observation consists simply in moving back one interferometer plate until the difference in path $\triangle$ between the two interfering beams is such as to give a visibility of one-half the maximum—the latter being obtained for $\triangle = C$. The half-width of the spectral line used as the source of illumination is then given by $\frac{0.22\ \lambda^2}{\triangle}$.

While determining the visibility curves for the spectral lines of some of the elements it occurred to the writer that if some standard could be used giving fringes of a known visibility, and in the same position as those due to the interferometer, the method of determining the half-width would reduce to a very simple photometric determination.

As the standard a mica plate was found very convenient. This plate was placed in the path of the light entering the interferometer and inclined at such an angle as to give straight line fringes perpendicular to those given by the interferometer and in approximately the same focal plane. A simple adjustment of the angle of the mica plate was all that was necessary to alter the width of the mica fringes or the angle of intersection of the two sets so as to make them similar in every respect.

It was found in practice that when the fringes formed a system of squares the points of equal intensity could be determined with considerable exactitude.

For absolute measurement of the half-width of the spectral line this standard would require to give fringes of a visibility one-half the maximum. But if comparative measurements only were required, such as the change in width of the spectral line brought about by different conditions of temperature, pressure, etc., operating on the same this method would find a very practical application. It should therefore be of special service in following such modifications in the constitution of radiating atoms as are brought into evidence by changes in their spectral lines.

II.—*The Secondary γ Rays Due to the γ Rays of Radium C.*

By A. S. EVE, D.Sc., Associate Professor of Mathematics and Lecturer in Radioactivity, McGill University, Montreal.

(Communicated by Dr. H. T. Barnes, and read May 26, 1908.)

The Röntgen rays and the γ rays from radioactive substances have so many properties in common that they are generally believed to be fundamentally of the same nature. But the secondary radiations caused by X rays and by γ rays, respectively, appear at first to be widely different. Whilst the γ rays give rise to secondary radiations following the order of the densities of the radiators, the X rays cause secondary radiations strongly diverging from that order. Thus Townsend found actually more secondary radiation from solid paraffin than from lead. The values he obtained were:—

TABLE I.

X Rays, Secondary Radiation.

Radiator.	Rays through Air.	Rays through .25 mm. of Aluminium.
Air	.2	1
Aluminium	6.0	3.5
Glass	7.5	3.0
Lead	24	6.0
Solid Paraffin	30	15.5
Brass	66	2.5
Zinc	68	3.0
Copper	70	2.5

Proc. Camb., Phil. Soc. X, p. 217, 1899.

Let us compare the secondary radiations from the γ rays of radium bromide enclosed in lead.

TABLE II.

γ Rays, Secondary Radiations.

Radiators.	
Lead	100
Copper	61
Brass	59
Aluminium	30
Glass	35
Solid Paraffin	20

Phil. Mag., Dec. 1904.

In this case the order of secondary radiation is that of density.

The remarkable dissimilarity in the two cases is at first sight perplexing, and the object of the present paper is to explain to some extent the cause of the apparent differences.

In the first place it must be pointed out that a comparison of the two tables above given is an unfair one, because the first table really shows secondary radiation of the X ray type, for the kathode rays were mainly absorbed by air before they reached the testing apparatus. But the second table gives the kathode secondary radiation due to γ rays, for in this case the kathode rays produce a much greater effect in the electroscope than the secondary rays of the γ type.

A few experiments recently made may be worth recording. The X rays from a very hard tube were employed, such as were used in some previous experiments to compare the ionizations of various gases by γ and X rays.[1] Such hard penetrating rays were then found to ionize gases almost in the same manner as γ rays. In the present case the X rays struck plates of the substances named in Table III., and the incident secondary rays were measured by the electroscope, described later, used throughout these experiments. The kathode secondary rays were absorbed by the air, between the secondary radiator and the electroscope. The incident secondary radiations from the same plates were also measured, due to 14 mgs. of pure radium bromide placed inside a hollow nickel steel[2] cylinder, 2.2 cms. thick, having stopped ends. The kathode secondary rays were in this case screened from the electroscope by aluminium 1.63 mms. thick, placed just in front of the very thin face of the electroscope. The results given show that when the kathode rays are in each case removed the orders are *not* those of atomic weights. Very thick radiators are needed to get the full value of the γ rays from the lighter substances.

TABLE III.

Secondary rays from X and γ rays.
Kathode rays removed by absorption.

Secondary Radiator.	Thickness in cms.	X	γ
Books (edges)	11	280	2.5
Paraffin	4	230	2.0
Paraffin	6.5	...	2.7
Brick	6	170	3.0
Brick	14	...	3.6
Slate	6	160	3.0
Wood	11	125	1.7
Cement	21	103	3.8
Lead	5	61	1.0
Iron	5	58	3.3

[1] Phil. Mag., Nov. 1904.
[2] 5% Nickel.

Lead is a poor secondary radiator in both cases, but iron radiates well with the γ rays and badly with the X rays. It is unnecessary to examine these results more closely, because the secondary X rays have been carefully investigated by Barkla and others, while the secondary γ rays will be discussed in this paper.

As regards the secondary kathode rays from X rays, β rays, and γ rays, it has been shown by J. J. Thomson, McClelland, and Kleeman, respectively, that the radiation intensities follow the order of the atomic weights.

It will be seen later that the secondary γ rays from a thick block of iron may amount to 25 or 30 per cent of the total secondary kathode and γ rays from the same block. Moreover, the velocity of the secondary kathode rays due to γ rays is nearly equal to that of the secondary kathode rays due to β rays. The values of the so-called coefficients of absorption by a screen of aluminium 0.4 mm. thick, placed before the electroscope I find to be as follows:

Primary β	21 .5
Kathode secondary from lead, due to β and γ rays	24 .5
Kathode secondary from lead, due to γ rays only	31 .0

Hence, the velocities of the kathode secondary rays are a little less for γ than for β rays, and both these groups have less velocity than that of the β primary rays.

On the other hand, the coefficient of absorption by lead of the secondary γ rays due to γ primary, reflected from lead or iron, is about 4, nearly equal to the coefficient of absorption found by Godlewski for the primary rays of actinium, greater than the coefficient of absorption of the γ rays from uranium, and yet greater than that of radium. (Phil. Mag., April, 1906) It may, therefore, be concluded that γ rays give rise to secondary rays of the γ type, and not merely to very penetrating kathode rays. This will be seen more clearly from the diagrams given later.

The fact that the kathode secondary rays due to β or to γ rays have velocities comparable with that of the primary β rays is a very important one. The secondary kathode rays due to X rays have much less velocity. Bragg has pointed out that it is probably more than a coincidence that the secondary kathode rays, due to X rays have velocities of the same order as those of the kathode rays in the X ray tube, while the secondary kathode rays due to γ rays approximate in velocity to that of the primary β rays. These relations, if more than accidental, do not necessarily furnish an argument in favour of the view recently advocated with so much skill by Professor Bragg as to the material character of X and γ rays. For it may be that ether pulses striking a solid body cause the ejection only of some of those corpuscles which have velocities in their orbit or free path approximating to those of the corpuscles which first gave rise to the ether pulses.

One fundamental difficulty arises in writing on secondary radiation. The investigations of H. W. Schmidt,[1] and of Crowther,[2] indicate that secondary kathode radiation consists mainly, or entirely, of scattered primary rays, for they have proved that β particles, in passing through matter, lose little or no velocity and are diffusely scattered. On the other hand, Kleeman and others in treating of secondary rays due to primary γ rays writes of " electrons ejected by γ rays." Now the electrons which constitute the secondary kathode radiation, due to β and to γ rays respectively, have nearly equal velocities, and it seems unreasonable to suppose that in the one case we have scattered primary and in the other case electrons ejected from the atoms of the secondary radiator. It must be admitted that Bragg's theory of the close similarity of β and γ rays—the difference being the important one of charge— removes all these difficulties as far as secondary radiation is concerned. Nor does this theory seem more complicated than the conception of an ether pulse with discreet centres of energy on the surface of the spherical shell of the ether pulse. But apparently other difficulties arise. Again, H. Starke, in Le Radium for February, 1908, finds that β rays striking a solid do not give rise to secondary γ rays, and my observations tend in that direction also, for the secondary γ rays appear to be caused solely by the primary γ rays. Nevertheless, it is remarkable that the impact of kathode rays should give rise to X rays, and that the impact of β rays should not give rise to γ rays. However, we have no knowledge of the effect of concentration of the impact of β rays. As matters stand at present the most notable difference between X and γ rays is that the former arise when the kathode rays are stopped or absorbed, and the latter where the β rays originate.

The following experiments show clearly that primary γ rays give rise to secondary γ rays, that the intensity depends upon the material surrounding the radium employed, upon the nature of the secondary radiator, upon the thickness and material of the screens placed in front of the electroscope, and that the intensity of the secondary γ radiation does not follow the order of the atomic weight, or of the density, of the secondary radiator. In all these particulars there is a similarity between secondary X and secondary γ rays, and this ac-

[1] Phys. Zeit., June 1907.

[2] Le Radium, March 1908.

counts to some extent for the apparent differences noted at the beginning of this paper.

In a previous paper (Phil. Mag., June, 1908) I have noted that books, carbon, cement or bricks are able to give rise to more penetrating rays than lead, when these substances are exposed to the β and γ rays of radium, provided the electroscope is screened from the secondary radiator by a sufficient thickness of aluminium, or by a thick book. It was shown too that these secondary rays came from a depth of at least 4 cms. in the case of carbon, 6 cms. for wood, 3.5 cms. for slate. Moreover, the primary rays had first to penetrate those thicknesses. It is these deep seated penetrating rays that are under consideration. The secondary radiators and screens were all tested, when the radium was not present, and they were found free from any radioactive effects under the conditions of the experiments.

Fourteen milligrams of pure radium bromide were placed in a test tube within cylinders of (1) lead, 1 cm. thick, or (2) nickel steel, 2.2 cms. thick. The radiators were 5 cms. or more thick and measured 22.5 x 22.5 square centimetres. The necessarily large size and thickness of the radiators made it difficult to procure suitable substances for the experiments, and I have worked mainly with lead, iron, brick and slate. The screens placed in front of the electroscope were either of (1) aluminium or (2) lead. The electroscope, 10 x 10 x 16 cms., was made of zinc and mounted on a platform. One face of the electroscope was removed and replaced with two very thin aluminium sheets, each .00031 cm. thick. The electroscope and screens were guarded from the radium and the cylinder containing it by blocks of lead 10 cms. thick. The effect with no radiator present, except air, was deduced from the effect with the stated radiator present; and this was done for all the screens used. The secondary rays from air are easily absorbed, so that the results given are quite reliable for secondary rays of the γ type.

The electroscope here, as in most cases, is affected not merely by the secondary γ rays which traverse it, but also by all the secondary rays caused by them from the sides of the electroscope and from the inner side of the screens. There seems no way of evading this complexity, and if all the conditions are identical, except the radiating plates employed, the results obtained do indicate the nature and magnitude of the secondary rays of the γ type passing from the radiator and entering the electroscope.

The measurements obtained are given in the following four tables and in the corresponding four diagrams. The radium bromide was in the same position, as nearly as possible, for all four series. The rays under investigation are all "incident," not "emergent."

TABLE IV. See Figure 1.

Radium in lead 1 cm. thick.
Aluminium screens. Secondary radiators stated.

Thickness of screens in mms.	Lead, 5 cms.	Iron, 5 cms.	Brick 6 cms.
0	12.2	8.4	5.9
0.41	4.26	3.81	2.25
0.82	1.74	2.56	1.77
1.75	.57	1.92	1.45
3.40	.22	1 78	1 43
7.10	.16	1 64	1.22

TABLE V. See Figure 2.

Radium in steel 2.2 cms. thick.
Aluminium screens.

Thickness of screens in mms.	Lead, 5 cms.	Iron, 5 cms.	Brick, 6 cms.
0	17.8	10.4	8.00
0.41	4.4	4.70	4 09
0.82	2.21	3.56	3 91
1.75	1.02	3.41	3.80
3.40	.59	3.28	3 35
7.10	.56	3.04	3 08

TABLE VI. See Figure 3.

Radium in lead.
Lead screens.

Thickness in mms.	Lead, 5 cms.	Iron, 5 cms.	Brick, 6 cms.
0	12.7	8.4	5.6
0.15	1.76	3.63	2.61
0.75	.69	2.25	1.45
2.00	.31	1.08	.78
4.00	.19	.53	.38

TABLE VII. See Figure 4.

Radium in steel 2.2 cms. thickness.
Lead screens.

Thickness in mms.	Lead, 5 cms.	Iron, 5 cms.	Brick, 6 cms
0	19.2	9.5	7.5
0.15	1.7	5.0	4.9
0.30	1.1	4.4	3.7
0.75	.80	3.1	2.52
2.00	.34	1.42	1.06
4.00	.30	.57	.43

From these results and diagrams the following deductions may be made:—

1. It is noteworthy that the radium in 2.2 cms. of nickel steel gives an effect about 1.5 times as great as when the radium is in 1 cm. of lead. From the relative densities we should expect 2.2 cms. of steel to be equivalent to 1.5 cms. of lead and, therefore, the radium in the steel cylinder should give, by the density law, two-thirds the effect of the radium in the lead. It actually gives one-and-a-half times as much. This remarkable result was confirmed by direct reading of the primary γ rays using different electroscopes. Thus the primary γ rays traverse steel much more readily than lead, but the rays passing through iron are subsequently absorbed more readily by lead than if the radium were in lead. The values for λ the coefficient of absorption by lead, between 2 and 4 mms. were as follows:—

Radium in lead (1 cm.)..................... = .47 }
Radium in steel (2.2 cms.)................. = 1.1 } primary γ rays.
Radium in steel (4 cms.)................... = .75 }

2. The secondary rays of the γ type from lead are feeble compared with those from iron or brick. This is true whether the radium is in iron or lead and whether the absorbing screens are of aluminium or lead.

3. It will be seen that 1 or 2 mm. of aluminium or lead absorb the kathode rays from the lead, iron or brick radiators acted upon by γ rays.

4. With radium in steel, and with aluminium screens, brick gave more secondary rays than iron. In the other three cases brick gave less than iron. However, 5 cms. of iron give almost maximum secon-

dary rays, whilst 6 cms. of brick do not give full value. Slate gives secondary kathode and γ rays, both somewhat less intense than brick gives.

5. When the radium was in a glass test tube, without steel or lead around it, the β and γ rays gave from a secondary radiator of lead a current measuring 250 scale divisions a minute in the electroscope, the γ rays gave 7.5 per cent of that amount. The latter could be divided into two parts, kathode and γ in type, The γ type was the following percentages of the total (kathode and γ), for lead radiator 6.2, for iron 25, for brick 28.

6. The values of the coefficients of absorption by a sheet of aluminium, 0.41 mm. thick, are as follows:—

Primary γ rays	21
Secondary kathode due to β and γ rays striking	
(a) lead	24
(b) iron	35
Secondary kathode due to γ rays striking	
(a) lead	31
(b) iron	34

Thus the β rays cause secondary kathode rays slower than the primary rays which cause them, and the γ rays cause secondary kathode rays yet slower. But all these rays have velocities of the same general order, and faster than the secondary kathode rays due to the X rays. This has already been proved by Dorn, Allen, Kleeman and others.

7. The values of the coefficients of absorption of the secondary γ rays, due to primary γ rays, were also determined for lead screens, changing the thickness from 2 to 4 mms.

		λ
(a) Radium in lead (1 cm)	Lead radiator	2.46
	Iron radiator	3.70
	Brick radiator	3.68
(b) Radium in steel (2.2 cms.)	Lead radiator	4.35
	Iron radiator	4.65
	Brick radiator	4.60

These may be compared with the coefficients of absorption of the primary γ rays passing through lead.[1]

Radium	0.57–0.45
Uranium	1.4
Actinium	4.7 –2.7

[1] Phil. Mag., April 1906.

Hence, the secondary γ rays due to the primary γ rays, using lead, iron or brick as secondary radiators, are absorbed to a degree approximating to that of the primary γ rays of actinium. It would be interesting to examine the secondary γ rays due to the primary γ rays of actinium. These would probably be absorbed even more readily and approximate more closely to the X rays. The effect would be difficult to obtain except with a considerable quantity of actinium.

The reasons for considering the penetrating secondary rays to be of the γ type, and not of the kathode, are as follows:—

1. There is a well marked bend in the absorption curves shown in the diagrams. This change of character is also well marked when the logarithms of the ordinates are plotted.

2. The primary rays penetrate several centimetres in substances such as brick or slate; some of the secondary rays emerge from that depth and will then penetrate several millimetres of lead.

3. The values of the coefficients of absorption by lead of these penetrating rays equal about 4, or nearly the value of the coefficient of absorption by lead of the primary λ rays of actinium.

4. If the secondary radiator, such as brick, be placed in a strong magnetic field, the ionization current in the electroscope, due to the penetrating secondary radiation from the brick, caused by α rays, is unaffected by the absence or presence or direction of the magnetic field.

The laws which govern the magnitudes of the secondary γ radiation are not yet clear.

If possible, further experiments will be made using different screens, radiators and cylinders enclosing the radium.

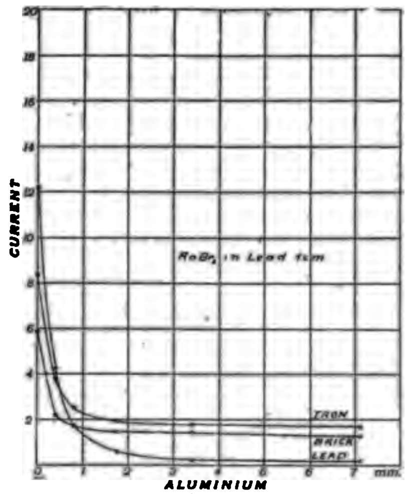


FIG. 1

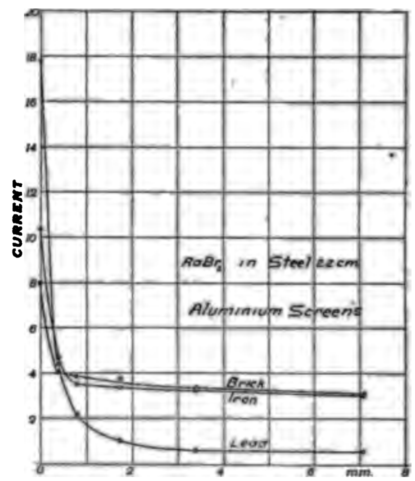


FIG. 2

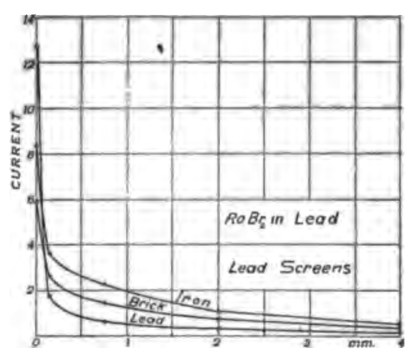


FIG. 3

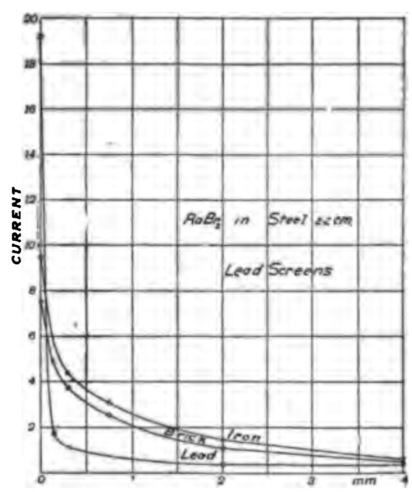


FIG. 4

III.—*On the Radioactivity of Potassium and other Alkali Metals.*

By PROFESSOR J. C. McLENNAN, and MR. W. T. KENNEDY, B.A.

(Read May 26, 1908.)

I.—INTRODUCTION.

In the course of some experiments made by them on the radioactivity of a series of salts which had hitherto been considered inactive, Messrs. Campbell and Wood, (Proc. Camb. Phil. Soc. Vol. XIV, Pt. i, p. 15, 1907), found that potassium salts exhibited a radioactivity greater than that of any other substance previously examined which did not contain any of the so-called radioactive elements.

In seeking for the source of this activity these experimenters found it impossible to separate out any active impurity from the salts examined, and they were led by the results of their investigation, which included measurements on the activities of a limited number of compounds of potassium, to conclude that the activity originated with the potassium itself and was an atomic property of that metal.

In a later paper, (Proc. Camb. Phil. Soc. Vol. XIV, Part ii, 1907), Campbell described some additional experiments dealing with the character of the radiation emitted by the potassium salts, and in concluding expressed the opinion that the radiation consisted of β rays possessing an average velocity less than that of the β rays of uranium.

In the following paper an account is given of some experiments which involved a minute examination of the radioactivity of a large number of potassium and other salts, and while the results of this examination confirm the discovery made by Campbell and Wood that potassium salts generally possess an exceptionally high activity, and emit a radiation possessing considerable penetrating power, they do not support the conclusion that the activity of these salts is a *normal* atomic property of potassium and that it is always directly proportional to the amount of that metal present in the salt.

In measuring and comparing the activities of the different salts these were each spread out in turn in uniform layers on a shallow tray which was placed on the bottom of the ionising chamber shewn in Fig. 1, which was 40 cm. long, 25 cm. wide, and 28 cms. deep. The saturation currents through the air in the chamber were measured with a sensitive quadrant electrometer and were taken as measures of the activities of the different salts.

II. Relation of Activity to Area of Salt Exposed.

Before proceeding with the examination of the different salts some preliminary measurements were made on the activity of potassium sulphate when different areas of a layer of this salt were exposed to the air in the chamber. A layer of the salt some 6 mm. in thickness was placed in the tray mentioned above, which was 35 cms. long and 18 cms. wide, and then covered with a thick plate of metal divided into sections 18 cm. long, and 5 cms. wide. These sections were, one after another, removed from the tray, so that larger and larger areas of the salt were left exposed to the air in the chamber. The saturation current corresponding to each area was measured, and the values which are given in Table I, and plotted in Fig. 2, shew that the saturation currents were directly proportional to the areas of the salt exposed. From this result it was evident that the substance which constituted the source of the radiation was uniformly distributed throughout the mass of the salt.

TABLE I.

Area of salt exposed in sq. cm.	Saturation current. (Arbitrary scale.)
5 x 18	17.87
10 x 18	35.5
15 x 18	53.8
20 x 18	71.5
25 x 18	89.75
30 x 18	106.
35 x 18	123.

III. Relation Between Thickness of Salt Layer and Activity.

Some additional measurements were made to ascertain the relation of the activity of a number of the salts to the thickness of the layer of salt exposed. In making these measurements the salts were ground to a fine powder and then sifted as uniformly as possible on the bottom of a shallow tray which had a surface area of 228 square cms. This tray was then placed in the ionising chamber and the saturation currents measured for each layer as before.

The results obtained with potassium sulphate are recorded in Table II, and a curve representing them is shewn in Fig. 3. From these it will be seen that the saturation currents steadily increased with the thickness of the layer of salt exposed until a thickness of 2.5 cm. was reached, when the current assumed a steady value and remained the same for greater thicknesses.

Additional observations were made with the halogen salts of potassium and still others with 2 samples of potassium cyanide, one with a sample of potassium hydroxide and one with a second specimen of chloride of potassium. The results of these measurements are given in Tables III and IV, and curves representing them in Figs. 4 and 5. From all the results recorded it will be seen that layers of the different salts between 2 and 3 mms. were amply sufficient to give the maximum saturation currents.

TABLE II.

ACTIVITY OF POTASSIUM SULPHATE.

Thickness of salt layer. (mm.)	Activity of salt. Saturation Current. (Arbitrary scale)
0.188	32
0.43	61
0.625	86
1.09	112
1.56	128
2.03	134
2.50	142
3.75	142
5.00	142

TABLE V.

TABLE OF ACTIVITIES.

No.	Salt.	Source of salt.	Percentage of metal in salt. =K	Activity of salt. Saturation current. Arbitrary scale. =A	$\frac{A}{K}$ 10^2	No.
1	KFL $(H_2O)_2$........	Mercks	41.5	207	499	1
2	KCL................	Mercks	52	152	292	2
3	KCL................	Kahlbaum	52	208	400	3
4	KCL................	Commercial	52	150	288	4
5	KBr................	Mallinckrodt	33	105	320	5
6	KI..................	Mallinckrodt	24	110	466	6
7	KOH................	Mercks	70	223	319	7
8	KOH................	Kahlbaum	70	160	228	8
9	KOH................	Mercks	70	200	285	9
10	KCN................	Eim. & Am.	60	41	68	10
11	KCN................	Kahlbaum	60	183	305	11
12	KCN................	Mercks	60	8	15	12
13	KCN................	Commercial	60	191	318	13
14	KCN................	Commercial	60	208	346	14
15	KCN................	Commercial	60	185	308	15
16	KNO_3..............	Commercial	38.6	85	218	16
17	KNO_2..............	Mercks	46	125	272	17
18	$KCLO_3$.............	Kahlbaum	32	128	400	18
19	$KMnO_4$.............	Commercial	25	80	320	19
20	$KMnO_4$.............	Commercial	25	78	312	20
21	$K_2C_2O_4$............	Commercial	47	126	268	21
22	$K_2C_2O_4$............	Commercial	47	93	198	22
23	$K_2SO_3(H_2O)_2$.......	Mercks	40.2	20	50	23
24	K_2SO_4.............	Kahlbaum	45	141	313	24
25	$K_2CO_3(H_2O)_2$......	Kahlbaum	45	141	313	25
26	$K_2C_2O_7$............	Commercial	36.4	128	387	26
27	K_3PO_4.............	Mercks	55	166	300	27

No.	Salt.	Source of salt.	Percentage of metal in salt. =K.	Activity of salt. Saturation current. Arbitrary scale. =A.	$\frac{A}{K}10^2$	No.
28	$K_4 Fe (CN)_6 (H_2O)_3$ ..	Kahlbaum	37	174	470	28
29	$K_6 Fe_2 C_{12} N_{12}$	Kahlbaum	36	163	459	29
30	K (metal)............	Mercks	100	195	195	30
31	Na metal............	Commercial	100	0	0	31
32	Na Cl (evapor.)......	Commercial	39	0	0	32
33	Na Cl (rock) (1)......	Commercial	39	66	169	33
	Na Cl (rock) (2)......	Commercial	39	0	0	
	Na Cl (rock) (3)......	Commercial	39	0	0	
34	$Na_2 CO_3$............	Commercial	43	0	0	34
35	$Li Cl (H_2O)_2$.........	Mercks	9	0	0	35
36	$Li_3 C_6 O_7$............	Mercks	23.3	0	0	36
37	$Li_2 CO_3$.............	Commercial	19	0	0	37
38	$Rb_2 Al_2 (SO_4)_4 (H_2O)_{24}$	Commercial	16.3	4	2.5	38
39	Cs Cl...............	Commercial	80	5	6	39
40	$NH_4 Cl$.............	Commercial	33	14	40	40
41	$NH_4 Br$.............	Commercial	18.4	0	0	41
42	$(NH_4)_2 CO_3$.........	Commercial	37.5	0	0	42
43	$NH_4 NO_3$...........	Kahlbaum	22	0	0	43

From this table it will be seen:—

First. That samples of a selected salt obtained from different sources exhibited widely differing degrees of activity. Two of the chlorides, as Nos. 3 and 4 shew, differed by more than 40 per cent. in their activities, and two of the hydroxides, Nos. 7 and 8, by nearly an equal amount. In the case of the cyanide of potassium the variation in activity was especially marked. As can be seen from Nos. 10 and 12 two samples of this salt exhibited activities which were approximately only 5 per cent and 20 per cent respectively of that shewn by a number of other specimens of the same composition.

In addition to the results recorded in Table V it may be stated that on one occasion a sample of potassium cyanide obtained from Kahlbaum was compared with one of potassium sulphate and one of potassium chloride obtained from Merck, and all three salts were found to possess to within one per cent the same activity. On another occasion a sample of potassium cyanide obtained from Kahlbaum was compared with a specimen of the same salt manufactured by Merck and was found to display an activity more than four times as intense as that of the latter.

In this connection the extremely low value found for the activity of the sample of potassium sulphite tested merits special emphasis. Potassium metal itself it will be seen exhibited a marked activity, but the value assigned to it, however, is not to be taken as comparable with the values recorded for the different salts of this metal, in as much as it was not possible to prepare layers of the metal for examination as regular and uniform as those of the salts.

Considering the results obtained with potassium salts as a whole it would appear that: the values found for $\frac{A}{X} \times 10^3$ shew such extremely wide variations, even after due allowance is made for the density and the state of division of the compounds, as to practically preclude the view that the activity of these salts is a *normal* atomic property of the potassium.

Second. That while one sample of sodium chloride in the form of rock salt shewed an activity comparable with that exhibited by a number of potassium salts, several other samples of rock salt were found to be quite inactive. Metallic sodium, too, and also a specimen of sodium carbonate, when examined, did not exhibit the slightest trace of radioactivity, and consequently it would appear that the activity observed in the single instance of sodium chloride mentioned was due to the presence in this salt of a trace of an active impurity. The low values obtained by Elster and Geitel in their measurements on the conductivity of air in a salt mine would also support this view.

Third. That with the exception of ammonium chloride which emitted a feeble activity, none of the lithium and ammonium salts shewed the slightest trace of radioactivity, and that a sample of rubidium alum exhibited an activity which was extremely small, and a specimen of caesium chloride one which was only just measurable.

V. Absorption Experiments.

In order to obtain an estimate of the penetrating power of the radiations emitted by the potassium salts quantities of the sulphate, the chloride, and the cyanide were spread in turn in uniform layers on a tray and placed beneath and close to the bottom of the ionising chamber AB, Fig. 1. In these measurements the bottom of the chamber consisted of a finely meshed gauze, which permitted the rays to pass into the chamber with as little absorption as possible. The tray containing the salt was then gradually lowered so as to increase the air column traversed by the rays before they entered the chamber and the ionisation currents were measured with the salt at different distances. The values of the currents obtained with three of the salts mentioned are shewn in Table 6. These values have been reduced for purposes of comparison to a common maximum intensity and the reduced readings are given in Table VII, curves representing them being shewn in Fig. 6. From these it will be seen, just as Campbell and Wood have pointed out, that the rays emitted by potassium salts possess considerable penetrating power. The saturation currents were not reduced to half value until the columns of air traversed amounted to between 12 and 15 cms., and even with the salts at a distance of 40 cm. from the chamber the ionisation currents were still approximately 15 per cent of their highest values.

TABLE VI.

Absorption Experiments.

Distance. (cm.)	Potassium.		
	Sulphate. Current. (Arbitrary scale.)	Chloride. Current. (Arbitrary scale.)	Cyanide. Current. (Arbitrary scale.)
2.1	178	235	240
4.7	158	200	205
9.1	118	166	178
16.6	81	94	125
24.4	59	65.4	96
31.9	39	44	64
39.1	28.5		33

TABLE VII.

Absorption Experiments—(Reduced Values).

Distance. (cm.)	Sulphate	Potassium Chloride	Cyanide
2.1	240	240	240
4.7	212	204	205
9.1	158	169	178
16.6	108	96	125
24.4	79.7	67	96
31.9	52	45	64
39.1	38		33

From the form of the curves it is evident that the radiations from the different potassium salts were not identical in their composition. The absorption curves for the sulphate and the chloride were very similar but that for the cyanide was markedly different and indicated by its shape that the rays from the salt besides being heterogeneous in character contained a predominating proportion of the more penetrating types.

It is of interest to note too that the absorption curves in Fig. 6 shew no irregularities in their initial portions such as one should have expected if the radiations had consisted, amongst others, of a type possessing the characteristics of the α radiations from the known radioactive elements.

These results it will be seen are in accordance with Campbell and Wood's observations and confirm the conclusions reached by them that the radioactivity exhibited by the potassium salts possesses the characteristics of either a β or an easily absorbed γ radiation rather than those of the α type of radiation.

In a second series of measurements on the absorption of the potassium rays the tray was filled with a quantity of potassium sulphate and then placed in the ionising chamber resting on the bottom. The salt was covered successively with an increasing number of sheets of tinfoil and the saturation current measured for each set of the absorbing sheets. The foil used was 0.0089 mm. in thickness. The values of the currents corresponding to the different thicknesses of tinfoil are given in Table VIII and the manner in which the values of the currents decreased is indicated by the curve in Fig. 7. In arriving at the numbers recorded in Table VIII corrections were made from a preliminary set of observations for the activity of the tinfoil sheets which were found to emit an extremely feeble though measurable radiation. From the values given in Table VIII it will be seen that it was necessary to cover the salt with foil representing a total thickness of .06 mm. before the radiation from the salt was reduced to one-half its original intensity.

TABLE VIII.

Thickness of tinfoil. (cms.)	Saturation current. (Arbitrary scale.)
0.00000	188
.00089	163
.00178	149
.00446	106
.01157	50
.01607	31
.02839	10

TABLE IX.

Absorption by Tinfoil.

Thickness of tinfoil. (cms.)	$\frac{I}{I_0}$	λ
0.00089	.867	160
.00178	.793	130
.00446	.563	124
.01157	.265	115
.01607	.165	112
.02839	.053	104

The mean values of the absorption constant λ for the different thicknesses were deduced from the formula $I = I_0 e^{-\lambda d}$, where I_0 was the ionisation current obtained with the unscreened salt and I the current when d centimetres was the thickness of the tinfoil traversed. The deduced values of λ are given in Table IX and as will be seen these shew a gradual decrease as the number of sheets of tinfoil used for a screen was increased. The values obtained by Rutherford[1] for the constant λ when studying the absorption of the β rays from Uranium with screens of tinfoil was 96, and later the value found by Crowther[2] for the same constant under similar circumstances was 69.3. A comparison of these values and those given in Table IX makes it evident that while the rays emitted by the potassium salts were very heterogeneous in character they did not contain any types possessing greater penetrating power than the β rays emitted by Uranium salts. This result too is in keeping with what Campbell and Wood found in their investigations on the absorption of these potassium rays.

VI. Activity of Potassium Salts and Secondary Radiations.

A set of measurements was made with the object of ascertaining whether the radiation emitted by the potassium salts, which from its characteristics evidently consisted of β rays, was due to some property inherent in the salts or whether it was due to a secondary radiation, of exceptionally high intensity, excited in the salt by the penetrating radiation which is known to exist at the surface of the earth.

A cylinder of lead some 60 cm. high and 25 cm. in diameter was prepared and the natural conductivity of the air in this cylinder determined. A layer of potassium sulphate was then placed in a tray on the bottom of the cylinder and when the conductivity of the air was again measured it was found to be approximately twice as high as it was before the salt was introduced.

From this it was evident that the radiation from the salt contributed to the conductivity practically as much as the combined action of the earth's penetrating radiation and that emitted by the walls of the cylinder. If then the activity of the salt consisted solely of a secondary radiation one should expect with a penetrating radiation gradually increasing in intensity to obtain proportionately greater effects when the salt was in the cylinder than when it was removed from it.

In order to realise these conditions a few milligrams of radium bromide sealed in a glass tube were enclosed in a heavy block of lead and this was placed at a number of different distances from the cylinder and the conductivity of the air in the chamber ascertained, with the radium in each position. The observations were made first with the salt in the cylinder and then repeated for each position of the radium after the salt had been removed.

---

[1] Rutherford "Radioactivity." Edition II., page 137.
[2] Phil. Mag., Oct. 1906, page 379.

TABLE X.

Position of radium bromide.	Saturation current. (Arbitrary scale.) Salt in cylinder.	Saturation current. (Arbitrary scale.) Salt not in cylinder.
First	6053	6272
Second	2568	2641
Third	907	945
Fourth	271	273
Fifth	209	227

The results of these measurements are given in Table X. From the numbers given in Table X it will be seen that although the ionisation currents were increased over thirtyfold, the ionisation and consequently the secondary radiation produced by the gamma rays from the radium was invariably less when the salt was in the cylinder than it was before the salt was introduced.

In as much as the ordinary or spontaneous ionisation in the cylinder was found to be increased approximately twofold by the introduction of the salt, it is clear, in the light of the numbers given above that this increase in the conductivity was due to a primary activity possessed by the salt, and not due to a secondary activity imparted to it by the influence of external radiations.

VII. Miscellaneous Experiments.

With a view to ascertaining whether the activity of potassium salts arose from the presence in the salts of traces of any of the active elements, radium, thorium, or actinium, an attempt was made to drive off any emanation which they might contain by raising the salts to moderate temperatures. Although a number of the salts was treated in this way, with none of them, however, was the slightest indication obtained of a loss of activity such as should accompany the expulsion of radioactive gases.

Although these experiments made it evident that the activity was not due to the presence of traces of the elements radium, thorium and actinium, or of their immediate products, in the salts, it was still possible that the activity might be due to the presence in minute quantities of uranium or of one of the active products of slow decay of radium. With the object of testing this surmise a sample of potassium sulphate which had been found to exhibit a comparatively high activity, was heated to a little over 1000°C, and maintained at that temperature for a considerable time.

After the salt had been subjected to this treatment it was again examined, but was found to possess exactly the same activity as before being heated.

Similar attempts were made to reduce the activities of samples of potassium chloride and potassium cyanide, but in none of these tests was any reduction of activity obtained as a result of the heating.

To test still further the possibility of driving off by volatilisation any active impurities which might be present, a quantity of active potassium sulphate, contained in a graphite crucible, which, on examination, shewed no sign of activity, was placed in a coke furnace, first melted and then heated as highly as possible for a time. During this heating the sulphate became partially converted into the sulphides of potassium. After cooling the mixture, which was ground to a fine powder and tested for radioactivity in the manner indicated above, was found to possess the same activity as before the treatment.

As the melting point of potassium sulphate is approximately 1060°C and in as much as the temperature of the salt during this experiment was raised very much beyond this point, it is clear that a temperature was reached considerably above the points of volatilisation of the radium products of slow decay, and it follows therefore from the absence of any loss of activity from the heating that none of these active products were present in the salt and that the source of its activity must be sought for elsewhere.

The only remaining known active product, whose presence in the salt could account for its activity appeared to be uranium X., and although it was not clear how such a product could become mixed with the salts of potassium, attempts were made to separate it out by recrystallisation, by precipitation with ammonium carbonate, and also by treating solutions of the salts with ether after the manner of Meyer and Schweidler.[1] By none of these processes, however, was it found possible to effect to a measurable degree the separation of any active product.

Attempts were also made with some of the salts to separate out by electrolysis active impurities which might be present but it was again found impossible to bring about any separation of the active constituents in this way.

---

[1] Meyer and Schweidler, Wein, Ber 113, July 1904.

VIII. Summary of Results.

1. It has been shewn that the activity of uniform layers of active potassium salts was directly proportional to the area of the salt exposed.

2. With uniform layers of a number of potassium salts the activity was found to increase with the thickness of the layer, and maximum activities were obtained with all the salts examined with layers of the salt from 2 to 3 mm. in thickness.

3. Such wide variations were found in the activities of different potassium salts, and of potassium salts of the same composition obtained from different sources, as to practically preclude the view that the activity was due to a *normal* atomic property of the potassium.

4. The rays from the potassium salts, which were found to be heterogeneous and to possess considerable penetrating power, exhibited characteristics similar to those of the β radiation emitted by uranium X. The penetrating power of the latter, however, is somewhat greater than that possessed by the potassium rays.

5. Experiments have been described which go to shew that the activity of potassium salts is not due to the excitation of a secondary radiation in the salts by the activity of penetrating rays coming from external sources.

6. By various tests it was found impossible to trace the activity of potassium salts to the existence in them of minute quantities of any of the known radioactive elements or their active products.

7. Of all the elements in the alkali group, potassium alone has been found to exhibit marked radioactivity. Both sodium and all of its salts were found to be quite inactive, and although a sample of rubidium alum exhibited an activity which was extremely small, and a specimen of caesium chloride one which was only just measurable, no evidence was adduced which would support exclusively the view that the activity observed was due to any physical property of the metallic constituents of these salts.

In conclusion we wish to express our very great indebtedness to Prof. Lang and to Prof. Lash Miller, as well as to other members of the staff in Chemistry, for their kindness in placing at our disposal a number of the specimens of the salts examined.

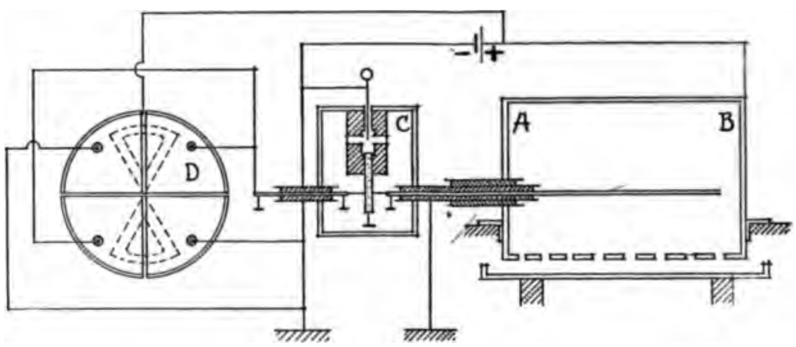


FIG. I

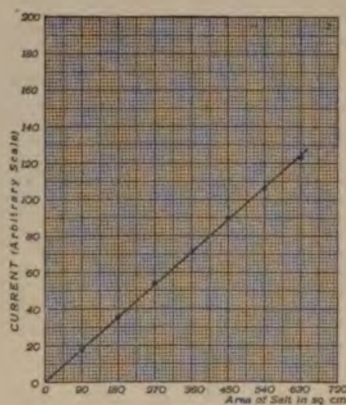


FIG. 2

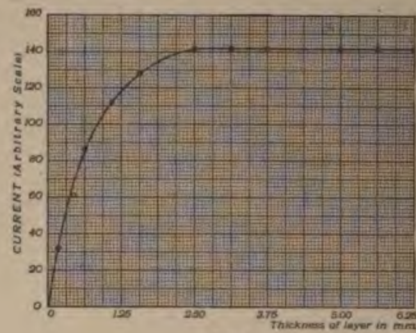


FIG. 3

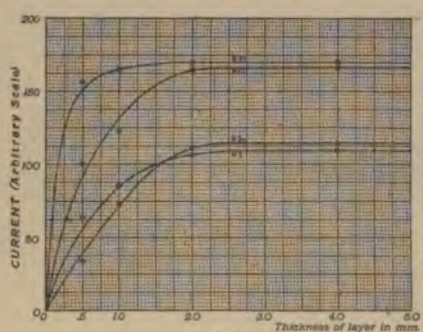


FIG. 4

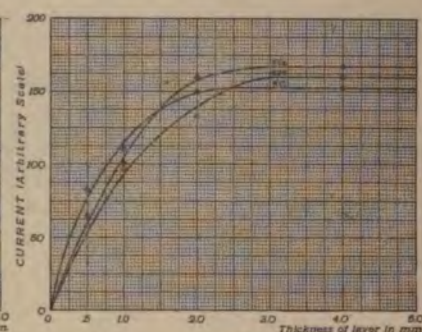


FIG. 5

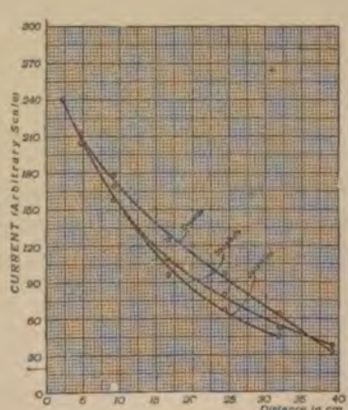


FIG. 6

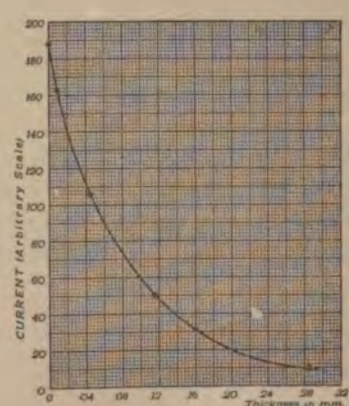


FIG. 7

IV.—*Note on the Temperature Variations in the Specific Resistance of Heusler's Alloys.*

By H. A. McTaggart, M.A., and J. K. Robertson, M.A.

(Communicated by Prof. J. C. McLennan, and read May 26, 1908.)

Introduction.

The following note contains an account of a preliminary study of the specific resistance of several samples of the bronze alloys discovered a few years ago by Heusler.[1] There already exists as a result of the investigations of various experimenters, a considerable amount of information with regard to the nature and properties of these alloys, but no careful examination of their electrical resistance has up to the present been attempted.

A perusal of the literature bearing on the subject of Heusler's alloys shews a number of striking contrasts between their properties and that of many other alloys, as well as pure metals. They are magnetic, though composed of non-magnetic constituents; their permeability shews unusual variations accompanying the processes of cooling from high temperatures; their hysteresis effects depend on similar treatment; and they exhibit magnetostriction phenomena altogether different from those displayed by other well known magnetic substances. Consideration of these properties, and particularly of those which are subject to modifications by specific heat treatment, suggested the possibility of the existence of peculiarities in the values of the coefficient of resistance in some regions of temperature.

It became then a matter of interest and importance to examine the resistance of these alloys, not only at ordinary temperatures but also over as wide a range as possible, so as to observe as fully as may be the character of any variations which might occur in the specific resistance in consequence of temperature changes. To add, then, if possible, from this line of investigation, some further data which might help to explain the magnetic properties of these bronzes, the authors, at the suggestion of Prof. McLennan, carried out as time permitted, the series of observations described below.

[1] Verh. d. Deut. Phys. Gesell. 5,219, 1903; Marburg Schriften, 237, 1904; Ann. d. Phys., 16,535, 1904; Electrician, June 16th, 1905; Phys. Rev., 96,335, 1905; Verh. d. Deut. Phys. Gesell. 7,133, 1905; Proc. Roy. Soc., 76,271, 1905; Phys. Rev., 23,498, 1906; Bulletin of Bureau of Standards, Washington, Vol. 12, No. 2, p. 297, Aug., 1906; Verh. d. Deut. Phys. Gesell, March, 1907; Phys. Rev., 24, 1907; Verh. d. Deut. Phys. Gesell., Jan., 1908.

Outline of Method:—The intention was to make determinations of the specific resistance at a considerable number of different temperatures, but lack of time confined the observations to five particular points—namely, that of liquid air, about —185° C., that of carbonic acid snow and ether, about 77° C., that of melting ice, boiling water, and that of paraffin heated to 160° C.

TABLE I.

No. of alloy.	Percentage Composition.			Atomic ratio of Al to Mn.
	Al.	Mn.	Cu.	
1A..............	8.0	32.1	59.8	.51
2, 2A............	9.7	25.6	64.6	.77
3, 3A, 3B.........	14.3	28.6	57.1	1.01
4, 4A............	15.9	23.9	60.3	1.92

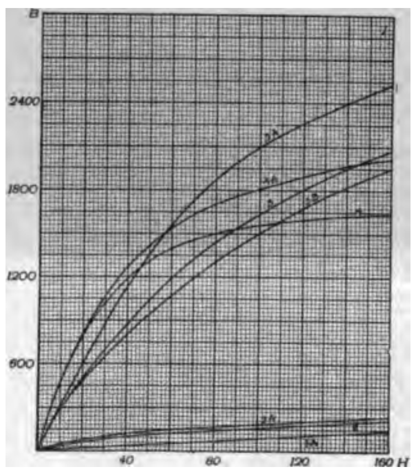


FIG. 1

Eight rods each about 15 cms. long, whose distinguishing marks are 1A, 2, 2A, 3, 3A, 3B, 4, 4A. and whose percentage composition is shewn in Table I were examined.

Before beginning the study of the resistance of the samples their permeability was roughly determined for purposes of comparison. To do this a ballistic method was employed, the rods being placed in a glass tube wound with a secondary coil, which was itself in turn placed inside a standard primary. No correction was made for end effects as a comparison of the relative magnetization values of the different specimens was all that was desired.

The curves given in Fig 1 shew graphically the values of B and H for each of the rods examined, and the numbers themselves from which the curves were plotted are given in Table II.

TABLE II.

Alloy 1A		Alloy 2		Alloy 2A		Alloy 3	
H	B	H	B	H	B	H	B
15.35	23.02	16.04	28.22	16.04	29.13	17.44	424.15
32.09	43.31	32.79	47.95	32.79	49.18	34.19	776.02
55.82	58.77	55.12	89.16	55.82	90.53	59.91	1179.20
75.36	73.59	75.36	118.59	76.06	120.64	77.45	1434.57
106.06	101.93	106.76	153.72	108.15	162.89	110.25	1733.56
130.48	116.03	131.88	175.86	131.88	195.16	136.07	1894.80
147.93	126.09	148.63	195.59	148.63	215.11	153.51	1993.15
163.28	131.41	163.28	203.54	166.07	217.87	168.86	2060.81
175.84	133.35	175.84	207.15	178.63	220.82	182.82	2110.22
187.01	138.02	188.40	210.77	193.29	212.24	193.98	2149.75

Alloy 3A		Alloy 3B		Alloy 4		Alloy 4A	
H	B	H	B	H	B	H	B
17.44	555.41	17.44	367.30	17.44	759.41	16.74	696.99
34.89	1021.38	34.19	664.41	32.49	1134.23	33.49	1101.79
58.61	1522.69	57.21	1045.36	56.52	1378.59	55.82	1472.04
78.85	1835.39	78.15	1308.23	77.45	1475.26	76.75	1662.45
111.64	2196.44	110.90	1633.01	117.23	1571.43	109.55	1853.23
136.07	2383.61	136.07	1811.83	134.67	1632.35	133.27	1947.48
153.51	2491.76	153.51	1930.08	153.51	1673.92	152.12	2005.48
168.86	2558.30	170.26	1999.48	167.47	1699.09	167.47	2043.43
181.42	2605.64	183.52	2052.35	180.73	1708.70	180.03	2072.34
193.29	2648.57	193.98	2087.73	190.49	1724.64	188.40	2093.58

To examine their resistance the rods were laid side by side about 1 cm. apart in two sets of four each, and their ends soldered together in series. In this way four rods at a time were placed in the bath and examined in succession. The resistance of each specimen was deduced from the observed value of the potential difference at the ends of a five cm. length of the alloy, and from the value of the current passing through it according to the equation—

$$R = \frac{V}{C};$$

and from this result the specific resistance was calculated according to the equation

$$\sigma = \frac{R\,A}{L}$$

where A = the cross section

L = the length of the specimen.

Apparatus:—The current traversing the alloys was supplied from a storage battery, a rheostat being used to make small adjustments when desired. To measure the current at any time, the difference of potential at the ends of a $\frac{1}{1000}$ ohm standard resistance in circuit with the alloys was observed by means of a Siemens and Halske potentiometer provided with a sensitive galvanometer.

To determine the potential difference at the ends of a 5 cm. length of the alloy, a pair of calipers fitted with ebonite arms bearing brass V-shaped tips with platinum edges made a sliding contact at any two points desired along the specimen and wires leading from the brass tips served to make connection with the same potentiometer, the readings for current and potential difference at the points of contact being taken in succession. To determine the resistance of the 5 cm. length of a specimen, the calipers were adjusted to a length of 10½ cms. and the difference of potential observed. The calipers were then shortened to 5½ cms. and the potential difference again noted. The difference of the two readings gave the potential difference at the ends of a 5 cm. length of a specimen, and from this, the dimensions of the rod being known, the specific resistance was deduced.

No special difficulty was encountered in preparing baths at the chosen temperatures. For the highest temperature a narrow copper vessel was used long enough to contain the alloys laid upon proper insulating blocks. The paraffin was heated by gas and kept at a constant temperature of 160° C.

For the lowest temperature a quantity of liquid air was poured over the alloys while resting in a narrow dish made of thin brass placed in a bed of wool. By this method the alloys soon reached a steady temperature, and as the liquid when covered by wool evaporated but slowly a constant temperature was easily maintained.

The next temperature, —77° C., was obtained by pouring a mixture of carbonic acid snow and ether into the same vessel as was used for the liquid air. the snow being obtained in the usual way by allowing the gas to expand under high pressure from the cylinder in which it was confined.

A mixture of ice and water gave the zero temperature, and a vessel of boiling water the temperature of 100° C.

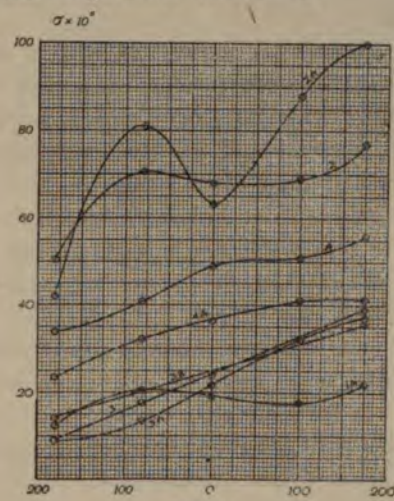


FIG. 2

To be certain before taking a reading that the baths had reached a steady state a nickel-iron thermocouple was used in connection with the potentiometer and the galvanometer mentioned above.

The results of the observations are given in Table III, and the points there given are joined by curves. as shewn in Fig. 2.

TABLE III.

Specific resistances of alloys.

Values of σ x 106 where σ is the specific resistance.

Temp.	1A	2	2A	3	3A	3B	4	4A
—180° C	12.87	50.30	41.90	9.29	9.48	14.02	33.09	23.8
— 77° C	20.80	70.26	81.00	17.79	13.66	20.44	40.50	32.0
0° C	19.31	68.36	63.70	24.48	22.09	24.35	49.39	36.8
100° C	18.78	68.89	88.10	31.88	32.18	31.63	51.51	41.4
160° C	22.58	77.80	100.50	39.65	37.72	36.57	56.61	41.8

Discussion.—From the values recorded in Table III it will be seen that the specific resistance of alloys No. 2 and No. 2A were exceptionally high, and although with the two alloys the resistances were determined for only a limited number of points it is evident from the form of the curves that the specific resistance of both underwent wide and irregular though somewhat similar variations. The existence of a maximum and a minimum value for the specific resistance of each in the range covered appears to be clearly established, and it is probable that had measurements for a larger number of temperatures been made these critical values would have been still further emphasized and more definitely determined.

Alloys Nos. 3. 3A and 3B, as well as Nos. 4 and 4A, shew very nearly a linear relation between specific resistances and temperatures, and in their behaviour approximate more closely to that of pure metals.

A comparison of the values of the specific resistance of these alloys with the known values of their constituents Cu. and Al. (that for Mn. apparently has not yet been determined) shews that all the specimens had a higher specific resistance than either of these two constituents. In this respect then the Heusler alloys resemble various alloys examined by Fleming and Dewar, and others. But, in the determinations of the latter the difference observed between the specific resistances of particular alloys and that of their respective components were not so large as that exhibited, for example by alloys 2, 2A.

This fact, coupled with the pronounced change in specific resistance which has been found to follow variations in the percentage composition of these alloys, make it desirable to have a more complete series of determinations for a larger number of specimens, and it is possible when these are made, that some additional information will be obtained which will assist in establishing a relation between the various phases of these alloys and the physical properties which they manifest.

It gives the writers pleasure to express, in this place, their sincere thanks to Prof. McLennan for his kindness in placing at their disposal the necessary apparatus to carry out the experimental work, and for his many helpful suggestions given from time to time during the investigation.

V.—*On the Conductivity of Mixtures of Dilute Solutions.*

By J. A. GARDINER, M.A.

(Communicated by Prof. J. C. McLennan and read May 26, 1908).

INTRODUCTION.

In a recent paper by Mr. E. F. Burton[1] some numbers are given which shew that, when dilute hydrochloric acid was added to a colloidal solution of silver, a drop in the conductivity of the solution occurred. During the course of that investigation Mr. Burton also observed a similar effect when dilute hydrochloric acid was added to a dilute solution of silver nitrate.

Now, according to the ionic theory of electrolysis, silver nitrate in dilute solution is completely dissociated into silver and nitrate ions, i.e., $AgNO_3$ becomes $\overset{+}{Ag} + \overset{-}{NO_3}$. The same is true of hydrochloric acid in dilute solution, HCl decomposing into the ions $\overset{+}{H} + \overset{-}{Cl}$. Also when we add dilute HCl to dilute $AgNO_3$ we should obtain the following:

$$AgNO_3 + HCl = AgCl + \overset{+}{Ag} + \overset{-}{Cl} + \overset{+}{H} + \overset{-}{NO_3}.$$

Since the hydrogen ion possesses greater mobility than the silver ion which it displaces one would naturally expect the conductivity of the silver nitrate to increase on the addition of the hydrochloric acid. From the observation described above it seemed evident, however, that the conductivity under the circumstances stated, did not follow the ordinary laws of electrolysis, and in order to examine the effect more fully a series of experiments was made under a variety of conditions described below.

Description of the apparatus.—The resistance of the solution was measured by a method similar to that adopted by G. B. Bryan[2] in "The Conductivity of Liquids in Thin Layers." The arrangement is shewn in Fig. 1.

By means of the double commutator CC an alternating current was supplied to two corners of a Wheatstone Bridge, and since the connections to the galvanometer were reversed at the same time as the current, any current through the galvanometer was always in one direction. The commutator had two ebonite drums, each with two

---

[1] Phil. Mag., Nov. 1906, p. 472.

[2] Bryan, Phil. Mag. 45, pp. 253-270, 1906.

brass segments and four brushes. When driven at full speed it gave about 20 alternations per second.

In making the measurements the conductivity vessel was placed in a water bath, kept at a constant temperature by means of a thermostat. The thermostat was regulated so as to give a temperature of 25°C, and the conductivities of the solutions in the following

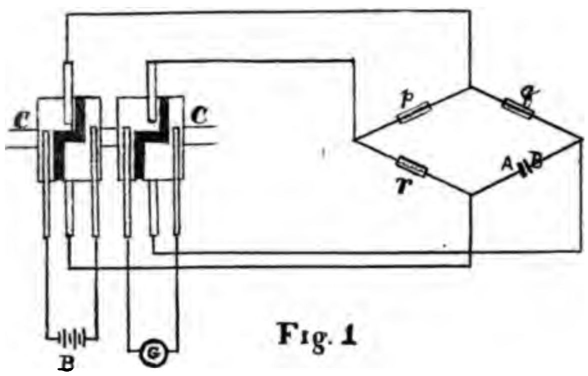


Fig. 1

experiments were found for that temperature. The electrodes, also, were coated with platinum black to prevent the absorption of liberated gases.

Experiment I.—To Prepare Standard Solutions of Silver Nitrate, Hydrochloric Acid, and Potassium Chloride.

The hydrochloric acid was standardised by means of sodium hydrate which was prepared by placing a piece of sodium freed from the petroleum and the crust of oxide, in the funnel F, made of nickel gauze. Fig. II. This funnel stood in a basin of distilled water, and over the whole a bell jar was placed as shewn in the diagram. Under the apex of the funnel was placed a platinum vessel D, which caught the sodium hydrate as it trickled down from the funnel above. The action was hastened by passing a current of steam through a tube placed in the water, so as to increase the evaporation. The sodium hydrate thus formed was made up to about the desired concentration, and the resulting solution was standardised by means of succinic acid, using phenolpthalein as indicator. The sodium hydrate solution was then used to standardise the hydrochloric acid solution, using the same indicator as before.

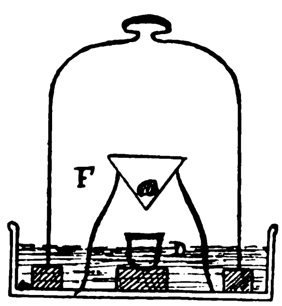


Fig. II.

The silver nitrate and potassium chloride solutions were made by dissolving known weights of each in distilled water and afterwards making the solutions up to the desired concentration.

Experiment II.—To Determine the Cell Constant.

The constant K which, for a given cell, depends on the size and shape of the electrodes, and on their distance apart, is equal to the ratio $\frac{\text{specific conductivity}}{\text{measured conductivity}}$ or since the conductivity $= \frac{1}{\text{resistance}}$ we have K = specific conductivity X measured resistance. In order to find the value of K a $\frac{N}{50}$ solution of KCl whose specific conductivity at 25°C is known to be 2.768×10^{-3}, was taken and its resistance found at that temperature by the method described above. The mean of several readings obtained in this way gave a resistance of 29.265 ohms, so that $K = 2.768 \times 10^{-3} \times 29.265 = .08100552$, with this constant the specific conductivity of any other solution was therefore given directly by $\frac{K}{\text{resistance of the solution}}$

Experiment III.—To 75 c.c. of redistilled water there was added drop by drop $\left(\frac{1}{30}\text{ c.c.}\right)$ a $\frac{N}{10000}$ solution of HCl and the specific conductivities found for the different concentrations are given in the following tables I, II and III :

TABLE I.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.70×10^{-6}
"	4.4×10^{-8}n HCl	2.70×10^{-6}
"	8.8×10^{-8} "	2.70×10^{-6}
"	22.2×10^{-8} "	2.793×10^{-6}
"	66.6×10^{-8} "	2.857×10^{-6}
"	133.3×10^{-8} "	3.240×10^{-6}
"	222.2×10^{-8} "	3.522×10^{-6}

TABLE II.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.314×10^{-6}
"	4.4×10^{-8}n HCl	2.314×10^{-6}
"	8.8×10^{-8} "	2.314×10^{-6}
"	17.7×10^{-8} "	2.314×10^{-6}
"	44.4×10^{-8} "	2.250×10^{-6}
"	111.1×10^{-8} "	2.314×10^{-6}
"	244.4×10^{-8} "	2.70×10^{-6}

TABLE III.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.025×10^{-6}
"	4.4×10^{-8}n HCl	2.076×10^{-6}
"	8.8×10^{-8} "	2.076×10^{-6}
"	13.3×10^{-8} "	2.104×10^{-6}
"	26.6×10^{-8} "	2.189×10^{-6}
"	71.1×10^{-8} "	2.70×10^{-6}
"	159.9×10^{-8} "	3.176×10^{-6}

The above tables and the curves plotted in Figs. III, IV and V, shew that on the addition of the first few drops of $\frac{N}{10000}$ HCl there was very little change in the conductivity of the solution, but as the HCl solution became more concentrated the conductivity gradually increased.

Experiment IV.—To 75 c.c. of redistilled water there was added a drop $\left(\frac{1}{27} \text{ c.c.}\right)$ of $\frac{N}{1000}$ $AgNO_3$, thus giving a 4.94×10^{-7} normal solution of silver nitrate. To this solution was added, drop by drop, a $\frac{N}{10000}$ solution of HCl. The variation in conductivity for different concentrations of the hydrochloric acid is shewn by the numbers in tables IV, and the curve in Fig. VI.

TABLE IV.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.745×10^{-6}
"	4.94×10^{-7}n $AgNO_3$	2.812×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	2.745×10^{-6}
"	8.8×10^{-8} "	2.571×10^{-6}
"	13.3×10^{-8} "	2.612×10^{-6}
"	35.5×10^{-8} "	2.704×10^{-6}
"	66.6×10^{-8} "	2.745×10^{-6}
"	133.3×10^{-8} "	2.842×10^{-6}
"	122.2×10^{-8} "	3.115×10^{-6}

From these values it will be seen that on adding successive drops of a $\frac{N}{10000}$ solution of HCl to a 4.9×10^{-7} normal solution of $AgNO_3^-$, the conductivity at first rapidly decreased and after reaching a minimum, steadily increased with the amount of HCl added.

This experiment was repeated, using solutions of $AgNO_3$, gradually increasing in concentration each time.

The results are given in tables V, VI, VII, VIII, IX, X.

TABLE V.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.596×10^{-6}
"	9.8×10^{-7}n $AgNO_3$	2.700×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	2.613×10^{-6}
"	8.8×10^{-8} "	2.764×10^{-6}
"	17.7×10^{-8} "	2.822×10^{-6}
"	39.9×10^{-8} "	3.022×10^{-6}
"	84.4×10^{-8} "	3.139×10^{-6}
"	173.3×10^{-8} "	3.375×10^{-6}

TABLE VI.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.454×10^{-6}
"	24.6×10^{-7}n $AgNO_3$	2.842×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	2.802×10^{-6}
"	8.8×10^{-8}n "	2.892×10^{-6}
"	17.7×10^{-8} "	3.000×10^{-6}
"	26.6×10^{-8} "	3.033×10^{-6}
"	88.8×10^{-8} "	3.039×10^{-6}
"	155.5×10^{-8} "	3.046×10^{-6}
"	244.4×10^{-8} "	3.315×10^{-6}

TABLE VII.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.613×10^{-6}
"	29.6×10^{-7}n $AgNO_3$	3.201×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	3.182×10^{-6}
"	8.8×10^{-8} "	3.189×10^{-6}
"	17.7×10^{-8} "	3.306×10^{-6}
"	44.4×10^{-8} "	3.521×10^{-6}
"	88.8×10^{-8} "	3.600×10^{-6}
"	155.5×10^{-8} "	3.715×10^{-6}
"	244.4×10^{-8} "	2.050×10^{-6}

TABLE VIII.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.700×10^{-6}
"	34.5×10^{-7}n $AgNO_3$	3.521×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	3.377×10^{-6}
"	8.8×10^{-8} "	3.400×10^{-6}
"	13.3×10^{-8} "	3.447×10^{-6}
"	22.2×10^{-8} "	3.681×10^{-6}
"	66.6×10^{-8} "	3.951×10^{-6}
"	133.3×10^{-8} "	4.111×10^{-6}
"	222.2×10^{-8} "	4.162×10^{-6}

TABLE IX.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.700×10^{-6}
"	39.5×10^{-7}n $AgNO_3$	3.632×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	3.632×10^{-6}
"	8.8×10^{-8} "	3.665×10^{-6}
"	13.3×10^{-8} "	3.913×10^{-6}
"	22.2×10^{-8} "	4.500×10^{-6}
"	88.8×10^{-8} "	4.909×10^{-6}
"	177.7×10^{-8} "	5.031×10^{-6}
"	266.6×10^{-8} "	5.400×10^{-6}

TABLE X.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	3.000×10^{-6}
"	44.4×10^{-7}n $AgNO_3$	3.733×10^{-6}
"	$AgNO_3$ sol. along with 4.4×10^{-8}n HCl	3.932×10^{-6}
"	8.8×10^{-8} "	4.500×10^{-6}
"	17.7×10^{-8} "	4.879×10^{-6}
"	84.4×10^{-8} "	5.226×10^{-6}
"	173.3×10^{-8} "	5.364×10^{-6}

Tables V, IX and the corresponding curves given in Figs. VII, VIII, IX, X, and XI, shew that the same effect was noticeable throughout, until a silver nitrate solution of normality 39.5×10^{-7} was reached after which it was not observed, i.e., with concentrations above this the conductivity steadily increased with the addition of $\frac{N}{10000}$ HCl as will be seen from the measurements which are recorded in table X and illustrated in Fig. XII.

Experiment V.—A silver chloride solution was made by adding HCl to $AgNO_3$. This was passed through a filter paper, and the precipitate washed with distilled water in order to remove the hydrochloric and nitric acid. The precipitate was then transferred to a beaker containing a small quantity of distilled water. This solution was then added drop by drop to 76 cc. of distilled water until the conductivity of the resulting solution had increased by an amount corresponding to the increase in the previous case with $AgNO_3$. Then to this solution of AgCl there was added drop by drop a $\frac{N}{10000}$ solution of HNO_3, and the conductivities taken as before. Tables XI, XII, XIII and the curves given in Figs. XIII, XIV and XV shew the variation in conductivity as obtained when a $\frac{N}{10000}$ nitric acid solution was added to different concentrations of the silver chloride solution.

TABLE XI.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.189×10^{-6}
"	AgCl solution	2.304×10^{-6}
"	AgCl sol. along with 4.4×10^{-8}n HNO_3	2.219×10^{-6}
"	8.8×10^{-8} "	2.213×10^{-6}
"	13.2×10^{-8} "	2.282×10^{-6}
"	22.2×10^{-8} "	2.314×10^{-6}
"	66.6×10^{-8} "	2.348×10^{-6}
"	133.2×10^{-8} "	2.571×10^{-6}
"	222.2×10^{-8} "	2.842×10^{-6}

TABLE XII.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.120×10^{-6}
"	AgCl solution	2.439×10^{-6}
"	AgCl sol. along with 4.4×10^{-8}n HNO_3	2.299×10^{-6}
"	8.8×10^{-8} "	2.294×10^{-6}
"	13.3×10^{-8} "	2.256×10^{-6}
"	22.2×10^{-8} "	2.347×10^{-6}
"	66.6×10^{-8} "	2.454×10^{-6}
"	133.3×10^{-8} "	2.632×10^{-6}
"	222.2×10^{-8} "	2.934×10^{-6}

TABLE XIII.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.700×10^{-6}
"	AgCl solution	3.368×10^{-6}
"	AgCl sol. along with 4.4×10^{-8}n HNO_3	3.361×10^{-6}
"	8.8×10^{-8} "	3.286×10^{-6}
"	17.7×10^{-8} "	3.375×10^{-6}
"	44.4×10^{-8} "	3.448×10^{-6}
"	88.8×10^{-8} "	3.529×10^{-6}
"	155.5×10^{-8} "	3.682×10^{-6}
"	244.4×10^{-8} "	4.01×10^{-6}

From the above tables it will be seen that as a $\frac{N}{10000}$ solution of nitric acid was added to a dilute solution of silver chloride a drop in the conductivity of the solution occurred at first, but as the nitric acid became more concentrated the conductivity steadily increased.

Experiment VI.—To 75 cc. of redistilled water there was added one drop $\frac{1}{30}$ cc. $\frac{N}{10000}$ HCl, thus giving a 4.4×10^{-8} normal solution of hydrochloric acid. To this solution there was added drop by drop a $\frac{N}{1000}$ solution of $AgNO_3$, and the corresponding conductivities were determined. The variation in conductivity for different concentrations of the silver nitrate is shewn in table XIV, and illustrated by the curve in Fig. XVI.

TABLE XIV.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.418×10^{-6}
"	4.4×10^{-8}n HCl	2.454×10^{-6}
"	HCl sol. along with 4.9×10^{-7}n $AgNO_3$	2.383×10^{-6}
"	9.8×10^{-7} "	2.382×10^{-6}
"	24.5×10^{-7} "	2.454×10^{-6}
"	73.5×10^{-7} "	3.115×10^{-6}
"	147.0×10^{-7} "	4.197×10^{-6}
"	245.0×10^{-7} "	5.625×10^{-6}

Here again a drop in conductivity was noticeable as a $\frac{N}{1000}$ of $AgNO_3$ solution was added to a 4.4 x 10^{-8} normal solution of HCl.

This experiment was repeated, beginning with an 8.8 x 10^{-8} normal solution of HCl, and the results which are given in table XV are shewn graphically by the curve in Fig. XVII.

TABLE XV.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.05 x 10^{-6}
"	8.8 x 10^{-8}n HCl	2.05 x 10^{-6}
"	HCl sol. along with 4.9 x 10^{-7}n $AgNO_3$	2.05 x 10^{-6}
"	9.8 x 10^{-7} "	2.131 x 10^{-6}
"	24.5 x 10^{-7} "	2.531 x 10^{-6}
"	73.5 x 10^{-7} "	3.375 x 10^{-6}
"	147.0 x 10^{-7} "	4.625 x 10^{-6}
"	245.0 x 10^{-7} "	6.231 x 10^{-6}

In this case the conductivity remained stationary at first and then gradually increased with the amount of $AgNO_3$ present in the solution.

Experiment VII.—To 75 cc. of redistilled water there was added drop by drop a $\frac{N}{1000}$ solution of $AgNO_3$. The specific conductivities for the different concentrations of $AgNO_3$ are given in table XVI, and a curve representing them in Fig. XVIII.

TABLE XVI.

Temp.	Concentration.	Spec. Conductivity.
25°C	Water	2.077 x 10^{-6}
"	4.9 x 10^{-7}n $AgNO_3$	2.189 x 10^{-6}
"	9.8 x 10^{-7} "	2.314 x 10^{-6}
"	24.5 x 10^{-7} "	2.745 x 10^{-6}
"	73.5 x 10^{-7} "	3.521 x 10^{-6}
"	147.0 x 10^{-7} "	4.765 x 10^{-6}
"	245.0 x 10^{-7} "	6.231 x 10^{-6}

From these values it will be seen that the conductivity of a silver nitrate solution steadily increased with the concentration.

Summary.—1. Tables I-III shew that as a $\frac{N}{10000}$ solution of HCl was added to water there was, at first, very little change in the conductivity of the solution, but as the HCl solution became more concentrated the conductivity gradually increased.

2. Tables IV-IX shew that on the addition of HCl to $AgNO_3$ of various dilutions a drop in the conductivity was observed. When, however, a 39.5×10^{-7} normal silver nitrate solution was reached this effect disappeared.

3. A similar drop in the conductivity was observed when a dilute nitric acid solution was added to a dilute silver chloride solution. Also, when a dilute silver nitric solution was added to a dilute solution of hydrochloric acid.

4. In the case of the silver nitrate solution (Experiment VII) the conductivity steadily increased with the concentration.

Explanation.—Two explanations may be given of the above phenomenon (1) The fact that, in Experiment III, the conductivity remains steady at first, may be due to the absorption of hydrogen by the platinum electrodes, and (2) The drop in conductivity indicated in Experiments IV, V, VI may be due to the hydrogen ion attracting to itself the neutral AgCl, and becoming loaded. Its mobility might, thereby, be decreased so as to have a value below that of the silver ion which it displaced.

Up to the present the results obtained are not sufficient to discriminate between these two explanations, and it is hoped that with additional observations the problem raised may be cleared up. In conclusion I wish to thank Mr. E. F. Burton for his kind assistance in the course of these experiments.

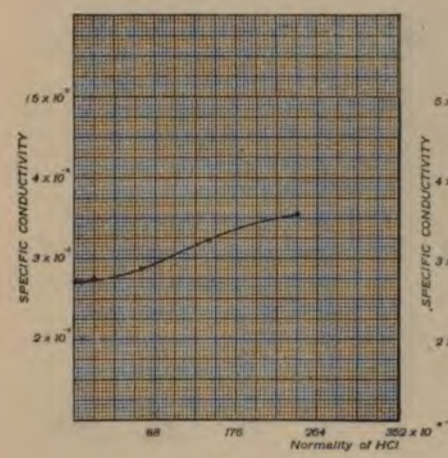


FIG. 3

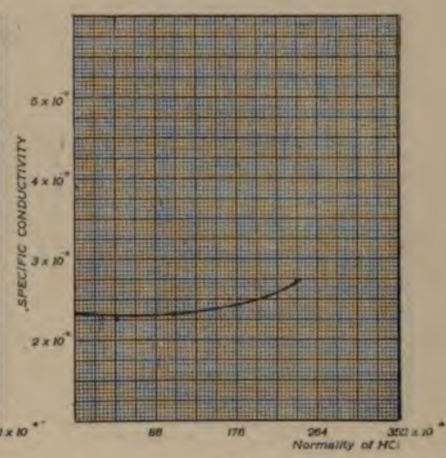


FIG. 4

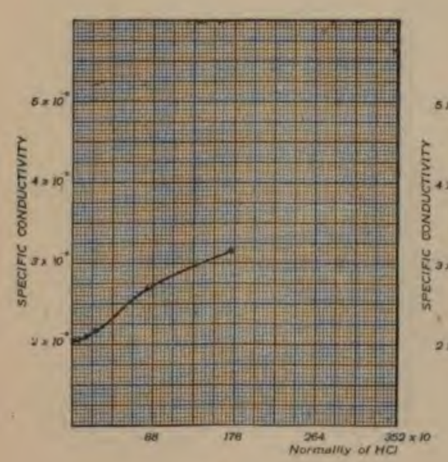


FIG.

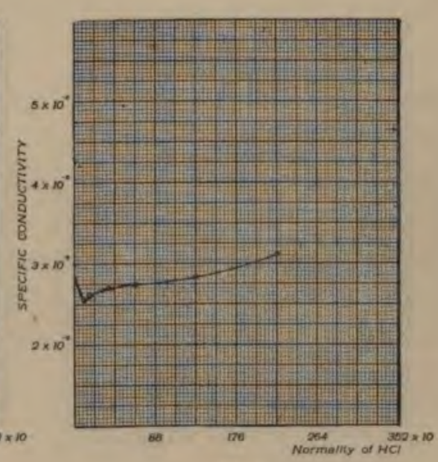


FIG. 6

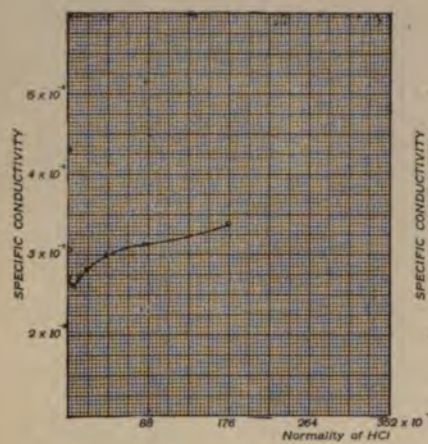


FIG. 7

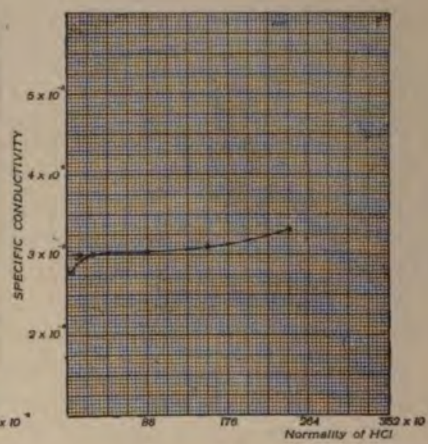


FIG. 8

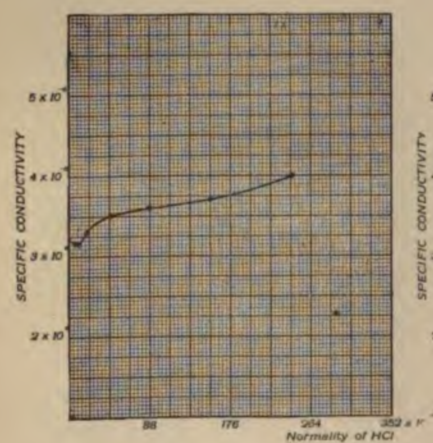


FIG. 9

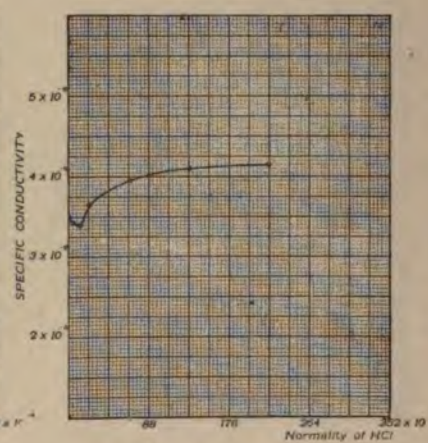


FIG. 10

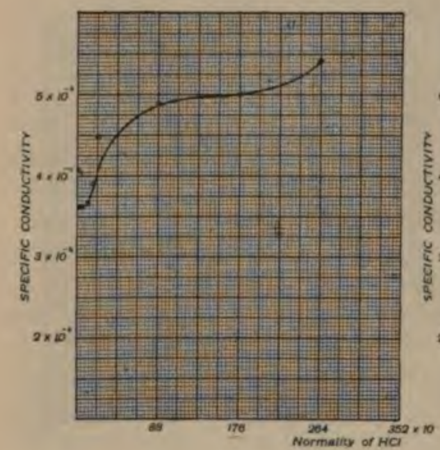


FIG. 11

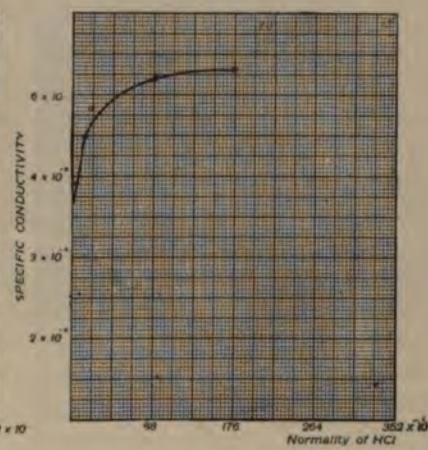


FIG. 12

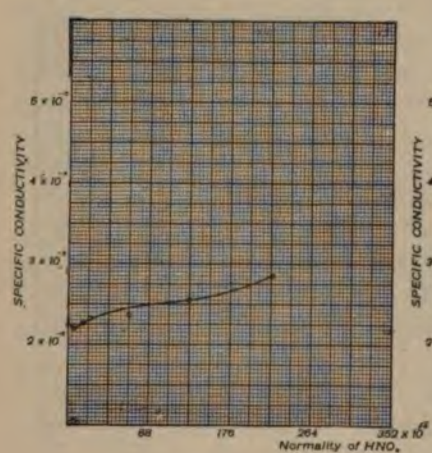


FIG. 13

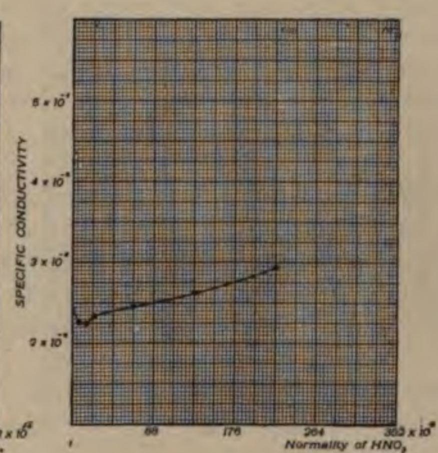


FIG. 14

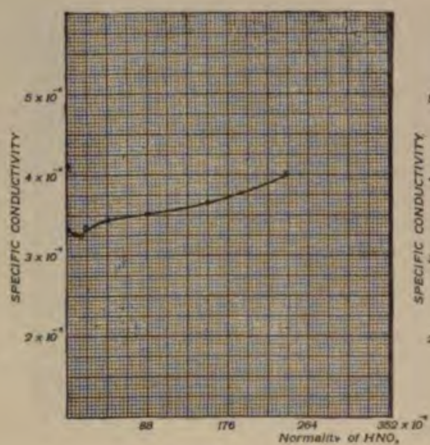


FIG. 15

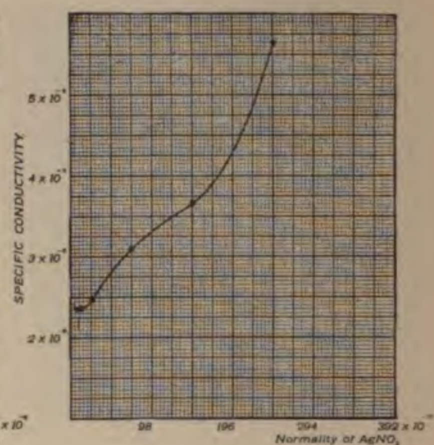


FIG 16

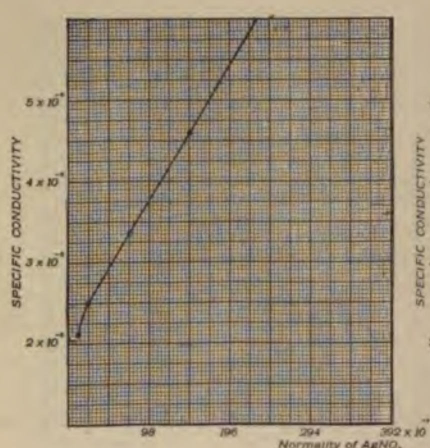


FIG. 17

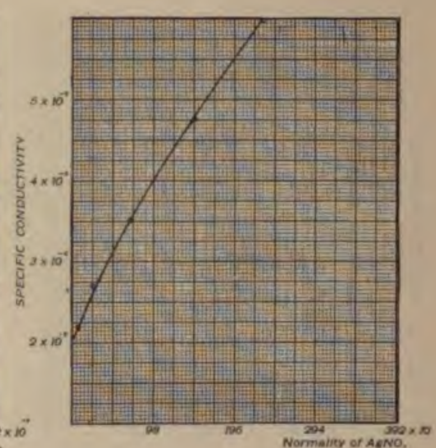


FIG. 18

VI.—*The Absorption of the Different Types of Beta Rays together with a Study of the Secondary Rays Excited by them.*

By V. E. POUND, M.A., University of Toronto.

(Communicated by Prof. J. C. McLennan and read May 26, 1908.)

I. INTRODUCTION. In a paper in the Phil. Mag., of July, 1907, Prof. MacKenzie gives an account of some observations which he made on the secondary radiation issuing from each side of plates of lead upon which a pencil of β rays was allowed to fall. Using plates of increasing thickness, he found that the secondary radiation issuing from the side of the plate upon which the β rays fell, gradually increased in intensity and reached a maximum value when a plate .2 mms. in thickness was used. With plates of still greater thickness, this secondary radiation remained constant in intensity. He obtained, however, an entirely different result on investigating the secondary radiation from the back of the plate upon which the β radiation was allowed to fall. Under these conditions the secondary radiation fell off very slowly as the thickness of the plates increased, and was still quite measurable with plates of lead 15 mms. in thickness.

In arriving at these results, MacKenzie[1] investigated the secondary radiation issuing from each side of the plates, first, when both β and γ rays were allowed to fall on them, and second, when γ rays alone were allowed to fall on the plates, and the results quoted by him, and ascribed by him to the action of the β rays were obtained by subtracting the effects due to the γ rays alone from those due to the combined β and γ radiations.

With the arrangement he adopted it was possible that in cutting off the β rays in order to study the effect of the γ radiation alone he also cut off a greater proportion of the latter than he estimated. If this were so it would result in ascribing to the β radiation a part of the secondary radiation, which properly should have been ascribed to the γ rays.

In view of the importance of his results in their relation to theories of secondary radiation now being put forward by Bragg[2] and others, it was thought well to make a more extended examination of the secondary radiations excited by both β and by γ rays, and in the following paper an account is given of some experiments in which the secondary radiation both from the back and the front of metal plates was studied, when these were traversed by γ rays alone, and also when pencils of β rays of different types were allowed to fall on them.

---

[1] Phil. Mag., July 1907.
[2] Phil. Mag., May 1908.

In differentiating the effects due to the various types of rays, the action of each was ascertained by deflecting pencils of each type into an ionisation chamber away from the others by means of a magnetic field.

II. Apparatus:—The arrangement adopted is shewn in Fig. I. The receptacle for holding the radium was a lead cylinder A with walls 4 cm. thick. One end of the cylinder was covered by a brass plate 2.5 mms. thick, in the centre of which was a hole 4.5. mms. in diameter. The capsule holding the radium was held close against this plate in such a position that the rays from the radium on issuing, passed between the poles of a powerful electromagnet. Immediately beneath the pole pieces of the electromagnet was the ionisation chamber B. It also was made of lead in the form of a cylinder 6.7 cms. long, with walls 4.6 cms. in thickness, the ionisation chamber proper being 4.7 cms. in diameter. At the top and bottom were brass rings to hold different thicknesses of selected absorbing materials over the ends of the chamber.

A properly screened and insulated electrode was inserted into the ionising chamber and connected to a Dolezeleck electrometer by means of which saturation currents were measured. The sensibility of the electrometer was such that a potential difference of one volt between the quadrants produced a deflection of 625 mms. on a scale about one metre distant from the needle. It was found that a potential of 240 volts applied to the ionisation chamber was always amply sufficient to give the saturation current.

III. Experiments on the Absorption and Reflection of β rays by tinfoil.

A. Measurements on transmitted rays.

In these experiments the β rays from the radium, on coming between the poles of the magnet, were deflected either downwards or upwards according to the direction of the field between the poles. As the capsule containing the radium was covered by a thin sheet of mica, the α rays were largely absorbed, so that the issuing beam contained only β and γ rays, which could easily be separated by the magnetic field in the manner indicated. Readings were taken of the saturation currents in the ionisation chamber as the current through the electromagnet was changed by small increments from 0 to about 28 amperes.

A series of measurements was made with a number of different thicknesses of absorbing layers of tin foil over the top of the ionisation chamber, and with the bottom of the chamber closed by a thin sheet of aluminium foil, .0065 mms. in thickness.

Before making these, however, a set of readings was taken without any metallic covering over the opening at the top of the ionising chamber, and with only the single sheet of aluminium foil over the opening at the bottom. In taking these the magnetic field was first applied in such a direction as to deflect the β rays down into the chamber and observations were made on the saturation currents corresponding to various field strengths. The field was then reversed and a second set of readings taken as the β rays were gradually deflected upwards and away from the chamber. Both sets of readings are given in column I of Tables I and II and curves representing them are shown in Fig. 2. From these curves it is seen that as the β rays were deflected down into the chamber by the magnetic field, the ionisation in the chamber rapidly increased to a maximum value and then decreased as the different pencils of rays were swept past by the increasing magnetic field. It is seen, also, that when the β rays were deflected upwards and away from the chamber by gradually increasing magnetic fields the corresponding saturation currents decreased rapidly until a constant limiting value was reached.

As already stated similar sets of readings were taken for different thicknesses of absorbing layers of tin foil over the top of the chamber. In columns II to V of Tables I and II are given the results obtained with layers .0196 mms., .0784 mms., .1568 mms., and .3136 mms. in thickness respectively and curves A, B, C, and D, corresponding to the results given in columns II to V of Table I are shown in Fig. 3.

Here again, it will be seen, when the β rays were deflected downwards that with each absorbing layer the saturation current passed through a maximum value. It will be seen, too, that the maximum saturation current fell away as the absorbing layer was increased, and further that as the thickness of the layers was increased it required a stronger and stronger field to produce the maximum ionisation.

The explanation of these results is found in the fact that the β rays issued from the radium in a number of approximately homogeneous sheaves or pencils possessing a maximum intensity in a direction at right angles to the axis of the ionising chamber. On applying the magnetic fields these sheaves or pencils would undergo different degrees of deflection, those of high velocity being less affected by the field than the more slowly moving ones.

As the rays from a sheaf of low velocity would enter the chamber first, the ionisation would increase and reach a maximum when the axis of this sheaf of rays coincided with the axis of the ionising chamber. Still higher fields would deflect the slow moving rays past the opening of the ionising chamber and introduce others possessing still higher velocities. In as much as Bragg,[1] and others, have shown that the

[1] Phil. Mag., Oct. 1907.

ionising power of β rays of high velocity is not so great as that of those moving more slowly, it follows that with increasing magnetic fields the ionising power of the rays introduced would be less than that of the rays cut out and hence a drop in the ionisation values would occur. This drop in the conductivity would continue until ultimately all the deflectable β rays were swept past the chamber. As the layers of tinfoil were gradually increased in thickness the more slowly moving β rays would be absorbed and the first effective sheaves transmitted would consist of rays possessing higher and higher penetrability and consequently of rays with less and less ionising power. It follows then that while a maximum conductivity would be obtained with each thickness of tin foil the value of the maximum would decrease with the thickness of the absorbing layer. It is evident, too, since with increasing thicknesses the first effective sheaves of transmitted rays would possess higher and higher velocities, that the field required to deflect the axis of these different sheaves into coincidence with the axis of the chamber would increase. Hence the maximum conductivities, when absorbing layers of increasing thicknesses were used would be obtained by fields excited by currents of greater intensity, and this, as the curves A B, C, and D shew, is actually what happened.

The numbers corresponding to the saturation currents obtained with the different absorbing layers when the rays were deflected upwards and away from the chamber by the magnetic fields are given in columns II to V of Table II, and curves representing them are shewn in Fig. 4. From these it will be seen that with each absorbing layer the ionisation fell away as the rays were deflected upwards and soon reached a value which was constant, and which represented the natural conductivity of the air in the chamber together with that impressed upon it by the undeviable rays from the radium and by the secondary rays which they excited.

These limiting curves it will be seen exhibit an effect already pointed out and emphasized by MacKenzie[1] and others, that when the thickness of a plate or wall upon which γ rays are allowed to fall is gradually increased the gain in ionisation at the back of the plate from the secondary radiation is at first greater than the loss produced by the absorption of the primary rays. This result is well exemplified by the curves A′, B′, C′, and D′, which correspond to absorbing layers of increasing thickness and which shew that the limiting value of the ordinate of B′ is greater than A′, that of C′ is equal to that of B′, and that of D′ is again less than that of C′.

---

[1] MacKenzie, Phil. Mag., July, 1907.

In addition to the measurements just described, others were taken for magnetic fields in both directions with absorbing layers 1.234 mms., 1.96 mms., and 3.136 mms. in thickness, and the results of these are recorded in Tables I and II. The curves E, F, and G, Fig. 5, were plotted from the numbers in columns VI to VIII of Table I and represent the conductivities obtained with fields which deflected the β rays down towards the chamber. The numbers corresponding to the saturation currents obtained with different absorbing layers when the rays were deflected upwards and away from the chamber are given in columns VI to VIII of Table II, and curves E′, F′, and G, which were drawn from the numbers given in this table are shewn in Fig. 5. and represent the conductivities when the rays were deflected in the opposite direction.

The short sharp rise in the curve E shews that with tinfoil 1.254 mms. in thickness the β rays were still able to penetrate the absorbing layer. A slight rise, as can be seen from the figure occurs in the Curve F, but with the Curve G no evidence exists of any rise in conductivity. This curve, moreover, coincides with the Curve G′ which is drawn from values of the ionisation obtained when the rays were deflected upwards, and this coincidence of the two curves G and G′ shews that with the absorbing layer with which the results illustrated by these curves were obtained, a thickness of tinfoil was finally reached which could not be penetrated by the β rays and by the secondary rays which were produced by them in the metal.

In order to find the precise thickness of tinfoil necessary to stop all the β and β secondary radiations, a curve shewn in Fig. 6 was plotted taking as ordinates the ionisation in the chamber due to the maximum β and β secondary rays for each thickness of tinfoil, and as abscissæ the thickness of the tinfoil screen with which each maximum was obtained. The maximum β and β secondary ionisation for each thickness was determined in the following manner. Taking the results for a particular thickness, the limiting value of the ordinate of the curve drawn for a deflection of the β rays upwards was subtracted from the maximum value of the ordinates of the curve drawn for deflections of the β rays downwards. Inasmuch as the limiting value of the ordinates of the former curve represented the ionisation in the chamber due to γ rays, and γ secondary, together with that due to natural causes, and the maximum value of the ordinates of the latter, the ionisation due to the maximum β, β secondary, γ and γ secondary radiations with that due to natural causes, the difference gave the ionisation due to the maximum β and β secondary ionisation for the particular thickness of tinfoil over the top of the ionisation chamber.

In Table III there is collected and given in row I, the maximum saturation currents in the chamber due to the β, β secondary, γ and γ secondary radiations and that due to natural causes, for the screens of different thicknesses of tinfoil; in row II, the saturation currents due to the γ, and γ secondary radiations and that due to natural causes, and in row III, the deduced maximum ionisation due to the β and β secondary radiations for the same screens of tinfoil sheets.

The ordinates of the curves in Fig. 6, are the values of the maximum β and β secondary ionisations taken from row III of the above table. The curve, as will be seen, is drawn with an initial rise, although no values were obtained from which the position of the highest point could be determined. Some observations to be given later, however, on the determination of the maximum thickness of aluminium necessary to absorb all the β and β secondary radiations, shew clearly that for aluminium the ionisation in the chamber due to the β rays rose and fell as the thickness of aluminium was increased. The inference was therefore drawn that for all metals this rise and fall in the conductivity due to β rays striking a wall of the chamber would occur, and would be made manifest if thin enough sheets of the metal were used.

From the regular manner in which the curve in Fig. 6 falls away, it is clear that in the experiments with tinfoil the thickest screen used was amply sufficient to absorb all the β rays and the secondary rays excited by them. An examination of the curve, moreover, makes it evident that even a thickness of 2.5 millimetres of tinfoil was amply sufficient for that purpose.

B. Measurements on reflected rays.

A series of measurements was also made on the secondary radiation produced at the front side of sheets of tinfoil when β and γ rays were allowed to fall on them. One layer of aluminium foil .0065 mms. in thickness was placed over the opening at the top of the chamber, and layers of tinfoil of increasing thickness were placed over the opening at the bottom. In these experiments the capsule containing the radium bromide was placed vertically above the ionisation chamber, so that the rays after passing between the poles of the magnet impinged directly on the thin sheet of aluminium foil forming the upper wall of the ionisation chamber, and after passing through it, traversed the air in the chamber and then impinged on the tinfoil at the bottom. As the magnet was excited by increasing currents the β rays were more and more deflected until all were swept aside by the field and γ rays alone entered the chamber.

In column II of Table IV is given a typical set of these measurements, and a typical curve plotted from them is shewn in Fig. 7. The values obtained with the complete set of reflectors used are recorded in Table IV, and it may be seen from the curve in Fig 7 that after a field corresponding to ten amperes was exceeded, the ionisation approached a limiting value which indicated that for magnetic fields excited by currents of ten amperes, and greater, the β rays were all turned aside and the γ rays alone were left to enter the chamber. The maximum ionisation due to the β, β secondary, γ, γ secondary, and that due to natural causes is given by the ordinate of the initial point of this curve. With the interpretation given above the ionisation due to the γ, γ secondary, and that due to any radiations from the metal forming the walls of the chamber may be taken to be represented by the point on the curve corresponding to the highest field. The difference in the values of these two ionisations gives a value for the maximum conductivity impressed upon the air by the β rays, and by the secondary radiations excited by them in the tinfoil.

In Table V is given the deduced values of the maximum ionisations which were due to β and β secondary rays from similar sets of measurements for different thicknesses of tinfoil at the bottom of the chamber. The curve drawn in Fig. 8 is plotted with ordinates representing the values of these maximum β and β secondary ionisations as recorded in the fourth column of this table, and with abscissæ representing the corresponding thicknesses of tinfoil. From this curve it is clear that the maximum conductivities produced by the β and the reflected β secondary rays reached a limiting value when the tinfoil sheets attained a thickness of .24 mms. and for still greater thicknesses remained constant.

Summarising all the results obtained with tinfoil it would then appear:—That when β rays from radium are allowed to impinge on sheets of tinfoil a maximum reflected secondary radiation is obtained when the tinfoil attains a thickness of .24 mms., and further that a thickness of 2.5 mms. of tinfoil is sufficient to absorb not only the transmitted secondary rays excited by β rays, but also the whole of the primary radiation itself.

This result, however, while giving definite information regarding a lower limit to the thickness of tinfoil requisite to absorb primary β rays gives only an upper limit to the thickness necessary to absorb the transmitted secondary radiations produced by such rays. In order to obtain a lower limit to the thickness of tinfoil required to absorb the transmitted β secondary radiation alone which is excited by β rays, it would be necessary to modify considerably the arrangement of the apparatus used in making these measurements.

IV. Experiments on the Absorption and Reflection of β Rays by Lead.

A. Measurements on the transmitted rays.

Experiments were conducted with lead in an exactly similar manner to those on the transmitted rays through tin foil, in order to find the minimum thickness of lead necessary to prevent the emergence of any β or β secondary radiations from the far side of a plate upon which the primary β rays of radium fell. The radium bromide was placed as in Fig. 1, and sets of readings were taken of the ionisation in the chamber,—1st, with the top of the chamber open, and, 2nd, with it covered by lead foil of varying thicknesses, the bottom of the chamber being always closed by a sheet of aluminium foil .0065 mms. in thickness. As before, these readings were taken as the β rays were deflected downwards into the ionisation chamber, and upwards and away from it by different magnetic fields.

The sets of readings taken with the opening at the top of the chamber uncovered, and also covered with lead foil screens .241 mms., .482 mms., .723 mms., and .964 mms., in thickness, respectively, are given in Tables VI and VII. From the values of the ionisations given in columns III, IV and V of Table VI, the curves A, B, and C, Fig. 9, were drawn. The curves A′, B′, and C also shewn in Fig. 9 were plotted from the numbers in columns III, IV and V of Table VII. The curves are of the same type as those for the tinfoil, which were fully discussed in Section II A.

The curve B drawn for a thickness of .723 mms. of lead indicates that β rays which were deflected by a field corresponding to about 6 amperes penetrated this thickness of lead, while the coincidence of the curves C drawn from the values corresponding both to the upward and downward deflections of the β rays when .964 mms. was the thickness of the lead screen, shews clearly that the β and also the β secondary rays could not pass through this thickness of lead.

As is fully explained in Section III A, the maximum value of the conductivities in the chamber due to β and β secondary rays for the different thicknesses of the screens can readily be deduced from the tables given above. These deduced values are given in row III of Table VIII, and a curve representing them is shewn in Fig. 10. From the curve it is evident that a screen of lead .9 mms. in thickness completely absorbed all of the β and the β secondary radiations excited in the lead including the most penetrating.

B. Measurements on reflected rays from lead.

In this set of measurements the arrangement of the apparatus was the same as when the measurements on the reflected rays from tin were taken, the radium being placed vertically above the ionisation chamber. Different thicknesses of lead were placed over the opening at the bottom, while the single sheet of aluminium foil .0065 mms. in thickness covered the top. As before, the saturation currents in the chamber were taken as the magnetic field deflected the β rays farther and farther from the opening of the chamber, and the values of the saturation currents are given in Table IX. From these it will be seen that with the lead reflectors of different thicknesses the saturation currents were practically the same when magnetic fields of sufficient strength to deflect all the β rays were applied. In order to ascertain the maximum ionisation for the various lead reflectors due to the β ray effect, the mean of the readings obtained with the high fields was taken as representing the conductivity due to the γ radiations, that due to the secondary radiations excited by these in the reflectors, and also that due to the so-called natural ionisation. This mean was subtracted from the maximum ionisation obtained with each of the reflectors before the application of a magnetic field and the differences which are recorded in column IV of Table X, and represented graphically by the Curve A in Fig. 11 were taken to represent the ionisations produced in the chamber by the primary β rays and by the secondary rays excited by them in the lead reflectors. From a consideration of those values and of the form of the curve in Fig. 11, it is evident that a maximum secondary radiation due to the impact of β rays on the lead reflectors was obtained with a thickness of .16 mms. of this metal.

From these results then it is clear that the secondary radiation emitted by the front side of a lead plate, which the β rays from radium fall do not come from a depth of the metal greater than .16 mms. It is also established by the results that a plate of lead .9 mms. in thickness will completely absorb all the primary β rays from radium as well as all the secondary radiation excited by these rays in the lead plate.

V. Experiments on the Absorption and Reflection of β Rays by Aluminium Foil.

A. Measurements on transmitted rays.

A series of readings was also made with a number of different thicknesses of absorbing layers of aluminium foil over the top of the chamber, in order to find the minimum thickness of aluminium necessary to stop the β rays. The bottom of the chamber was closed by the same sheet of aluminium foil .0065 mms. thick, used throughout these experiments. As before, the first series of measurements was taken without any cover over the top of the chamber and this series is given in column I of Tables XI and XII. The results obtained with layers .0065, .28 mms., 1.184 mms., 3.41 mms., 4.73 mms., and

8.14 mms., in thickness respectively are given in columns II to VII of Tables XI and XII.

The curves A, B, C, D, and E, shewn in Figs. 12 and 13 are plotted from the results given in columns I, II, IV, VI and VII of Table XI, and curves D′ and E′, Fig. 13, from the results given in columns VI and VII of Table XII.

On comparing the results obtained when there was no metallic covering over the opening at the top of the ionisation chamber with the results when a covering of .0065 mms. of aluminium was used, it is readily seen that the addition of the covering considerably increased the maximum ionisation in the chamber as the β rays were deflected into it. This effect is also brought out very clearly by the curves A and B in Fig. 12. This increase in ionisation in the chamber due to the thin covering of aluminium was interpreted as being due to the action of secondary radiation. The small thickness of aluminium foil used would only absorb a very small proportion of the primary β rays, and, consequently, it would be possible for the excited secondary rays to make a contribution to the ionisation in the chamber greater than the loss incurred by the absorption of the primary rays. Of course, it is also possible that the increase in ionisation observed could be interpreted as being due to a decrease in velocity impressed upon the primary rays by their passage through the foil. It is to be noted, too, in connection with this explanation, that since the values of the ionisation shewn by curve A were obtained with the opening at the top of the chamber uncovered, these undoubtedly represented the ionisation of a somewhat larger body of air than was used in the experiments when the opening was covered. It follows, therefore, that the real increase in ionisation produced by the passage of the β rays through the single sheet of aluminium should have been greater than that indicated by the curves A and B of Fig. 12. Some measurements were made with screens of two and of three sheets of aluminium, and as these were found to give maximum ionisations approximately the same as that obtained with a single sheet, it was seen that in order to investigate more fully this rise in conductivity it would be necessary to use still thinner sheets of aluminium than the one with which the opening was first closed. As this point was not specially pertinent to the subject under investigation by the writer, its examination was deferred. This rise in conductivity resulting from the passage of β rays through a thin layer of aluminium was not observed in the experiments with lead and tin screens, doubtless because the least thicknesses of these metals absorbed more of the primary β rays than could be compensated for by the excited secondary radiations. This result, it will be remembered, was referred to in Section

III A, and was given as a reason for drawing the curve shewn in Fig. 6 with an additional rise, although no determinations were made with which it could be confirmed.

Curve C shews that while the more deflectable of the β radiations were absorbed by 1.184 mms. of aluminium foil, the more penetrating still passed through it. The slight rise in curve D also indicates that some of the β radiation was still able to penetrate 4.73 mms. of aluminium. With a thickness of 8.14 mms. of aluminium, however, no rise in the conductivity occurred, and as curve E, Fig. 13 shews, this thickness was sufficient to cut off all the β ray effect.

It will be seen that the curves which are drawn on a large scale for deflections of β rays downwards, and for deflections of these rays upwards, corresponding to a thickness of 8.14 mms. of aluminium over the opening at the top of the chamber and denoted by E and E′ do not coincide. It will be recalled further, that the curves drawn for the limiting thicknesses of tin and lead under the same conditions shewed an exact coincidence. This peculiarity in the behaviour of the aluminium screen was investigated at considerable length and was finally shewn by some experiments which are described later in Section VI to be due to the action of the secondary β rays excited on the far side of the thicker aluminium screens by the γ rays entering the chamber.

In Table XIII there is given in row I the maximum saturation currents in the chamber due to the β, β secondary, γ and γ secondary radiations and that due to natural causes for the different thicknesses of aluminium foil, in row II, the saturation currents due to the γ and secondary radiation and that due to natural causes and in row III, the maximum ionisations due to the β and β secondary radiations deduced as explained in Section III A, from the Tables above and their corresponding curves. On looking at the figures given in row III of this table, it is seen that there is apparently a β ray ionisation of .5 or about one-seventh of one per cent of the greatest β ray ionisation in the chamber when the top of the chamber is covered by 8.14 mms. of aluminium. This conductivity, however, represents really a γ ray effect, due as said before to the thickness of the aluminium used and should be deducted from the last three of the numbers given in row III of the table. These corrected values of the maximum β and β secondary ionisations are given in row IV, and a curve, Fig. 14, is plotted from these values. An examination of this curve makes it evident that a thickness of approximately 7 mms. of aluminium foil was amply sufficient to absorb all the β rays, and the secondary rays excited by them.

B.—Measurements on reflected rays from aluminium.

A series of measurements was also made on the secondary radiation produced at the front side of sheets of aluminium foil when β and β rays were allowed to fall on them, and from these the critical depth of the β ray effect has been determined. The arrangement of the apparatus was the same as for the measurements on the reflected radiations from tin and lead. The values of the saturation currents in the chamber found for the different thicknesses of aluminium foil at the bottom are given in Table XIV, and the maximum ionisations due to the β rays have been deduced from these tables and their corresponding curves. These maximum currents are given in Table XV and the curve in Fig. 15 plotted from them shews the manner in which the intensity of the secondary radiation was increased. From this curve it is evident that the maximum conductivity produced by the β and the reflected β secondary rays attained a limiting value when the aluminium foil sheets reached a thickness of .4 mms.

It follows then from these results that a thickness of 7 mms. of aluminium will completely absorb all the β rays from radium and the secondary rays which they excite in the metal. It follows too that the secondary rays, emitted by the front side of a plate of the metal when bombarded by the β rays from radium do not come from a depth in the metal greater than .4 mms.

VI.—Experiments on the Secondary Rays Excited in Aluminium by γ Rays.

It has been stated in Section V that when a sheet of aluminium 8.1 mms. in thickness which was sufficient to absorb all the β rays and the secondary rays excited by them was placed over the opening at the top of the ionisation chamber the saturation currents were not the same with a magnetic field applied in one direction as those obtained with the same field reversed. This lack of symmetry in the values of the saturation currents obtained when screens of aluminium were used is illustrated by curves E and E′ in Fig. 13. In the experiments with lead and tin screens no effect of this kind was observed, and in order to clear up the matter an additional series of experiments was carried out to ascertain if possible the cause of it in the case of aluminium.

1. In the first experiment a thickness of 4.73 mms. of aluminium was placed over the opening at the top of the chamber, and above this a thickness of .964 mms. of lead. This thickness of lead, it will be remembered was found in the earlier experiments sufficient to absorb all the β and the β secondary radiations. It follows then, that with this screen none but the γ rays of radium could enter the

ionisation chamber when this double thickness of lead and aluminium was placed over the top. The conductivities in the chamber for gradually increasing fields in both directions were taken and these are given in Table XVI. The second column of this Table shews a slight gradual decrease in ionisation as the β rays were deflected into the chamber, and the fourth column shews a greater decrease as the β rays were deflected away from the chamber. Here again it will be seen that the difference in the ionisations for the directions of the magnetic field was approximately of the same magnitude when there was 8.4 mms. of aluminium over the ionisation chamber. Since none but γ rays could enter the chamber this difference in ionisation must have been due to the action of the magnetic field in the chamber on the secondary radiation issuing from the back of the aluminium screen under the excitation of the β rays.

2. The next experiment was to place the radium protected by the lead cylinder on the side of the ionisation chamber directly opposite to its former position. The same aluminium screen 8.14 mms. in thickness was placed over the chamber as before, and the β rays were again deflected down into the chamber by a suitably directed magnetic field and afterwards upward and away from it with the field reversed. The results are given in Table XVII. The numbers thus recorded shew the same characteristics as when the radium was in the first position. When the magnetic fields were such as to deflect the β rays downwards into the chamber the ionisation decreased but slightly. On the other hand a considerably greater decrease took place when the β rays were deflected in the opposite direction.

3. A third experiment was carried out with the radium and its lead protection placed back in the original position. One sheet of tinfoil .0196 mms. in thickness was inserted over the top of the ionisation chamber and 8.14 mms. of aluminium was then placed over the tin. Readings were then taken of the conductivity in the chamber for the two deflections. These readings are given in Table XVIII, and the curves A and A′ representing them are drawn in Fig. 16. These curves and the curves E and E′ drawn in Fig. 13 are on the same scale. A comparison of the latter which correspond to a screen of 8.14 mms. of aluminium alone over the top of the chamber, with the curves A and A′ in Fig. 16, makes it clear that the insertion of the sheet of tinfoil beneath the aluminium screen brought the curves representing the two deflections more nearly into coincidence. The natural conclusion would be then, that for a greater thickness of tinfoil below the aluminium the two curves representing the ionisations for the two deflections would coincide. To test this connection four

sheets of tinfoil or a thickness of .0784 mms. were placed above the opening of the chamber and over this the 8.14 mms. of aluminium. The conductivity in the chamber was then measured for different magnetic fields. The results are given in Table XIX. and curve B illustrating them is shewn in Fig. 16. The numbers in the table and the curve both shew that with a screen made up in this way the conductivities in the chamber were identical for magnetic fields of equal intensity in either direction. This experiment shewed clearly that the effect under consideration was due to a peculiarity in the secondary radiation emitted by the aluminium.

4. In the fourth experiment the radium protected by the lead cylinder was placed vertically above the ionisation chamber and also above the poles of the magnet in such a way that the pencils of rays from the radium were directed straight into the ionising chamber. The saturation currents for magnetic fields in both directions when the 8.14 mms. of aluminium alone covered the chamber were then measured. From the values of these currents which are recorded in Table XX it will be seen that the ionisation corresponding to any selected field intensity was the same for both directions of the field. Since the disposition of the apparatus in this experiment was symmetrical it follows that the effect noted with the previous arrangement was not only connected with some special property of the secondary radiation excited in the aluminium by the gamma rays, but it also was due evidently to a non-symmetrical configuration of these secondary rays in the ionising chamber.

The following is offered as an explanation of the foregoing experiments.

In Fig. 17, A represents the ionisation chamber, B the electrode, CD the aluminium screen, and R the position of the radium in the non-symmetrical arrangement. From a consideration of the figure it is evident that the line RA, which is the axis of a pencil of γ rays entering the chamber will mark the line of greatest intensity of these rays, since for all other rays the metal path traversed is longer and consequently the absorption is greater. It follows then that RA will also represent the direction of the axis of the pencil of secondary rays of greatest intensity issuing from the back of the aluminium plate. If then the magnetic field was applied in such a direction as to deflect the primary β rays down into the chamber, this field since the chamber was so situated as to be affected by the field, would deflect the secondary rays issuing from the back of the aluminium screen in the same direction. With the field in the opposite sense the primary β rays would be deflected upwards and away from the chamber, and the secondary rays in the chamber would also be turned by this field in a similar way, i.e., with one direction of the field the axis of the pencil of secondary rays corresponding to RA would be turned anti-clockwise, while with the field reversed this pencil would undergo a clockwise deflection. From the diagram shewn in Fig. 17 it can be seen that when the pencil of maximum intensity RA is given a clockwise rotation the air path traversed by it will be lessened, and consequently the ionisation produced by it reduced. On the other hand, with the anti-clockwise rotation the length of path traversed by this pencil will be increased, and hence one should not expect the magnitude of the decrease in ionisation following the application of the field producing this deflection to be as great as when the field applied caused the rays to be deflected in the opposite sense. It is evident, too, that the tertiary rays excited on the walls of the chamber by the aluminium secondary rays would be greater in the case of the anti-clockwise rotation of the secondary rays than in experiments when the rotation of these rays was in the opposite direction. One naturally inquires why this effect did not appear in the experiments when tin and lead were used as coverings for the openings into the chamber, and also when a thickness of 0.0784 mms. of tinfoil was placed below the aluminium cover. The probable explanation is that the transmitted secondary rays from tin and lead are not so effective ionising agents or so good exciters of tertiary rays as the secondary rays from aluminium. The effect even in the case of aluminium is small although quite noticeable, and it is probable therefore, with the weaker secondary rays from the tin and lead that the effect would be very much less, and consequently masked by the other influences present.

The experiments which have just been described are also interesting for the light which they throw on the nature of the transmitted secondary radiation excited in the metals aluminium, tin, and lead by γ rays. According to the argument which has been presented, it follows from Bragg's conclusions, since the secondary rays from aluminium are better ionisers than those from tin and lead, that the particles constituting these secondary rays must be endowed with smaller velocities than those constituting the secondary radiation from the other two metals. The transmitted γ excited secondary rays from aluminium should therefore, from this point of view, be more easily absorbed than those emitted by tin and lead.

This conclusion regarding the character of the transmitted secondary radiation excited in aluminium by γ rays is in accord with the conclusions of McClelland,[1] Starke[2] and others, who have found

[1] McClelland, Trans. Roy. Dublin Soc. 8, p. 169, 1905.

[2] Starke, Le Radium, Feb., 1908.

an exceptionally high co-efficient of absorption for the reflected secondary rays excited by β and γ rays in this metal.

VII. A Comparison of the Secondary Radiations excited in different Metals by β Rays.

Some conclusions of interest can also be drawn from the results of the experiments of the present investigation regarding the secondary rays excited in different metals by β rays. For the purpose of making a comparison, the thicknesses of the limiting absorbing layers of the three metals studied with both reflected and transmitted rays are collected in Table XXI, and in Fig. 18 curves are drawn with the thicknesses of the absorbing layers as abscissæ and the densities of the absorbing substances as ordinates. The curve A is plotted from the results of the transmitted radiation experiment, while the curve B corresponds to the measurements on the reflected rays. It will be noticed that the scale of abscissæ used for the latter curve is only one tenth that adopted in laying out the former. From the results in the table and from the form of the curve it will be seen that the thicknesses of the absorbing materials required to stop the β and β' secondary rays were not directly proportional to the densities, but that as the densities decreased it required greater thicknesses to stop the rays than should have been expected from density consideration alone.

It is highly probable that the maximum depth from which the secondary rays come on the front side of a metal plate when primary β rays impinge on it, represents the thickness that the secondary rays excited by the primary ones will penetrate in that metal. Now, if the secondary rays excited by the primary in the three metals are all of the same penetrability, one should expect on the assumption that they are β rays, that numbers representing the maximum penetrability found for these secondary rays would follow the same absorption law with reference to the density that the numbers representing the maximum penetrabilities of the primary radiation followed. In other words, the two curves A and B should be similar in form if the secondary rays excited in the three metals possess the same penetrability. But it is clear from the manner in which the two curves intersect in the figure that they do not typify the same absorption law. It will be seen from the curve B that the maximum penetrabilities of the secondary β rays, as determined by the reflection experiments, approximate very closely to a linear relation which exhibits in a striking manner the important result that secondary rays excited in plates of different metals when β rays are allowed to fall on them are the more penetrative the greater the density of the metal of which the reflector is made.

VIII. Summary of Results.

1. The β radiation from radium bromide which includes the β radiations from all the radium products in the equilibrium state will not produce any ionisation on the far side of a plate of aluminium 7 mms. in thickness, of a plate of tin 2.5 mms. in thickness, or of a plate of lead .9 mms. in thickness.

2. The maximum secondary radiation emitted from the front side of plates of the metals aluminium, tin, and lead, when bombarded by β rays are given by the following thicknesses:

Aluminium............	0.4 mms.
Tin..................	0.24 mms.
Lead.................	0.16 mms.

3. The transmitted secondary radiations excited by γ rays in lead and tin are more penetrating than the transmitted secondary radiation excited in aluminium by the same rays.

4. When β rays are allowed to fall in turn on reflectors of different metals, it is found that the greater the density of the metal from which the reflector is made the greater is the penetrability of the reflected secondary rays excited by the β radiation.

5. From the experiments on the transmission of β rays through sheets of aluminium foil, it has been shewn that when very thin sheets of the metal are used, the ionisation at first contributed by the transmitted secondary radiation excited by the β rays is greater than that lost through absorption of the primary rays.

In conclusion I wish to express my best thanks to Prof. McLennan, at whose suggestion the investigation was undertaken, for his help and advice and unfailing kindness throughout the course of the research.

TABLE I.

Ionisation by β transmitted secondary rays from tinfoil with primary rays deflected down into chamber.

Current in magnet (amp.)	Saturation currents (arbitrary scale) with different thicknesses of tinfoil.							
	I mm. 0.00	II mm. 0.0196	III mm. 0.0784	IV mm. 0.1568	V mm. 0.3136	VI mm. 1.254	VII mm. 1.96	VIII mm. 3.136
0.0	46.6	42.3	27.3	23.3	19.4	16.25	14.59	13.08
0.2	51.5	53.9	29.7	....	....	....	....	....
0.45	128.4	84.2	....	....	....	....	....	....
0.85	292.0	196.5	52.0	27.0	20.3	....	14.51	12.87
1.15	348.5	294.8	86.0	....	....	....	....	....
1.65	360.0	343.2	152.0	62.6	25.0	....	....	12.73
2.2	....	327.3	221.1	115	....	16.19	....	....
2.5	305	....	....	....	45.8	16.19	....	12.66
3.2	170.2	....	161.9	....	....	....	14.44	....
4.0	....	149.3	....	97.4	62.8	16.13	....	12.61
5.0	....	....	96.9	79.0	57.0	16.48	14.35	12.45
6.6	....	81.1	69.1	....	46.7	....	14.21	....
7.0	62.5	73.4	....	58.5	....	16.43	....	12.29
10.0	34.0	50.7	47.1	45.2	34.5	16.22	14.02	12.28
15.0	20.8	35.4	29.8	31.5	25.7	15.9	13.96	12.22
20.0	16.0	27.5	26.5	25.4	22.5	15.64	13.85	....
25.0	....	....	....	....	20.0	15.51	13.82	....
27.5	....	23.0	22.2	22.0	....	....	....	12.1

TABLE II.

Ionisation by β transmitted secondary rays from tinfoil with primary rays deflected up from chamber.

Current in magnet.	Saturation current (arbitrary scale) for different thicknesses of tinfoil.							
	I mm. 0.0	II mm. 0.0196	III mm. 0.0784	IV mm. 0.1568	V mm. 0.3136	VI mm. 1.254	VII mm. 1.96	VIII mm. 3.3136
0.0	46.6	41.7	26.4	22.1	19.1	16.25	14.55	12.82
0.7	14.7	....	....	....	....	....	....	....
0.85	....	23.2	20.9	20.1	18.3	....	14.34	....
1.45	10.5	....	....	....	....	....	....	....
1.70	....	....	19.5	19.0	18.0	....	....	12.56
1.80	....	18.4	....	....	....	15.84	....	....
2.5	....	....	....	....	17.9	15.84	....	12.52
3.8	7.6	17.3	17.9	18.2	17.7	15.73	....	12.44
5.0	....	....	17.8	17.9	17.6	15.68	....	12.4
6.6	7.41	....	17.5	17.8	17.3	15.58	14.15	12.36
7.0	....	16.9	....	....	....	....	....	....
10.0	....	16.8	....	....	17.2	15.21	14.09	12.26
12.0	....	....	17.9	17.6	....	....	....	....
15.0	7.23	16.6	17.9	....	17.0	15.29	13.9	12.10
17.5	....	....	....	....	....	....	....	....
21.0	7.14	16.3	....	17.3	16.9	15.17	13.87	12.06
26.5	....	16.2	17.6	17.2	16.8	....	13.79	....

TABLE III.

Remarks	Saturation current.								
Thickness of tin over the top of chamber......	mm. 0.0	mm. 0.0196	mm. 0.039	mm. 0.0784	mm. 0.1568	mm. 0.3136	mm. 1.254	mm. 1.96	mm. 3.136
I. Max. $\beta + \beta$ secondary$+\gamma+\gamma$ secondary + natural ionisation..........	360.0	343.2	287.5	230.	113.8	67.8	17.2	14.4	12.37
II $\gamma +$ γ secondary + natural ionisation..........	7.37	16.9	17.8	17.7	17.7	17.6	15.4	14.1	12.37
III $\beta +$ β secondary ionisation........	352.63	326.3	269.7	212.3	96.1	50.2	1.8	0.3	0.0

TABLE IV.

Ionisation by β reflected secondary rays from tinfoil.

Current in magnet	Saturation currents (arbitrary scale). Different thicknesses of tinfoil.							
	I mm. 0.0	II mm. 0.0081	III mm. 0.0196	IV mm. 0.039	V mm. 0.0784	VI mm. 0.1568	VII mm. 0.6272	VIII mm. 1.96
0.0	1086	1121.9	1165	1198	1225	1230	1234	1230
0.85	....	826.4	858.2	864.6	881.2	891.4	898.4	920
0.9	821.4	....	....	....	....	....	....	....
2.5	267.4	230.3	224.1	294.8	225.7	226.3	232.1	250.2
4.5	103.5	104.5	95.8	98.2	91.2	95	95.0	86.4
6.75	68.0	72.3	64.9	64.9	57.5	61.8	62.5	57.3
10.0	58.9	61.4	53.9	55.4	47.6	51.5	50.8	47.7
15.0	54.2	54.7	49.1	48.7	43.9	47.3	46.7	43.5
22.0	51.8	50.4	46.3	....	43.4	44.9	44.9	41.0
23.5	....	....	....	46.0	....	....	....	....
28.5	....	48.5	44.7	....	42.6	43.2	43.0	....
29.5	....	....	....	44.7	....	....	....	....

TABLE V.

Ionisation by β transmitted secondary rays from lead foil with primary rays deflected down into chamber.

Thickness of tin foil over bottom of chamber.	Max. $\beta + \beta$ secondary $+ \gamma + \gamma$ secondary + natural ionisation.	$\gamma + \gamma$ secondary + natural ionisation.	Max. $\beta + \beta$ secondary ionisation.
mm. 0.0000	1086	51.8	1034.2
0.0081	1121	47.5	1073.5
0.0196	1165	44.7	1116.3
0.039	1198	44.7	1153.3
0.0784	1225	42.6	1182.4
0.1568	1230	43.2	1186.8
0.6272	1234	43.2	1190.8
1.96	1230	41.5	1188.5

TABLE VI.

Ionisation by β transmitted secondary rays from lead foil with primary rays deflected down into chamber.

Current in magnet. (amperes)	Saturation current (arbitrary scale), with different thicknesses of lead foil.				
	I mm. 0.0	II mm. .241	III mm. .482	IV mm. .723	V mm. .964
0.0	56.5	21.1	19.6	16.9	16.5
.2	95.8	....	....	....	....
.85	294.8	21.9	....	....	16.3
1.35	383.3	....	....	....	....
1.70	359.3	....	....	....	....
2.5	302.6	30.0	20.4	16.9	16.2
4	....	48.7	22.6	....	15.9
4.5	118.5	....	....	17.0	....
5.	....	50.4	24.8	17.4	....
6.5	68.0	....	....	17.34	....
7.	....	....	25.4	....	15.8
10	41.5	35.4	24.0	17.03	15.7
15	26.4	27.9	21.6	16.45	15.4
22.5	18.0	23.3	19.5	16.45	15.4

TABLE VII.

Ionisation by β transmitted secondary rays from lead foil with primary rays deflected up from chamber.

Current in magnet. (amperes)	Saturation current (arbitrary scale) for different thicknesses of lead foil.				
	I mm. 0.0	II mm. .241	III mm. .482	IV mm. .723	V mm. .964
0.	56.5	21.1	19.5	16.9	16.5
.8	18.5	20.1	....	....	16.3
2.5	9.4	20.0	19.0	16.7	16.1
4.5	....	19.7	18.8	16.59	16.0
6.5	8.6	19.5	....	....	....
7.0	....	....	18.5	16.71	15.8
10	....	19.1	18.5	....	15.7
15	8.1	19.0	18.1	16.15	15.5
22.5	8.1	19.1	18.0	16.28	15.4

TABLE VIII.

Remarks.	Saturation Current.				
	mm.	mm.	mm.	mm.	mm.
Thickness of lead over the top of chamber......................	0	.241	.482	.723	.964
I. Max. $\beta + \beta$ secondary $+ \gamma + \gamma$ secondary + natural ionisation..	383.2	50.9	25.8	17.5	15.6
II. $\gamma + \gamma$ secondary natural ionisation.	8.4	19.4	17.7	16.5	15.6
III. Max. $\beta + \beta$ secondary ionisation.	374.8	31.5	8.1	1.0	0.

TABLE IX.

Ionisation by β reflected secondary rays from lead foil.

Current in magnet. (amperes)	Saturation current (arbitrary scale) for different thicknesses of lead foil.					
	I mm. 0.0	II mm. .066	III mm. .093	IV mm. 0.116	V mm. .241	VI mm. .964
0	1161.0	1315	1337	1349	1349	1340
8	799.0	....	809.8	....	818.5	801.3
2.5	146.0	....	147.8	....	139.8	145
4.5	64.9	....	59.5	....	65.3	63.8
6.5	58.9	....	54.7	....	54.2	55.5
·10.	57.8	....	56.3	58.3	56.1	....
15	58.9	57.8	58.6	58.0	....	56.6
22	57.8	56.9	57.2	56.6	56.9	56.9
28	56.9	56.1	56.3	56	55.3	55.8

TABLE X.

Thickness of lead over bottom of chamber.	Max. $\beta + \beta$ secondary $+ \gamma + \gamma$ secondary natural ionisation.	$\gamma + \gamma$ secondary $+$ natural ionisation.	Max. $\beta + \beta$ secondary ionisation.
mm.			
0.	1161	57.8	1103.2
.066	1315	56.9	1258.1
.093	1337	56.7	1280.3
.116	1349	57.3	1291.7
.241	1349	55.6	1293.4
.964	1340	56.2	1283.8

TABLE XI.

Ionisation by β transmitted secondary rays from aluminium foil with primary rays deflected down into chamber.

Current in magnet. amp.	Saturation currents (arbitrary scale) with different thicknesses of aluminium foil.						
	I mm. 0.0	II mm. .0065	III mm. .28	IV mm. 1.184	V mm. 3.41	VI mm. 4.73	VII mm. 8.14
0	77.6	65.7	25.7	14.6	13.99	13.12	12.32
2	117.3	100.8	....	....	....	....	....
.45	176.9	157.5	36.2	....	....	....	....
.8	302.6	319.4	63.1	15.7	13.97	13.24	....
1.3	365.0	396.5	....	....	....	....	....
1.65	359.3	396.5	280.4	22.2	14.57	....	....
2.5	294.8	319.4	287.5	50.4	15.65	13.15	..
4.5	111.6	127.7	111.6	73.2	17.42	13.22	12.24
6.5	63.1	74.2	68.0	53.7	20.31	13.42	12.22
10	37.4	43.2	22.7	35.5	....	13.42	12.15
15	25.1	18.4	27.9	23.8	16.64	13.17	12.13
22	18.6	20.9	20.1	18.1	15.37	13.08	12.09

TABLE XII.

Ionisation by β transmitted secondary rays from aluminium foil with primary rays deflected up from chamber.

Current in magnet. amp.	Saturation current (arbitrary scale) for different thicknesses of aluminium foil.						
	I mm. 0.0	II mm. .0065	III mm. .28	IV mm. 1.184	V mm. 3.41	VI mm. 4.73	VII mm. 8.14
0.0	63.1	71.5	25.9	14.7	13.93	13.12	12.37
.85	19.8	11.2	16.3	13.9	13.74	13.02	12.27
2.5	11.7	10.3	11.8	13.1	13.65	12.90	12.08
4.5	....	10.4	11.3	12.7	13.41	12.57	....
6.5	13.5	10.2	11.0	12.4	12.90	12.30	11.51
15	12.6	10.1	10.7	12.0	12.72	11.87	11.11
22	12.3	10.1	10.6	11.9	12.46	11.68	10.89

TABLE XIII.

Remarks.	Saturation current.						
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Thickness of aluminium over the top of chamber.......	0.0	.0065	.28	1.184	3.41	4.73	8.14
I Max. $\beta+\beta$ secondary + $\gamma+\gamma$ secondary + natural ionisation..........	365	396.5	287.5	79.3	20.3	13.5	12.2
II $\gamma+\gamma$ secondary + natural ionisation..............	12.6	10.2	11.	12.3	13.1	12.3	11.7
III Max. $\beta+\beta$ secondary ionisation..................	352.4	386.3	276.5	67.0	7.2	1.2	.5
IV....................	352.4	386.3	276.5	67.0	6.7	.7	.0

TABLE XIV.

Ionisation by β reflected secondary rays from aluminium.

Current in magnet.	Saturation currents. (Arbitrary Scale,) Different thicknesses of aluminium foil.				
amperes.	I mm. .0065	II mm. .026	III mm. .065	IV mm. .280	V mm. .963
0.0	1106	1126	1140	1176	1181
.8	709.8	716.5	....	....	....
.85	....	....	684.3	710.0	723.9
2.5	127.1	128.9	116.5	125.8	170.4
4.5	66.8	58.6	65.7	59.2	62.1
6.5	57.4	52.0	55.5	49.5	52.9
15	57.7	55.2	58.0	54.3	53.2
23	56.1	54.5	56.6	53.4	52.5
30	....	53.4	54.7	52.	51.5

TABLE XV.

Thickness of aluminium foil over bottom of chamber.	Max $\beta + \beta$ secondary $+ \gamma + \gamma$ secondary + natural ionisation.	$\gamma + \gamma$ secondary + natural ionisation.	Max. $\beta + \beta$ secondary ionisation.
mm. .0065	1106	57.1	1048.9
.026	1126	53.8	1072.2
.065	1140	56.2	1083.8
.280	1176	52.3	1123.7
.963	1181	52.5	1128.5

TABLE XVI.

Thickness of lead over the top of the chamber —.964 mms.
Thickness of aluminium over the top of the chamber —4.73 mms.
Lead above aluminium.

β rays deflected towards chamber. β rays deflected away from chamber.

Current through magnet.	Saturation current.	Current through magnet.	Saturation current.
0 amperes	10.85	0 amperes	10.68
2.5	10.94	2.5	10.74
4.5	10.87	4.5	10.37
6.5	10.89	6.5	10.10
10	10.70	10	9.88
15	10.67	15	9.74
22	10.65	21	9.60

TABLE XVII

Thickness of aluminium over the top of chamber—8.14 mms.
Radium on opposite of chamber from its usual position.
β rays deflected towards chamber. β rays deflected away from chamber

Current through magnet.	Saturation current	Current through magnet.	Saturation current.
0 amperes	12.50	0 amperes	12.56
4.5	12.46	.85	12.43
10	12.43	2.5	12.32
15	12.41	4.5	12.06
22.5	12.40	7	11.76
....	.....	10	11.43
....	.....	15	11.11
....	.....	22.5	10.91

TABLE XVIII.

Thickness of aluminium over the top of chamber—8.14 mms.
Thickness of tin over the top of chamber—.0196 mms.
Aluminium above tin.
β rays deflected towards chamber. β rays deflected away from chamber.

Current through magnet.	Saturation current.	Current through magnet.	Saturation current.
0 amperes	16.31	0 amperes	16.26
2.5	16.29	2.5	16.06
4.5	16.08	4.5	15.77
6.5	15.86	6.5	15.43
10	15.75	10	15.38
15	15.60	15	14.89
23	15.43	22	14.74

TABLE XIX.

Thickness of aluminium over the top of chamber —8.14 mms.
Thickness of tin over the top of chamber—.0784 mms.
Aluminium above tin.

β rays deflected towards chamber. β rays deflected away from chamber.

Current through magnet.	Saturation current.	Current through magnet.	Saturation current.
0 amperes	16.00	0 amperes	16.10
2.5	16.04	4.5	15.69
4.35	15.66	10	15.56
6.5	15.66	15	15.39
10	15.44	22	15.17
15	15.35	....	.....
18	15.19	....	.....

TABLE XX.

Thickness of aluminium over the top of chamber—8.14 mms.
Radium vertically above chamber.

β rays deflected towards chamber. β rays deflected away from chamber.

Current through magnet.	Saturation current.	Current through magnet.	Saturation current.
0 amperes	15.69	0 amperes	15.37
2.5	15.31	3 amperes	15.31
4.3	15.13	4.5	15.23
6.4	14.97	6.3	14.78
10	14.81	10	14.66
15	14.89	15	14.82
22.5	14.72	22.5	14.74

TABLE XXI.

	Lead.	Tin.	Aluminium.
Thickness required to absorb β and β secondary radiation...............	.9 mm.	2.5 mm.	7 mm.
Thickness giving maximum reflected secondary radiation due to β rays.......	.16 mm.	.24 mm.	.4 mm.
Density....................	11.3	7.3	2.6

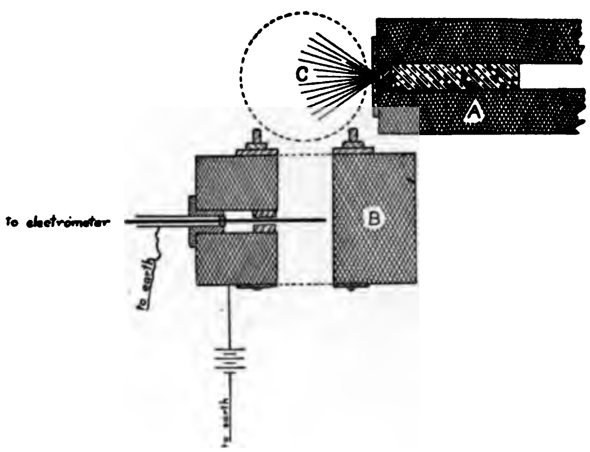


Fig. 1

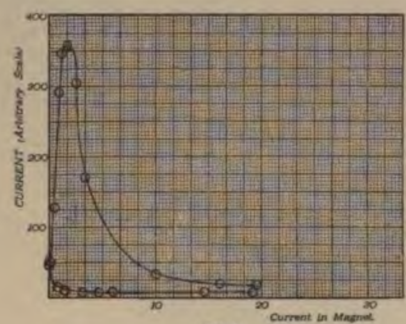


FIG. 2

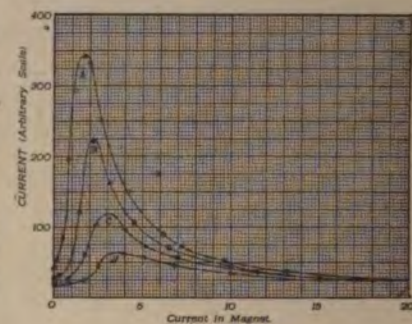


FIG. 3

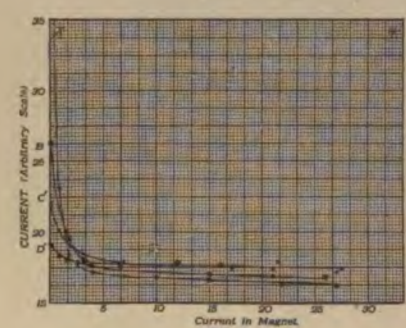


FIG. 4

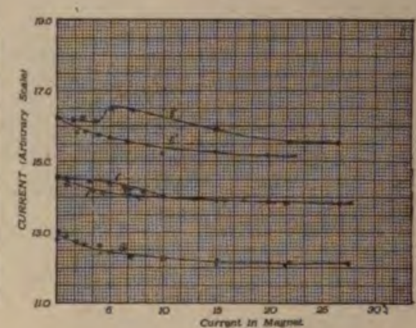


FIG. 5

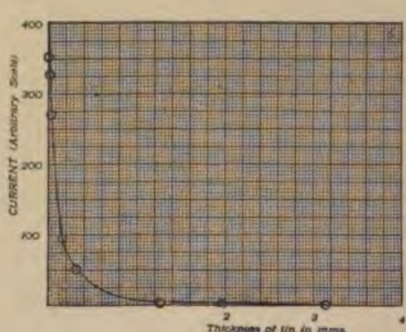


FIG. 6

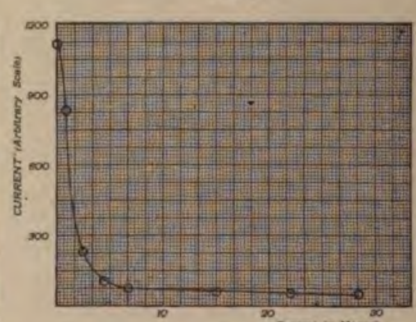


FIG. 7

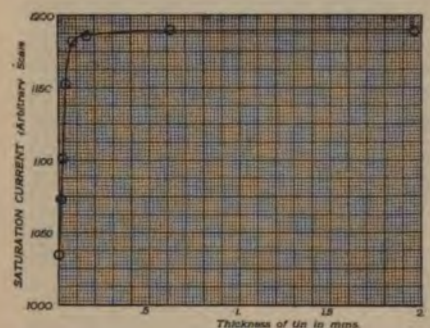


FIG. 8

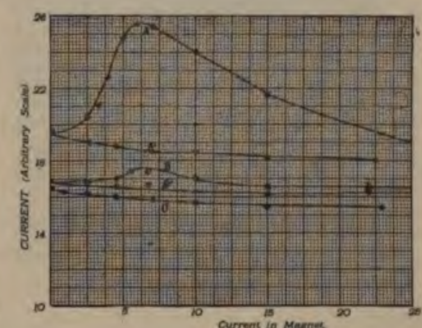


FIG. 9

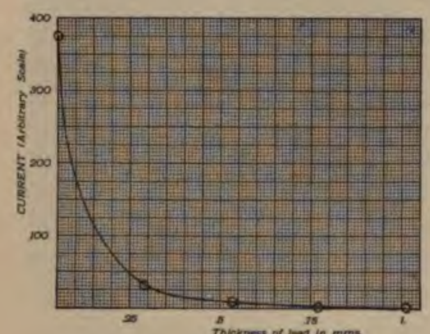


FIG. 10

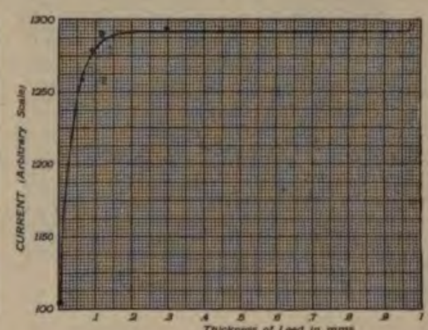


FIG. 11

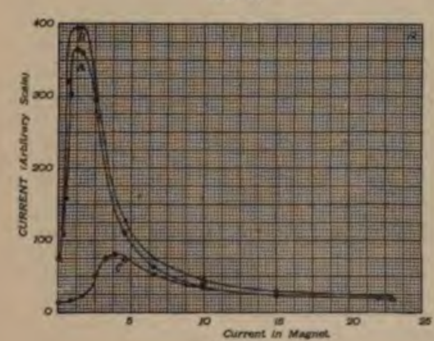


FIG. 12

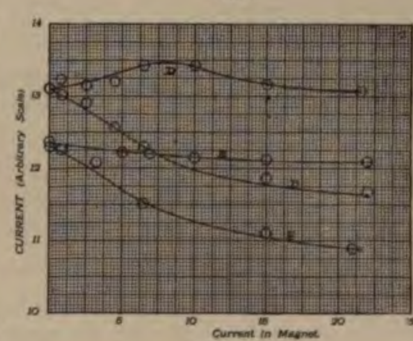


FIG. 13

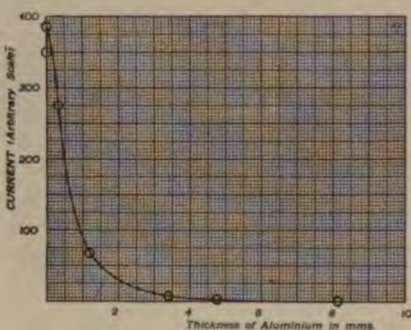


FIG. 14

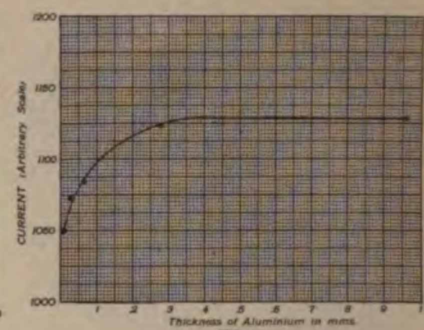


FIG. 15

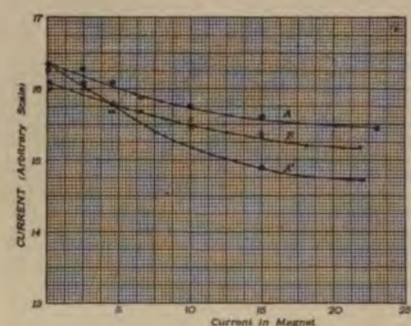


FIG. 16

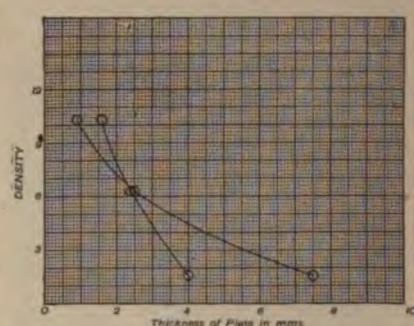


FIG. 18

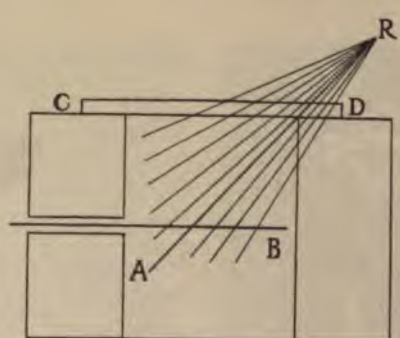


Fig. 17.

VII.—*On Variations in the Conductivity of Air enclosed in Metallic Receivers.*

By C. S. WRIGHT, B.A., 1851 Exhibition Scholar, University of Toronto.

(Communicated by Professor J. C. McLennan, and read May 26th, 1908.)

I.—INTRODUCTION.

In a paper in the *Philosophical Magazine* of December, 1907, Professor McLennan records some observations made on the ionization of air enclosed in cylindrical receivers of lead, zinc, and aluminium. For "q," the number of ions generated per cc. per sec., in these receivers he obtained the value 15, when they were made of zinc and aluminium; while with lead, values were found ranging all the way from 23 to 160 ions per cc. per sec., depending on the sample of lead from which the cylinder was made. From these results, Prof. McLennan drew the conclusion that ordinary commercial lead contained in general varying amounts of some active impurity.

From these and other experiments he pointed out also, that four possible causes must be considered as contributing to the ionization in the cylinders, viz.:—(1) penetrating radiation from the earth, (2) secondary rays excited by this type in the metal of the receivers, (3) radioactive impurities present in the metals, and (4) a possible intrinsic radiation from the metals themselves.

In view of the theoretical importance of ascertaining whether metals generally possessed any specific activity it was thought highly desirable to endeavour to obtain metals as free as possible from active impurities, and also to take observations on the conductivity of air enclosed in vessels made from them in localities and under conditions in which the penetrating radiation from the earth and the accompanying secondary radiation excited by it in the receiver, was very largely cut off, or at least reduced to a minimum.

Several attempts had been made during the last few years to find some efficient screen for the earth's radiation. Cooke, while making some measurements on the conductivity of the air enclosed in a brass cylinder, found a decrease of about 30 per cent when the cylinder was completely surrounded by large masses of lead. Shortly afterwards Elster and Geitel[1] observed a fall of 28 per cent in the conductivity

[1] Elster and Geitel, Phys. Zeit., Nov. 1, 1905, p. 753.

of air enclosed in an aluminium receiver when the apparatus was set up in a rock salt mine. Later still, Cooke[1] was able to reduce the ionization 12 per cent by immersing his cylinder in a reservoir of water to a depth of several feet. The greatest decrease, however, was that observed by McLennan and Burton,[2] who cut off 37 per cent of the conductivity of the air enclosed in a galvanized iron cylinder, by surrounding it with a layer of water drawn from Lake Ontario, 60 cms. thick. This last result, taken in conjunction with an observation by McLennan that Lake Ontario water contains no appreciable radioactive impurities, gave rise to the idea that possibly a large body of water, such as the lake itself, might furnish an efficient screen for the earth's radiation.

The object of the present investigation, therefore, was to observe the conductivity of the air confined in metallic vessels possessing little if any radioactive impurity and from the results to determine, if possible, what portion of the ionization was due to an intrinsic activity in the metal.

In carrying out the investigation, the conductivity of air confined in vessels of lead, zinc, and aluminium was measured at a number of points in the neighbourhood of Toronto, both on land and over the water of Lake Ontario, and it was found that while a uniformly low and steady value was obtained for the conductivity over the water at all depths beyond a few metres, values varying over a wide range were obtained for the ionization, in measurements made on land at different places and on different soils.

The lowest values for "q," the number of ions generated per cc. per sec. in air confined in the metallic cylinders, were obtained in measurements on the surface of the lake and on the top of large masses of sand on the lake shore. With a lead receiver, under these circumstances, the value 8.6 ions per cc. per sec. was obtained for "q," and with zinc and aluminium cylinders, under the same conditions, the values 6.00 and 6.55 respectively. These values, it will be seen from Table I, are considerably below those hitherto recorded for the conductivity obtained under any circumstances of air contained in closed metallic receivers.

---

[1]H. L. Cooke, Phil. Mag., 1903.

[2]McLennan and Burton, Phys. Rev., 3, 1903; Burton, Phys. Rev., 3, 1904.

TABLE I.

Receiver.	Observer.	q	Conditions.
Lead..........	Eve[1]	96	Observations in Physical Lab., McGill, Montreal, —unscreened.
Zinc..........	"	24	
Aluminium....	"	24	
Brass..........	H. L. Cooke[2]	13.6	Unscreened.
Brass..........	"	9.1	Screened by large masses of lead.
			Observations taken in basement of University Library, McGill.
Lead..........	McLennan[3]	23	Unscreened.
Zinc..........	"	15	Measurements made in old Physics department, University of Toronto.
Aluminium....	"	15	
Lead..........	Wright	8.6	Measurements made over the surface of Lake Ontario—receivers otherwise unscreened.
Zinc..........	"	6.0	
Aluminium....		6.55	

II.—Apparatus.

Measurements such as were contemplated on the ionization in metal receivers over the surface of the lake required the use of some instrument which would be portable and at the same time not easily put out of adjustment. The electroscope recently devised by C. T. R Wilson was found to fulfil all the requirements.

The instrument, Fig. 1, consisted essentially of a gold leaf system G, insulated from the outer case by a quartz ring and suspended inside a similarly insulated inner case connected with a quartz Leyden jar of about 100 cms. capacity charged to a potential of —50 volts.

In making a measurement on the conductivity of the air with this instrument, the metal receiver was placed on top of the electroscope, as

[1]Eve., Phil. Mag., Sept., 1906.
[2]H. L. Cooke, Phil. Mag, p. 403, 1903.
[3]McLennan, Phil. Mag., Dec., 1907.

shown in Fig. 1, and supported on ebonite blocks so as not to be in electrical connection with the instrument proper. The receiver was then charged to any desired voltage and the current through the air observed by the charge which was communicated in a given time to the electrode carried by the gold leaf system.

The function of the compensator C, which consisted of a sliding tube condenser was to annul by its motion any charge the system acquired

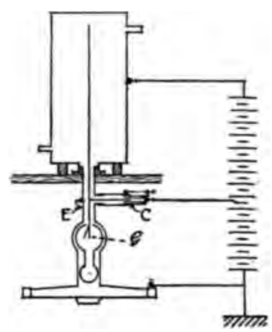


FIG. I

through the conductivity of the air in the receiver; this motion being so regulated as to keep the potential of the gold leaf always at zero, and thus minimize any tendency to promote a leak across the quartz insulation.

Thus, for a determination of "q." it was necessary only to know the charge annulled in the time during which the compensator moved a standard distance.

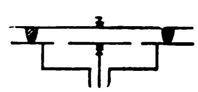


FIG. II

For a determination of the charge corresponding to this standard distance the parallel plate condenser shown in Fig. 2 was added in place of the electrode. The compensator tube was then charged to a known potential, giving for the total motio a certain deflection of the gold leaf; and the voltage on the upper condenser plate was then so adjusted as to bring the gold leaf back to its zero position. The charge could then be readily calculated from the dimensions of the parallel plate condenser and the voltage applied to it.

The corresponding values of voltage on compensator tube and charge annulled are given in Table II, and are illustrated by the curve in Fig 4.

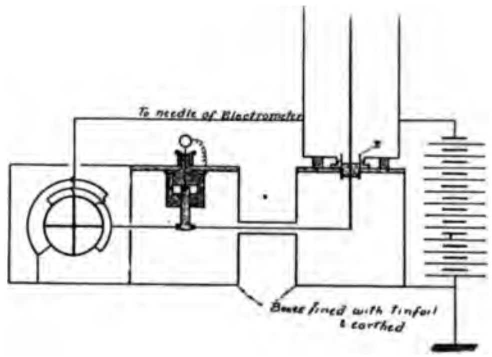


FIG 4

These values were determined experimentally and they showed that the capacity of the tube condenser was, as its construction demanded, practically independent of the voltage applied to it.

TABLE II.

Voltage on Compensator = V	Charge Annulled = E	E/V
	Electrostatic Units	Charge (E.S.U.) per volt
28.4	.1449	.00512
36.7	.1858	.00506
42.9	.2146	.00500
51.1	.2577	.00504
57.2	.2853	.00499
65.4	.3241	.00495
71.4	.3528	.00494
78.3	.3882	.00496
		Mean = .00501

From the following calculations it will be seen how the different constants of the instrument were used in making a determination of the value of "q" for the air contained in a certain lead receiver:

Reading of Compensator distance Scale Divisions (cms.)	Time.	Remarks.
.254	1′ 02″	Date of Experiment, Mar. 19th, 3 P.M.
.508	1′ 45	Locality — Basement of Physics Laboratory.
.762	2′ 29	
1.016	3′ 15	Potential Applied to Cylinder = – 85 volts.
1.270	4′ 05	
1.524	4′ 48	Potential Applied to Compensator = — 13.0 volts.
1.778	5′ 33	
2.032	6′ 17	Vol. of Cylinder = 26700 ccs.
2.286	7′ 05	
3.302	8′ 09	

From Table II, the charge annulled per volt on the compensator tube = .00501.

.˙. total charge annulled in 489″ was
.06513 e.s. units

Thus $.06513 = 3.4 \times 10^{-10} \times q \times 489 \times 26700$
or $q = 14.67$ assuming the charge on an ion to be
3.4×10^{-10} E.S.U.'s.

As a check on the values for "q" obtained with the instrument for the ionization in the metallic receivers, determinations were alternately made in the laboratory with the Wilson electroscope and with a sensitive Dolazelek electrometer. The method of using the latter is shown in Fig. 3. With this arrangement it was possible by simply removing the receiver, unscrewing the electrode and slipping a metal cap over the earthed tube E, to allow for any charge acquired by the electrodes and the free quardrants through possible defective insulation of supports, or by conduction through the air in any part of the apparatus. other than through that in the metal receiver.

The capacity of the instrument was found by measuring in each determination of the conductivity, the rate of motion of the needle, both with and without an auxiliary condenser of known capacity attached to the electrode.

To show how the determination of "q" with this instrument was arrived at and to give an estimation of the magnitudes involved, a measurement was undertaken with the same cylinder and under the same conditions as obtained in the case of the determination with the Wilson instrument, the actual values being given in Table III. These values for "q," as obtained with the two instruments, are seen to be practically the same and so afford a conclusive test of the accuracy of the measurements.

TABLE III.

(1)—Date Mar. 19, 4 p.m.

(2)—Lead Cylinder No. 1.

(3)—Locality—Basement of Physics Laboratory.

(4)—Potential applied to needle + 250 volts.

(5)—Rate of motion of needle without condenser = 13.0 mm. per min.

(6)—Rate of motion of needle with condenser = − 7.4 mm.

(7)—Rate of motion of needle due to defective insulation cylinder being removed and electrode capped = − 1.0 mm.

∴ Rate due to conduction in air in cylinder alone = − 12.0 mm.

(8)—Sensitiveness = 832.2 mm. per volt.

(9)—Capacity of auxiliary condenser = 128.04 cms.

(10)—Temp. 10°C, voltage on cylinder + 85.

(11)—Volume of cylinder = 26700 ccs.

From this we obtain:—

Capacity of electrometer 169.1 cms.

The calculation to determine "q" is then

$$\frac{169.1 \times 12}{832.2 \times 300} = q \times 3.4 \times 10^{-10} \times 60 \times 26700$$

Whence: $q = 14.93$

Before making the final measurements in these comparisons, preliminary observations were made to ascertain what voltage it was necessary to apply to a receiver in order to obtain saturation currents. A set of the different voltages applied and the corresponding values of the currents obtained with a lead cylinder of comparatively high activity. but having dimensions the same as cylinder No. 1 mentioned above, are given in Table IV and a curve to represent them in Fig. 6. From the latter it may be seen that a potential of 60 volts gave a reading well over the knee of the curve, and as the voltage applied in all the determinations lay between 80 and 250 volts, it is clear that saturation currents were always obtained.

TABLE IV.

Voltage on Receiver (positive.)	"q" = No. of ions. per cc. per sec.
2	13.6
4	21.3
6	26.2
8	29.3
11.2	33.3
17.7	37.8
34.0	40.8
47.0	41.6
63.3	42.9
81.6	42.9
163.2	43.3
251.2	44.2

III.—Some Special Observations with Lead Cylinders.

It will be remembered that Prof. McLennan in his investigation of last year drew the conclusion that ordinary commercial lead, in so far as he investigated it, contained in general an active impurity. Such being the case, one should expect a certain falling off in the course of time of the ionization in a lead receiver due to the decay of the activity. It was decided then to determine again the conductivity of air in certain lead receivers used by him in June last in his investigation to see whether any decrease from the former values could be noted. Lead cylinders, described as numbers 1, 2 and 3 in Prof. McLennan's paper, were used for this purpose, and the values of the ionization for each cylinder determined with both the electroscope and the electrometer. These numbers, which are given in Table V, show a considerable decrease in the value of "q" from the values for each receiver obtained by Prof. McLennan.

TABLE V.

Mar. 6th.

q_0= Number of ions per cc. per sec. reduced to zero centigrade.

Lead Cylinder.	By Electroscope.	By Electrometer.	Values obtained by Prof. McLennan.
	"q_0"	"q_0"	"q"
No. 1......	15.14	15.42	23.
No. 2.......	135.8	139.6	160.
No. 3.......	28.55	29.21	37.

This result seemed somewhat surprising in view of the fact that Prof. McLennan had obtained the same numbers repeatedly during a period of over six months. As the experiments made by the writer with the three lead cylinders were carried out in a room in the new physical laboratory, and those by him in one in the older building, it was thought well to make a redetermination in the latter, but, on doing this, it was found that a slightly lower value even was obtained for the ionization in the measurements taken in this room than in those in the new laboratory.

Although the experiments were made in a room supposed to be free, or far removed, from any active substances, it seems probable that there was in the old department, or in the rooms adjacent, some unobserved source of radiation present during Prof. McLennan's investigation which was absent during the measurements made by the writer, and this impurity was very probably removed when the old laboratory was vacated by the Department of Physics and adapted to other purposes.

It might be pointed out that the lowest value for "q" hitherto recorded for the ionization in a lead cylinder, even with this possible additional influence is that of 23 ions per cc. per sec., given by Professor McLennan. The present value of 15, obtained with this cylinder, is still lower, and would seem to indicate that we possessed in this lead receiver one which contained little if any impurity. It was, therefore, especially suitable, if proper screens could be found, for the investigation of any intrinsic activity associated with the metal lead itself.

IV.—Preliminary Observations on Conductivity.

(a)—General conditions of the different experiments—

It has been noted by Prof. McLennan and other observers that when a metallic receiver has been thoroughly scoured with emery or glass paper in order to remove any active coating which may have been deposited on its surface by exposure to the atmosphere, and after being washed with hydrochloric acid, ammonia, alcohol and distilled water, then filled with freshly filtered air and allowed to stand, the ionization of the enclosed air gradually increases for some days and ultimately reaches a steady value. Owing to this effect it was found necessary in comparisons of the ionizing power of radiations existing in any two localities or under any two conditions to make the observations, with the ionization chamber under precisely the same conditions in both circumstances.

The different comparisons were made, therefore, either with a receiver freshly cleaned and freshly filled with filtered air immediately before taking the observations, or else with a receiver containing air which had been allowed to remain in it till the steady state had been reached.

Further, as it was impossible always to obtain observations at different times with the atmospheric conditions the same as to pressure and temperature, it was assumed that the ionization obtained in all localities would vary dirctly with the density of the air in the receiver, and in making any reductions which were necessary in order to reach values which were comparable, assumption, which is amply warranted by the measurements of McLennan and Burton[1] on the ionization of air at different pressures, has been adopted.

In this connection it may be well to emphasize the extreme importance of taking every precaution in making observations such as are described in the present paper, to secure absolute uniformity in the conditions of the measuring receivers. With the different receivers used in the present investigation it was found that when the cylinders were thoroughly scoured and washed in the manner described above, the conductivity of freshly filtered air admitted into the chamber was always the same at any particular observing station, and thus, by always working under these definite conditions, it was possible to obtain very definite results.

Numerous investigators in this field of research have experienced considerable difficulty in arr'ving at concordant results, but if the precautions mentioned are taken, it is possible to obtain a thoroughly reliable value for the conductivity of air enclosed in any metal receiver.

(*b*)—*Daily variation in the conductivity of atmospheric air.*

Among other investigators, Wood and Campbell,[2] McKeon[3] and Strong[4] have observed daily variations in the conductivity of air confined in metallic vessels, and, inasmuch as it was not practicable to take observations in different localities at the same time of day in the

---

[1] McLennan and Burton, Phys. Rev. (3), 1903.
[2] Wood and Campbell, Phil. Mag., Feb., 1907.
[3] McKeon, Phys. Rev., Nov., 1907.
[4] Strong, Phys. Zeit., Feb. 15, 1908.

present investigation, a number of preliminary sets of observations was made throughout different days in a room in the Physics Building on the conductivity of the air confined in a lead receiver, in order to obtain evidence of the daily variation, and also, if such existed, to obtain an estimate of its magnitude.

Two sets of continuous readings taken in this way with the air in a lead cylinder in the steady state mentioned above, are given in Table VI, and from the values quoted it will be seen that there is no evidence of any appreciable regular variation in the conductivity. It is to be noted, too, that the extreme values obtained did not differ from the mean conductivity by more than 3 per cent of the latter.

TABLE VI.

Lead Cylinder 1, in steady state. Voltage on Cylinder—83.

Time.		q° = number of ions per cc. per sec. reduced to 0° C.
Dec. 24th—	10.23 A.M.	22.48
	10.43	22.51
	11.10	22.54
	11.32	22.45
	11.55	21.74
	12.15 P.M.	22.73
	12.40	21.96
	1.00	22.94
Dec. 26th—	9.35 A.M.	22.44
	9.58	21.86
	10.20	21.87
	10.45	22.25
	11.05	22.96
	11.28	22.79
	11.50	22.53
	3.55 P.M.	22.65
	4.15	22.54
	4.40	22.94
		Mean = 22.45

In the results which will be given later it will be seen that variations amounting to as much as 75 per cent were obtained in the conductivity by a change in the observing station, and from the results obtained and given in Tables IX, X and XI it will be seen that any variation in conductivity due to daily changes in the value of the penetrating radiation from the earth which might have existed, were negligible in comparison with the variation in the conductivity due to a change in the point of observation.

(*c*)—*Secondary radiation from the walls of a room.*

In view of the existence of a penetrating radiation at the surface of the earth having its origin either in the atmosphere or in the soil. and in view of the production by such radiations of secondary rays at the surface of substances traversed by them, it was thought advisable, before going on with the main part of the investigation, to see how far the influence of a secondary radiation excited in the walls of a room could be detected from those walls.

To obtain some information on this point, two plans suggested themselves,—(1) to place the conductivity chamber at a selected distance from a wall and to study the secondary rays excited at that wall by a quantity of radium placed at points on a circle with the chamber at its centre; (2) to study the variation in the ionization in a metal receiver with the radium at a fixed distance from the wall and the chamber placed at points on a circle with the radium as centre. A set of measurements was made by following the first plan, but time has not permitted the carrying out of a series of observations with the second arrangement.

The electroscope, provided with a zinc receiver, in these measurements was placed at a distance of about one metre from the wall of a large room, and the radium enclosed in a lead box with walls 2 cms. in thickness, was moved around the circumference of a circle having as centre the cylinder and as radius the distance of the same from the wall.

The values for "n," the number of ions per c.c. per sec. due to the primary radiations from the radium, as well as the radiation emitted by the brick wall, together with the corresponding secondary rays excited in the metallic cylinder, are given in Table VII, and shew a regular decrease in the ionization as the distance of the radium from the wall was increased, with indications of a possible smaller maximum for a definite angle subtended at the wall by the line joining the radium with the electroscope. A curve representing the variation of "n" with the distance of the radium from the wall is given in Fig. 6. From these results it is clear that for all positions of the radium a secondary radiation of considerable intensity was emitted by the brick wall under the excitation of the rays from the radium.

TABLE VII.

Cylinder of zinc.
Potential of cylinder = 250 volts, positive.
Radius of circle on which radium was placed, about 1 metre.

Distance of radium from wall (cms).	Ionisation (arbitrary scale).
5.5 cms.	72.93
10.0	71.74
16.2	69.16
23.4	69.83
28.6	69.16
63.6	67.94
98.0	66.31
146.0	65.70
5.5	72.93

In order to obtain further information regarding this secondary radiation the instrument provided with an aluminium cylinder was moved to one of the corners of the room and a similar set of observations made, the values obtained for "n" in this case being given in Table VIII, and illustrated by the curves in Fig. 7.

TABLE VIII.

Distance of aluminium receiver from far wall = 300 cms.
Distance of aluminium receiver from near wall = 105.5 cms.
Potential of receiver = 250 volts positive.
Radium placed on ciicle 100 cms. radius, with receiver at centre.

Distance of radium from near wall.	Ionisation (arbitrary scale.)
5.5	51.86
10.9	50.89
20.	50.68
41.4	49.95
55.1	49.13
76.4	49.80
110.9	50.63
153.7	50.00
197.	48.08

There again it is seen that the effect of the secondary radiation was quite marked. As the results show the ionization steadily decreased to a minimum value which corresponded approximately to the position in which the radium was on the line joining the electroscope to the corner of the room. After passing through this minimum value the ionization then steadily increased and reached a maximum when the radium was slightly beyond a line drawn from the cylinder perpendicular to the far wall. After this the ionization fell away again as the distance of the radium from both walls was increased.

The maximum variation in the values of "n" for these experiments, it will be seen from Tables VII and VIII amounted to as much as 10 per cent. It seemed reasonable, therefore, to suppose that the presence of some such object as a brick wall might, when the penetrating rays from the earth impinged upon it, in the same way affect the natural ionization in any metallic cylinder, and care was, therefore, taken in the measurements made when determining the screening effect of the lake and of different soils, to place the electroscope and receiver as far away as possible from any building which might modify in some such way as that indicated the ionization of the enclosed air.

V.—Screening Experiments.

Being assured from the foregoing experiments that changes in the ionization due to daily variations were inconsiderable in comparison with variations due to a change in position, three series of measurements were then undertaken with the object of investigating the screening effect of Lake Ontario, care being taken to choose positions of observation as far as possible from any artificial surroundings. The first and second series were made with lead cylinders after the ionization had reached the steady state and the third with well cleaned cylinders of lead, zinc and aluminium containing freshly filtered air. A considerable decrease in the ionization when measured over the water was noticeable in every case, a reduction of as high as 60 per cent being recorded in the case of the freshly cleaned lead cylinder in the third series of measurements referred to above.

1.—*Measurements on board steamer "Corona."*

In the first set of measurements a series of observations was made on a selected day in the laboratory on the conductivity of the air enclosed in a lead receiver which had not been recently cleaned, and the mean of these readings was found to give a value of 42 ions per c.c. per sec. for the conductivity. Measurements were then made on the same day on board the SS. "Corona" during one of her voyages, and also at a number of points on land on the south side of Lake Ontario, between Queenston Heights and Niagara Falls. These results are recorded in Table IX.

TABLE IX.

Comparison of conductivity experiments made on Steamer "Corona" with those made on land.

"q_o" = Number of ions generated per cc. per sec. at 0°C.	Locality.
41.7 (mean value)	Physical Laboratory.
34.9, 35.6, 35.2	On board "Corona" outward trip.
43.3	Queenston Heights.
42.4	Pavilion Niagara Falls Park.
42.	Tunnel of Ontario Power Co., 42 metres underground.
35.9, 35.5, 36.5	On board "Corona" homeward trip.

Mean of results of land experiments = 42.3 ions per cc. per sec.
Mean of results of steamer experiments = 35.6 ions per cc. per sec.
Difference = 6.2 ions per cc. per sec.

From the table it will be seen that the ionization at different points on the limestone soil of the Niagara District was practically constant. It will be seen, too, that the ionization obtained about 42 metres underground at the Falls was practically the same as that obtained at the surface on the limestone ridge. We see also from the figures that the screening action of the lake minus any effect due to an intrinsic radiation from the boat itself is represented by the value of 6.7 ions per c.c. per sec. with the particular lead cylinder used. From the figures which are given later in Table X it will be seen that the screening effect of the lake in a cylinder of lead in the condition of that used in the above experiment is represented by 9 ions per c.c. per sec., which shows that approximately 2.3 ions per c.c. per sec. must have been due to a radiation emitted by the steamer or by its contents.

2.—*Measurements made along the waterfront of Toronto Bay.*

A second series of measurements was made with the lead cylinder referred to in the first portion of the paper as No. 1, after it had reached what has been referred to above as the steady condition, observations on the ionization being taken at different points along the water front of Toronto Bay.

The results given in Table X shew a total decrease of 9 ions per c.c. per sec. from the value of "q" obtained in the laboratory, due to the screening action of the water, and they seem to indicate in addition that the ionization over sand banks washed up by the waves was but little greater than that over water even of a considerable depth.

TABLE X.

Dec. 28th.

Lead Cylinder 1, in steady state.

"q_0" = number of ions per c.c. per sec. (mean value.)	Locality.
22.5	Laboratory of new Physics Building.
19.3	Under York St. Bridge—"made land," 30 m. from water.
14.1	South end of west side of Eastern Gap, 3.40 m. from shore; water 4.6 m. deep.
14.2	Sand spit of Ward's Island, 110 m. from shore.
13.5	Toronto Canoe Club House. Light pine structure on piles. Water 5.6 m. deep.

This result is probably due to the fact that any radioactive substances originally present in the sand have been washed away by the action of water.

In this connection it is important to note that in making these determinations of the conductivity of air enclosed in lead receivers it was frequently observed that in the measurements on the surface of the lake with newly cleaned lead cylinders, filled with freshly filtered air, the drop in conductivity observed was invariably about 50 per cent less than the drop obtained with lead cylinders which, after being well cleaned and filled with clean air, had been allowed to stand long enough to reach the steady state.

This difference in the drop in conductivity is well illustrated by the results obtained with the lead cylinder No. 1. With this cylinder in the steady state, as the numbers in Table X shew, the conductivity when measured in the laboratory corresponded to the generation of 22.5 ions per c.c. per sec. With the same cylinder freshly cleaned and filled with well filtered air the conductivity, as measured in the same room in the laboratory always corresponded to the generation of approximately 15.3 ions per c.c. per second. In the measurements on the surface of the lake water, however, the conductivity corresponded to the generation of 13.9 ions per c.c. per second when the cylinder was in the steady state, while, as will be seen from the results recorded in the next section, it corresponded to the generation of only 8.5 ions per c.c. per second when the cylinder had been freshly cleaned and filled with filtered air.

This difference in the values obtained for the drop in conductivity with the lead cylinder in the two conditions can no doubt be traced to differences in the secondary radiation excited in the walls of the vessels by the penetrating radiation from the earth.

It is clear that the surface of the lead after being freshly cleaned must have gradually become covered with a deposit through oxidation and other causes, and it is reasonable to conclude that the presence of this deposit would produce such a modification in the intensity of the secondary radiation as to bring about the results described.

3.—*Measurements made in different localities and with different receivers freshly cleaned.*

The preliminary measurements just described made it abundantly evident that the lake water acted as a very efficient screen for the earth's radiation, a maximum decrease in the value of "q," of as much as 9 ions being recorded in the last series of observations. A careful set of measurements was therefore undertaken, having for its object a determination of the relative decrease in the values of "q" over water from those obtained in the laboratory, when freshly cleaned receivers of lead, zinc and aluminium were used in turn as the containing vessels. In the case of the lead cylinder the conductivity was measured at a larger number of points to determine if possible in what way the ionization was influenced by external conditions such as a change of soil.

The results, which are in many cases the mean of a number of observed values obtained on different occasions and differing but slightly from one another, are given in Table XI.

From the values of "q," given in Table XI, for the three receivers, we obtain for the difference between the ionization in the laboratory and over the water the numbers 6.7, 7.4 and 6.0 for the receivers of lead, zinc and aluminium respectively. These values then may be taken as given by a measure of the relative ionization in the three receivers due to that portion of the radiation from the earth which was cut off by the water, together with the secondary rays induced by the radiation in the different cylinders. That the actual numbers obtained for "q" at any observing station were not in the same ratio as these decreases is a conclusive proof that the ionization measured at these stations was not due entirely to the radiation from the earth.

It might be well to call attention again to the fact that these decreases in the receivers of lead, zinc and aluminium of 6.7, 7.4 and 6.0, which are in the ratio of 1.1 to 1.23 to 1.00, must give a true measure of the total ionization in the three receivers which is due to a portion, at least, if not the whole of the penetrating radiation from the earth. If then we could obtain cylinders of lead, zinc and aluminium free from active impurities and possessing no intrinsic activity, we should expect the values for "q" at every point on the surface of the earth to be in this ratio.

Emphasis might also be laid upon the extremely low values found for the ionization over the water when the cylinders were freshly cleaned and freshly filled with filtered air. These values of 8.6, 6 and 6.5 obtained for the receivers of lead, zinc and aluminium are very much lower than those obtained by any other observer under any conditions, and afford a conclusive proof of the efficacy of Lake Ontario water as a screen for the earth's penetrating radiation.

The experiments made at Stations 5 and 6 are of special interest, as the conductivity obtained at these points was practically the same as that obtained in the experiments on the surface of the lake, which shows that the sand was entirely free from the radioactive substances which were probably present in the clays and rocks at other points of observation.

VI.—Secondary Rays Induced by the γ Rays from Radium.

To determine if this ratio of 1.1 to 1.23 to 1.0 for the three receivers of Pb., Zn. and Al. would be found to hold also in the case of ionization due to the γ rays from radium, a series of measurements was undertaken with the electrometer used before.

A quantity of radium bromide encased in a lead box with walls 2 cms. thick, was used as the source of the penetrating rays, and the ionization measured in each receiver for different distances between it and the radium. The difference between the ionization before and after the radium was placed in position was recorded as due to the primary rays from the radium together with the secondary rays excited by them in the receiver. From Table XII it will be seen that "n," the value of the ionization in each receiver due to the presence of the radium, varied inversely as the square of the distance "d" from the cylinder, the same variation being shown graphically in Fig. 8. In this connection it may be noted, however, that for distances less than three metres a much larger value for "n" was obtained than was demanded by the law of the inverse square.

TABLE XII.

d= Distance of Radium from Cylinder. (Metres.)	Lead.	I	Zinc.	I	Aluminium.	
	"n"	nd^2	n	nd^2	n	nd^2
6.0	223.5	6847	154.7	5569	135.4	4874
5.5	262·6	6933	181.9	5866	....	....
5.0	314.6	7022	229.6	5740	195.3	4882
4.5	381.9	7047	279.8	5665	246.3	4987
4.0	478.3	6899	359.7	5755	317.1	5074
3.5	....	7371	462.	5668	421.7	5166
3.0	....	....	....	....	842.5	5266
		Mean =6976		Mean =5711		Mean =4996

This variation from the law appeared at first sight somewhat difficult of explanation. On consideration, however, of the results obtained in the previous section, it at once seemed evident that the variation of "n" from the value of it demanded by the law of the inverse square was but another manifestation of the same secondary radiation excited by the presence of the radium in the neighbourhood of the brick wall against which the electrometer was set up.

In Table XII the value of the constant "nd^2" has been calculated, giving for the receivers of Pb., Zn. and Al. respectively the numbers 6976, 5711, and 4996, which are thus a measure of the ionization in the different cylinders due to the γ rays from radium plus the secondary rays induced by them in the enclosing metals. These numbers we see are in the ratio of 1.4 to 1.14 to 1.0 for the three metals Pb., Zn., and Al., whereas the ratios arrived at from the figures of Table XI for the corresponding effects due to the earth's radiation were 1.1 to 1.23 to 1.00. The considerable difference beween these ratios would thus seem to indicate a difference in penetrability between the γ rays from radium and the penetrating radiation from the earth. It is possible, however, that the discrepancy may have had an entirely different origin and further measurements should be made to ascertain the cause of it before a satisfactory explanation can be offered.

VII.—Experiments on Absorbing Power of Water.

From the foregoing experiments with radium in conjunction with the effect noticed in IV c., we see that there was in each case some additional effect inside the cylinder which must be considered as due to the presence of the wall. From these experiments the idea presented itself that possibly the earth's penetrating radiation was the same at all points on its surface, and that the differences observed in the values for "q" for the land and water experiments were due not so much to differences in the absorbing power of the different soils as to differences in a secondary radiation induced in the crust of the earth by this penetrating radiation.

To determine if any effect of this kind could be noted in the case of water for the penetrating rays from radium, the sample used in the investigation described in Section IV was lowered under the ice on Grenadier Pond, and the ionization noted in a lead cylinder placed above it for different depths of the radium. In making these measurements the radium was hermetically sealed in a glass tube, which was then enclosed in a tube of brass, whose walls were 1 cm. in thickness.

The results (Table XIII) shewed that 2 metres of water completely cut off all effect from the radium—both primary and secondary, the same being illustrated by the curve in Fig. 9.

TABLE XIII.

Cylinder 113 cms. above ice.

Depth of water over radium = d.	Number of ions due to radium = "n."
0 metres.	4485
½	447.2
1	16.11
2	.69
3.65 at bottom	.62

This result, surprising as it at first sight appeared, is exactly what one would expect from a consideration of the values of Table XI, which shew that practically the same value for the ionization was obtained over water of depths ranging from 2.5 to 10 metres. Owing also to this fact that complete absorption of the γ rays from radium took place it is clear that over the water of Lake Ontario, at least, there is no appreciable secondary effect due to the earth's penetrating rays, such as has been shewn to be emitted by a brick wall under bombardment by the γ rays from radium.

Since, in addition, we know from an observation made by Prof. McLennan, that the waters of Lake Ontario contain no appreciable radioactive emanation, the conclusion is forced upon us that in the case of the experiments described above with the cylinders of lead, zinc, and aluminium, the water of the lake acted as a perfect screen for the earth's penetrating radiation, and the values of "q" recorded in Table XI for Observation Station No. 2 may be taken to represent the conductivities impressed upon the air either by intrinsic radiations arising from the metals of the receivers themselves, or else by radiations from active impurities still remaining in them.

Taking in the case of the lead cylinder the value of 8.6 ions per cc. per sec., as due to intrinsic activity, we have a means then of calculating the ionization in this cylinder, due to the soil alone in any position on the surface of the earth.

From the value of 11.1 ions obtained with the lead cylinder over clay (given in Table XI) a calculation shews that 2.6 ions per c.c. per second in such a cylinder is due to the soil alone. If now we assume, as seems justifiable from the experiments of Professor McLennan, *loc. cit.*, on the conductivity of air enclosed in lead receivers, that the ratio of the ionization due to the secondary rays in a lead cylinder of the dimensions of those used in this investigation, is twice that due to the primary, it follows that approximately 0.9 ions would be generated in free air over a clay soil by the earth's penetrating radiation in the localities referred to above.

On the basis of Strutt's determination of the radium content of the rocks and soils, Strong[1] has recently deduced a value of 0.8 ions as an upper limit for the ionization in free air due to the penetrating rays from radioactive substances in the soil, and this number it will be seen is in good agreement with the experimental result obtained in this investigation.

In passing, it might be noted that this calculation throws some light on the results obtained (Table VI) for the regular daily variation,

[1] Strong, Phys. Zeit., 9, pp. 117-119, Feb. 15, 1908.

which it will be remembered was found to be inappreciable, and which is exactly what should be expected if only some two or three of the ions generated in the cylinder per c.c. per second were due to a penetrating radiation from the earth.

VIII.—Summary of Results.

The results obtained in the preceding investigation may be summed up as follows:—

(1) No evidence of a regular daily variation was noted.

(2) It has been shown that there is a penetrating secondary radiation set up by penetrating rays such as those from radium, in the brick wall of a room.

(3) Proofs have been adduced to show that the water of Lake Ontario acts as a perfect screen, both for the earth's radiation and if a sufficient depth be taken, for the γ rays from radium. On this account, and owing to the fact that the water of Lake Ontario contains no active impurity, it has been possible to determine what portion of the ionization in the receivers used in this investigation was due to residual active impurities and to intrinsic activity in the metals of the receivers.

(4) Based on this fact, a determination has been made of the ionization in free air due to radioactive impurities in a clay soil, and this value, 0.9 ions per c.c. per second, has been found to be in close agreement with a value deduced by Strong from Strutt's determination of the radium content of the earth.

(5) The ratio of the ionization in cylinders of lead, zinc, and aluminium due to the radiations from the earth has been determined and has been found different from the ratio for the ionization due to the gamma rays from radium,— a result which needs confirmation, but which points to a difference in the penetrability of the two radiations.

(6) The values obtained in the open for the ionization in well cleaned receivers of lead, zinc, and aluminium, are lower than any hitherto recorded, the numbers 8.6, 6.0 and 6.5 respectively being obtained over the water of Lake Ontario.

Considered as a whole, the experiments described above are interesting from the light which they throw on the question of the radioactivity of metals and substances generally. The values obtained for "q" for the three cylinders at Station 2, Table XI, differ from each other but little. They are, moreover, of the order of magnitude of effects which might easily be accounted for by active impurities in the metals, since differences as large as these values of "q" may easily be obtained with cylinders made from different samples of almost any metal selected at random. Considering also the difference in the atomic weights of the three substances, aluminium, zinc, and lead, and having in mind that radioactivity is a property associated with atomic structure, it would seem that if these metals could be obtained entirely free from active impurities, and the conductivity of air contained in vessels made from them studied, it would be found, if the observations were carried out under conditions, or in places where no ionization was possible from penetrating radiations arising from external sources, to drop to a very low value if it did not entirely vanish.

In conclusion I desire to thank Professor McLennan, both for his valuable suggestions and for his assistance at all times throughout the investigation.

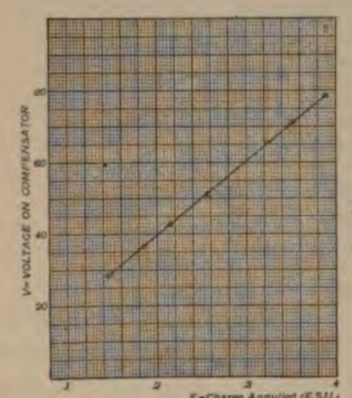


FIG. 3

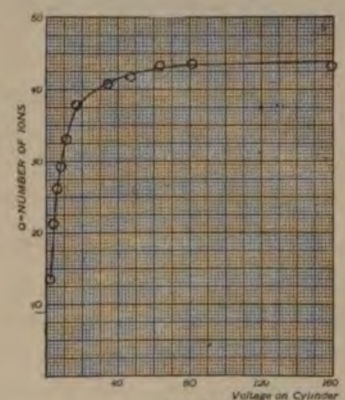


FIG. 5

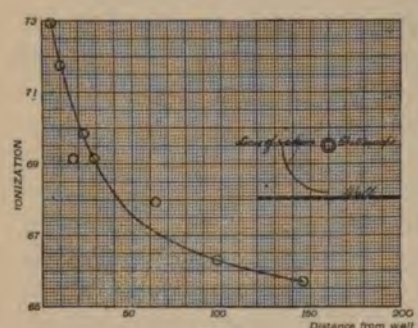


FIG. 6

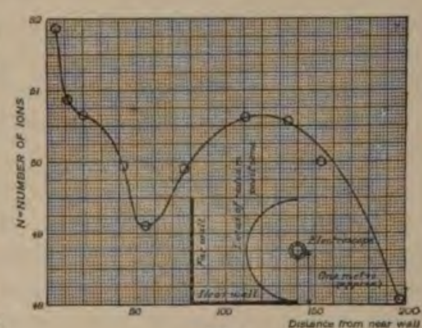


FIG. 7

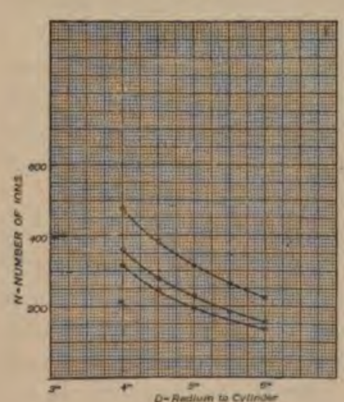


FIG. 8

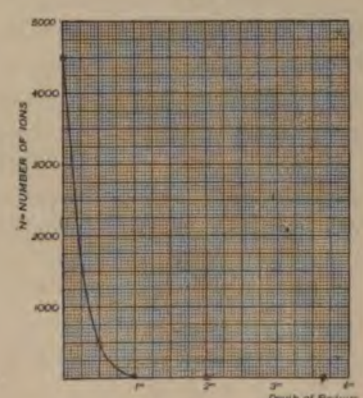


FIG. 9

VIII.—*On the Charges gained by Insulated Metallic Conductors, surrounded by other Conductors, and the Relation of these Charges to the Volta Effect.*

By J. K. ROBERTSON, M.A.,

University of Toronto.

(Communicated by Prof. J. C. McLennan, and read May 26, 1908).

I. INTRODUCTION.

In 1903 McLennan and Burton [1] found that a metal cylinder, either of lead, copper, zinc, tin, or aluminium, placed within, and insulated from an outer earthed one of the same material, gradually acquired a negative charge, the value of which steadily rose to a maximum which varied with the metal. In November, 1907, McKeon [2] published results of experiments made concerning the same effect, which are not altogether in agreement with those observed by McLennan and Burton. He found, in the case of lead and tin receivers, that the charge acquired was positive. Further, while the observations of McLennan and Burton extended only over a period of some hours, his were continued for several days. During such an interval, moreover, he observed very considerable variations in the value of the charge. From his observations he concluded that these changes took place at definite periods of the day, and, in explanation, suggested a connection between them and the diurnal variations in the ionization of atmospheric air, to which attention has been drawn by Campbell and Wood,[3] and others.

In view of the lack of agreement existing between the two sets of observations, the writer undertook to make a closer examination of the effect in order to ascertain, (1) its cause and (2) its relation to variations in the earth's penetrating radiation, and to the daily changes in the ionization of the atmosphere noted above.

On making a rather exhaustive set of observations with different metals, it was found that the sign acquired by the insulated cylinder varied largely with the treatment to which the surfaces of the outer and inner cylinders were subjected. For example, it was found possible, with two particular pairs of cylinders, to alter the sign of the charge merely by thoroughly cleaning the surfaces. A summary of the results obtained in a variety of cases is given in Table I, and it will

[1] Phil. Mag., Sept., 1903.
[2] Phys. Review, Nov., 1907.
[3] Phil. Mag., Feb., 1907.

be seen from it that a close connection exists between the surface condition and the nature of the charge acquired.

Variations with time in the magnitude of the charge were also observed in a number of cases, but these, in so far as the observations extended, were not such as to indicate any periodicity. In only one case, that of lead No. 1 in lead No. 2, were observations made for a very extended period of time, and the resulting curve (*vide* Fig 1), although showing marked variations, would hardly indicate the presence of definite periodic changes.

TABLE I.

No.	Combination.	Sign of charge of insulated cylinder.	Maximum and minimum values of potential of insulated cylinder in millivolts.	Remarks.
1	Lead No. 1 in No. 2.....	+	102 approx.	Needle positive.
2	Lead No. 1 in No. 2.....	+	113	Needle negative. Same day as No. 1.
3	Lead No. 1 in No. 2.....	+	79, 72, 78.	Needle positive. Radium used. Four days after No. 1.
4	Lead No. 1 in No. 2.....	–	46, 32	After cleaning. Radium used. Needle positive.
5	Lead No. 1 in No. 2.....	–	45, 41, approx.	Needle negative. Radium used.
6	Lead No. 1 in No. 2.....	–	31.8	One day after No. 4.
7	Lead No. 1 in No. 2.....	–	29 approx.	Radium inside inner cylinder. One day after No. 6.
8	Lead No. 1 in No. 2.....	–	27, 24, 25	Four days after No. 4. Radium used.
9	Lead No. 1 in No. 2.....	–	13	Twenty days after No. 4.
10	Lead No. 1 in No. 1.....	+	84.6, 83, 31	Fourteen days after No. 4. No. 1 had not been cleaned for some months.
11	Lead No. 1 in No. 3.....	+	59, 58, 55	Radium used but removed between the values 58 and 55.
12	Lead No. 1 in No. 3.....	+	22, 9	Radium used. Lead No. 1 had been cleaned about 7 days.

TABLE I. Contd.

No.	Combination.	Sign of charge of insulated cylinder.	Maximum and minimum values of potential of insulated cylinder in millivolts.	Remarks.
13	Lead No. 1 in No. 3.....	+	42.5, 41	Fourteen days after No. 12.
14	Lead No. 2 in No. 3.....	–	50	Radium used, inner cylinder had been abraded with emery paper.
15	Double combination. Lead No. 1 in Lead No. 2. Lead No. 2 in Lead No. 3...............	–	27.2, 21	Radium used. Eleven days after No. 4, and four days after No. 14.
16	Double combination. Lead No. 1 in Lead No. 2. Lead No. 2 in Lead No. 3...............	–	13, 5	Two days after No. 15.
17	Lead No. 2 in No. 4.....	+	174, 160	Cleaned one day before.
18	Lead No. 2 in No. 4.....	–	268.7	One day after No. 17.
19	Lead No. 2 in No. 4.....	+	105, 70	Three days after No. 17.
20	Lead No. 2 in No. 4.....	+	105, 70	Five days after No. 17.
21	Lead No. 2 in No. 4.....	+	105, 70	Six days after No. 17.
22	Lead coated with aluminium paint. No. 2 in No. 4...............	–	22.6	
23	Same combination, two coats of bronze paint.	+	75	
24	Same combination, two coats of bronze paint..	+	125	One day after No. 23.
25	Tin No. 1 in Tin No. 1..	–	83, 66, 85	
26	Tin No. 2 in Tin No. 2...	–	91, 48, 89	Nos. 1 and 2 were made out of the same sheet of tin.
27	Double combination. Tin No. 1, No. 2 in Tin No. 2..................	–	94	Two days after No. 26.
28	Tin No. 2 in Tin No. 2....	+	171, 38	After cleaning.
29	Tin No. 2 in Tin No. 2...	+	82	One day after No. 28.

TABLE I. Contd.

No.	Combination.	Sign of charge of insulated cylinder.	Maximum and minimum values of potential of insulation cylinder in millivolts.	Remarks.
30	Tin No. 1 in Tin No. 1, both coated with aluminium paint........	–	162	Eleven days after No. 25
31	Tin No. 1 in Tin No. 1, both coated with aluminium paint........	–	156, 155	One day after No. 30.
32	Same combination coated with tinfoil..........	–	36.4, 25.5	
33	Same combination coated with tinfoil..........	–	27.2	One day after No. 32.
34	Same combination with tinfoil scraped off.....	–	76, 60	
35	Combination No. 34 + a coat of bronze......	–	91, 66	Five days after No. 34. At first a small positive charge indicated.
36	Combination No. 34 + a coat of bronze......	–	103	Two days after No. 35. At first a small positive charge.
37	Zinc in Zinc...........	+	92, 51	Cleaned before using. The inner and outer cylinders were not out of same sheet.
38	Zinc in Zinc, both covered with one coat of aluminium paint......	+	189, 175	Two days after No. 37.
39	Zinc in Zinc, both coated with two coats of aluminium paint........	–	Off the scale, 475	Three days after No. 38.
40	Zinc in Zinc, both coated with two coats of aluminium paint........	–	Off the scale, 740	Four days after No. 39.

Throughout the investigation the Volta effect seemed to be of considerable importance, so much so that the writer was led to undertake a series of experiments to determine, if possible, by a somewhat similar method, the contact potential difference between two metals. A few measurements have been made, and these seem to indicate that, in this latter investigation at any rate, secondary radiation is a very important factor in modifying results arising from the Volta effect.

II. Experiments—Metal Effect.

In carrying out the investigation, an attempt was made to examine as many combinations of cylinders as possible, and use was made of the following materials, (1) four outer and two inner cylinders of lead. These were made of lead selected at random from different sheets taken from the stock in the laboratory workshop; (2) two outer and two inner ones of tin — all made out of the same sheet of the substance; (3) an outer and an inner of zinc, made from two entirely different sheets of the metal.

An effort was also made to ascertain, if possible, the connection between the surface condition of the metals, and the sign and nature of the charge gained by the inner cylinder. To accomplish this, cylinders were washed with the different solutions and abraded to a greater or less extent with emery paper. Sets of observations were also taken with cylinders coated with aluminium and with bronze paints.

The outer cylinders were about 60 cm. long, and 25 cm. in diameter, the inner ones two or three centimetres shorter, and about 15 cm. in diameter. Larger ones were made in one or two cases, by joining two outer ones and two inner ones together, so as to ascertain in this way the effect of thus varying the size of the cylinders.

Method of Experimenting.

The method of measuring the charge was essentially the same as that employed by the previous investigators. The inner cylinder was insulated from the outer by means of paraffin blocks, and the charge acquired measured by a sensitive quadrant electrometer. Connection was made as shown in Fig. 2. The lid at one end of the outer cylinder had a cylindrical projection of the same material, which was inserted into a box lined with tin foil. This box contained the special arrangement devised by Prof. McLennan,[1] for making and breaking the earth connection of one pair of quadrants without altering the capacity of the system. To one end of the inner cylinder was soldered a piece of metal of the same material, which also projected into the box, and was joined to the "make and break." The inner cylinder and all wires connecting it to the electrometer were screened from electrostatic disturbances by means of earthed conductors.

[1] Phys. Review, March, 1905.

The electrometer used was of the Dolezaleck type, the quadrants being insulated with ebonite supports, and it had a sensibility such that for a potential of one volt, it gave a deflection of about 600 mm., on a scale about one metre from the needle. A few readings were taken with another instrument of the same type, with amber supports. No difference was observed, however, between the results obtained with the two instruments.

The chief difference between this arrangement and that of the previous investigators lay in the fact that they used air-tight receivers, while those of the writer were not hermetically sealed. This is of some importance, as it has been shewn[1] that the conductivity of air enclosed in a metallic receiver gradually increases with the time it is confined. Meteorological conditions might also have a disturbing influence.

III. Discussion of Results.

(*a*) Change of sign of charge acquired by the insulated cylinder. A glance at Table I will show the great variation observed in the sign of the charge acquired, by the respective insulated cylinders. Even with a selected combination of cylinders, the sign acquired was not always found to be the same, for, in some cases, it was possible to reverse the sign by simply cleaning the metals. Lead No. 1 in lead No. 2 (*vide* Table I, Nos. 3 and 4) changed from positive to negative after the cylinders had been thoroughly cleaned by being abraded with emery paper, and then washed with distilled water, dilute hydrochloric acid, water, ammonia, water and alcohol. On the other hand, tin No. 2 in tin No. 2 was reversed from negative to positive, after being washed in the same manner (*vide* Table I, Nos. 26, 28 and 29).

---

1 McLennan and Burton, Phys. Rev., Vol. XVI, No. 3, 1903

TABLE II.

Lead No. 1 in lead No. 2.
Without radium.

Time.	Deflection (millivolts).
50″	6 positive
1′ 20″	11
2′ 15″	17
2′ 55″	21
4′ 8″	27
4′ 52″	32
6′ 5″	38
7′ 5″	42
9′ 7″	51
11′ 5″	57
14′ 10″	65
19′ 45″	76
26′ 50″	84
36′ 45″	91
58′ 15″	96
79′ 10″	96
1 hr. 30′	97
1 hr. 43′	97
3 hr. 16′	100
5 hr. 37′	102
6 hr. 18′	108
18 hr. 22′	113

In all cases where the inner and outer cylinder were known to be of the same composition, namely, tin No. 1, tin No. 2, and tin No. 1. with its various coats of paint, with the single exception of the cleaned tin, the sign was negative. Whenever the outer and inner cylinders were not of exactly the same material, there would be a contact potential difference, and in all such cases this would be an important factor in determining the nature of the charge acquired. Assuming that there was a negative effect due to another cause, this Volta effect would explain the variations in the sign for many other combinations, and also for the change from positive to negative of the lead combination after cleaning. It would not, however, explain the change from negative to positive of the tin combination after cleaning, unless, indeed, we are to suppose that it was possible to select two pieces of tin from the same sheet which differed in constitution and structure sufficient to exhibit a contact difference of potential. It would also not explain the different sign of lead No. 2 in lead No. 4 (*vide* Table I, Nos. 17 and 18) on two successive days, nor the change from negative to positive, when, to the same combination of cylinders coated with aluminium paint, was added two coats of bronze (*vide* Table I, Nos. 22 and 23).

In the case of the tin combination coated with aluminium and with bronze paints, at first a small positive charge was observed, which slowly changed into a comparatively large negative one. This was observed on two different days, and would seem to indicate the presence of two opposing influences, one of which became insignificant as time went on.

TABLE III.

Lead No 1 in lead No. 2.
With radium.

Time.	Deflection (millivolts).
8″	41 positive
12″	61
15″	67
20″	69
30″	77
3 1/2 mins.	79
14 "	79
35 "	78
46 "	77
66 "	76
1 hr. 33 "	75
1 hr. 50 "	75
2 hr. 13 "	74
3 hr. 15 "	74
3 hr. 58 "	72
4 hr. 10 "	75
4 hr. 22 "	76
4 hr. 33 "	78
4 hr. 43 "	78

(*b*) Extent of the charge and variation in its magnitude with time.

The charges in all the experiments were found to rise with varying rates to their maximum values. These rates, however, were found to be very greatly increased by the presence of radium bromide. Typical sets of readings showing the rates at which the charge was acquired with and without radium are given in Tables II and III. Other sets of readings, illustrating various phases of the work are given in Tables II, IV, V, VI, VII and VIII, from which the curves shewn in Figs. 3, 4, 5, 6, 7 and 8 are plotted.

TABLE IV.

Tin No. 2 in tin No. 2. Without Radium.

Time	Deflection (millivolts).
1 1/2 mins.	8 positive
2 2/3 "	15
4 "	22
5 1/2	28
6 3/4	33
9 1/4	42
11 2/3	47
19	58
33	65
44	70
78	76
1 hr. 40 mins.	80
2 hr. 5 "	80
2 hr. 39 "	82
2 hr. 51 "	82
4 hr. 1 "	82

In agreement with McLennan and Burton, the writer found that the extent of the charge varied little with the size of the cylinders, and with the sign of the charge on the needle of the electrometer. A double combination was made by joining the two inner tin cylinders together by means of a piece of tin soldered to each, and also by joining in a similar way the two outer ones. With such an arrangement, the magnitude of the charge acquired (—94 millivolts) was about the same as the maximum values for each combination separately, namely,— —85 and —91 millivolts (*vide* Table I, Nos. 25, 26, 27. See also Nos. 4, 14, 15, and compare Figs. 3 and 8).

The maximum value, it will be seen (*vide* Table I) varied greatly with different combinations, and also was different at different times

TABLE V.

Cylinder—Tin No. 1 + Aluminium paint.
Without radium.

Time	Deflection.
4/5 mins.	7 negative
1 1/3	12
1 3/4	17
3	28
4	38
5 1/2	50
6 3/4	60
7 3/4	67
10	80
11 1/2	88
14 1/2	103
17 3/4	116
24 1/6	133
36	149
50 3/4	158
1 hr. 3 mins.	161
2 hr. 1 "	162

of observation for the same combination. A good example of this latter effect is to be found on the case of lead No. 1 in lead No. 2 (*vide* Table 1, Nos. 4, 5, 6, 7, 8 and 9). Shortly after the cylinders had been cleaned the maximum negative charge acquired was 46 millivolts, one day later the value was 32, four days later 27, and twenty days later only 13. Another good illustration of this is the case of lead No. 1 in lead No. 3 (*vide* Table I, Nos. 12 and 13), where the maximum value of the positive charge increased in fourteen days from 22 to 42 millivolts.

These results would seem to indicate the growth of a deposit or deposits removable by cleaning, which resulted in the insulated cylinders gaining a positive charge, and here we may have an explanation of the high positive charge which McKeon found for his lead combination.

TABLE VI.

Zinc in zinc. Without radium.

Time.	Deflection (millivolts).
3 4/5 mins.	8 positive
6 1/2 "	16
8 1/2	23
11 5/6	33
16 1/3	42
19	49
25 1/2	62
36 1/2	72
50 5/6	83
60 1/2	88
1 hr. 17 1/2 mins.	92
1 hr. 35 "	96
2 hr.	71
2 hr. 47 "	51

It is known that on old lead, such as McKeon used, radioactive deposits are gradually formed, and on this account, there would be an emission of charged particles from both the inner and the outer cylinders. It is evident that this might result in a difference in the number of charged particles coming to the insulated cylinder and in the number leaving it. It could then happen that the insulated cylinder would acquire a positive charge, the magnitude of which would be largely determined by the nature of the active deposit.

TABLE VII.

Tin No. 2 in tin No. 2. Without radium.

Time.	Deflection (millivolts).
3 1/2 mins.	9 negative
10	18
13 2/3	25
18 3/4	33
23 3/4	42
27 3/4	49
35 1/5	59
41 1/4	65
50 1/2	75
61 2/3	82
74 1/4	89
80 1/3	91
86 1/2	89
1 hr. 33 1/4 mins.	85
1 " 38 1/4	79
1 " 43	72
2 " 3	48
3 " 11	52
4 " 13	75
5 "	81
5 " 57	85
6 " 27	86
6 " 47	88
7 " 12	89

It was found, too, that the charge did not always remain at a maximum value. With some cylinders it gradually decreased in amount, and in a few of these cases a second rise was observed (*vide* Figs. 6 and 7). As noted above, with the combination lead No. 1 in lead No. 2,

TABLE VIII.

Tin No. 1 + tin No. 2 in tin No. 1 + tin No. 2. Without radium.

Time.	Deflection (millivolts).
57 secs.	8 negative
2 mins. 50 secs.	15.5
5 " 5 "	23
7 1/2 mins.	31
10 5/6 "	39
15	46.5
20 1/2	54
29 4/5	62
52 2/3	71
74 1/2	77
2 hr. 5 mins.	87
2 " 34 "	90
3 " 5 "	91
4 " 1 "	94
4 " 2 1/2 "	93

observations, for which the values are given in Table IX, and the curve representing them is shewn in Fig. 1, were continued for an extended period of time. As in this case, considerable variations were observed,

TABLE IX.

Lead No. 1 in lead No. 2.

Time.	Deflection (reduced to millivolts).	Time.	Deflection (reduced to millivolts).
Wed. 4.01 p.m.	0	Thur. 9.05 p.m.	52.6
4.02	2	10.00	54
4.03	5	11.05	54.6
4.05	8	12.00	56
4.08	11	Friday 1.05 a.m.	57
4.11	13	2.00	59
4.17	16	3.05	60.5
4.22	18	4.00	62
4.31	21	5.05	63
4.44	25	6.00	63
4.48	27	7.00	63.5
4.55	29	7.30	63.3
5.05	32	8.37	64
5.17	33	10.10	64
5.25	34	10.24	61
6.24	40	10.34	60
7.06	42	11.19	63
7.25	43	11.54	56
Thur. 12.30 a.m.	36	12.39 p.m.	55
1.00	34	12.54	55.6
1.40	33	1.55	57.5
1.52	33	2.25	58
2.55	34	2.52	59.5
3.55	34	3.30	60
4.55	33	4.26	57.5
6.00	33.5	4.43	58
7.00	33	6.18	58
8.00	33	7.05	58
8.48	29	8.00	56
9.37	33	9.05	53
10.08	34.5	10.00	51
10.40	33	11.00	48.7
10.52	32	11.30	47.7
11.20	33.5	12.00 a.m.	47
12.10 p.m.	36	Sat. 1.05 a.m.	47
12.50	39	2.00	41.7
2.06	42	3.10	37.9
2.45	46	4.00	37.8
2.55	47.5	5.05	35
3.49	50.5	6.00	34
4.10	55	7.00	32.8
4.37	53	8.48	31.2
5.46	50	9.51	31.4
7.06	50	10.53	30.1
8.04	52		

it is possible that all the others would have exhibited similar changes, had the observations been continued long enough. With these lead cylinders, which were freshly cleaned the day before readings were commenced, the highest maximum value of the negative charge acquired was about 64 millivolts (a scale deflection of about 33 millimetres). At the end of the period of sixty-seven hours, it was found that the zero had drifted 6.5 mms. to the negative side. The readings given in Table IX, however, were all corrected for this change in zero, and also for a gradual change in the sensibility of the electrometer due to a dropping in the potential of the storage cell used to charge the needle, from 170 volts to 144 volts.

In one or two cases where a drop from the initial maximum charge occurred, it was observed that, for the same combination, on different days the drop was not always in evidence. (See Table I, compare Nos. 28, 29, and Nos. 32, 33). After the cylinders had been cleaned, tin No. 2 rose in about four hours to a maximum of 171 millivolts, and then dropped to 38. The next day, in the same time, it rose steadily to 82 millivolts. It is, of course, possible, that had the observations been continued long enough a drop might have been observed here too, and it should be mentioned that the former set of observations was taken between 3 p.m. and 7.30 p.m., while the latter were taken between 9.30 a.m. and 2 p.m. McKeon's explanation of these results as being due to daily variations in an external cause is possible, but it would seem that a more probable one is found in a change taking place in the surface of the metals, perhaps arising from modifications in the state of the atmospheric air.

(*c*) Variation in the magnitude of the charge with the intensity of penetrating rays.

McKeon attributed the variations which he observed to changes in the amount of ionization of the enclosed air. That this can not be the cause is shewn by the fact that, while the presence of the radium affects very greatly the rate at which the charge is acquired, it modifies but little the maximum value. This was observed by McLennan and Burton, as well as by the writer.

McLennan and Burton also found that, when the cylinders were placed in a tank filled with water, the layer of water being 13 cms. thick, the maximum value of the charge was unchanged. By this means the natural radiation was lessened,[1] and yet the charge remained the same.

---

[1] Univ. of Toronto Studies, Phys. Science Series. No. 2; also, Phys. Rev., Vol. XVI, No. 3, p. 184, 1903.

To further investigate the effect of varying the amount of ionization, some measurements were made on the charge acquired by the inner of two lead cylinders when some radium in a small glass tube was placed within the inner cylinder and successively surrounded with a series of different thicknesses of sheet lead. In each case the charge acquired by the insulated cylinder rose in half a minute or less to a maximum value. From Table X a comparison can be made of the values of the charge acquired in each case, and of the relative intensities of the radiation used to hasten the action. The intensities were compared by placing the radium with its different coverings at a fixed point near the electrometer, and measuring the current from the needle to the free quadrants.

TABLE X.

Remarks on manner of screening radium.	Limiting charge (Negative). Arbitrary Scale.	Intensity of radiation Arbitrary Scale.
In glass tube	7.0	304
First covering of lead	7.0	210
Second covering	6.8	188
Third covering		
1st reading	6.8	167
2nd reading	6.5	167
Fourth covering		
1st reading	6.2	135
2nd reading	6.7	135

It will be seen that while there were slight changes in the value of the charge acquired, these were by no means proportional to the changes in the intensity of the radiation.

One must conclude, therefore, that, although variations do occur in the charge acquired by the inner cylinder in combinations such as those investigated, these can not be due to changes in the amount of ionization produced by the earth's penetrating rays. They may possibly be due, however, to some changes in the surface of the metals themselves, or to changes in the radiations given off by these metals.

TABLE XI.

Plates.	Sign and magnitude of charge acquired by free copper plate. 2 mm. apart millivolts.	10 mm. apart millivolts.
um.	−9	+289
in)	+4	+277
ick)	−15	+261
	+38	+212
r (thin)	−68	−79
r (thick)	−85	−48

Table XI gives the results of some measurements made by using ferent upper plates. The metals are arranged in the order in which ey occur in the Volta series, and it will be seen from the values of e maximum potentials recorded that other influences besides the Volta ffect must have contributed to the result. The values obtained are ery much lower than the contact potential differences usually recorded. Further, although aluminium and zinc come higher in the contact series than lead, yet, when the plates were 2 mm. apart, lead gave a higher positive potential to the copper plate than either of them. Indeed, aluminium and the thicker zinc plate, as will be seen, give a slightly negative value to it. With both the zinc and copper plates, an increase in the thickness resulted in an increased negative charge on the free plate.

TABLE XII.

Upper plate zinc.

Distance between plates.	Deflection for thin plate.	Deflection for thick plate. (1 volt = 550 mm.)
2 mm.	+30 mm.	+2 mm.
3	69	37
5	151	106
7	209.5	165.5
10	223	193
12	214.5	192.5
15	194	176
17	183.5	168
20	163.5	148
25	132.5	123.5
30	114	105.5
35	97	91
40	83	77

TABLE XIII

Upper plate copper.

Distance between plates.	Deflection. (1 volt=550 mm.)
2 mm.	—31
3	—19.5
5	—10
7	—10.4
10	—15
13	—19
15	—20.5
20	—25.2
25	—28
30	—30
35	—31.5
40	—32.5

It will be observed, also, that when the plates were 10 mm. apart, there was a marked positive increase in the values. This was more carefully investigated by taking a series of measurements with different distances between the plates. The results obtained are given in Tables XII and XIII, and are illustrated by the curves in Figs. 10 and 11. It will be seen that, as the distance between the plates was increased, the values of the charge acquired became more and more positive, until a maximum point was reached, after which the values became more negative.

In these latter experiments it must be remembered that not only was the distance between the plates varied, but, since the radium was kept in a fixed position, the distance from the upper plate to the radium, as a consequence, was varied also. That this is an important factor is shewn by the results of some measurements made with the radium at various distances from the plates, which were kept at fixed distances apart.

The results obtained are given in Tables XIV, XV and XVI, and are represented graphically by the curves in Figs. 12, 13, and 14. From these it will be observed that as the distance of the radium was increased

TABLE XIV.

Upper plate zinc. Distance between plates, 2mm.

Distance of radium.	Deflection. (1 volt=575 mm.)
7.3 cm.	+32. mm.
14.1	—26
19.8	—42.8
24.6	—48.8
32.1	—50.8
42.9	—49.5
52.8	—44.8
62.8	—40.4
71.2	—35
80.2	—33

there was a gradual decrease in positive values or an increase in negative ones until a minimum point was reached. After this there followed a slight increase in the positive or a decrease in the negative readings. The appearance of a final maximum is suggested but not well marked by the form of each of the curves.

TABLE XV.

Upper plate zinc. Distance between plates, 10mm.

Distance of radium.	Deflection. (1 volt=522 mm.)
7.3 cms.	+215.5
14.4	+114.5
21.9	+ 51.5
17.6	+ 81
27.5	+ 26.5
32.6	+ 11.5
37.4	+ 4.5
42.2	— 1
48.6	— 4
56.8	— 6
68.1	— 4.5
79.6	— 0.5

In order to ascertain exactly whether the potential acquired by the free plate continued to approximate to a final steady value, a set of observations was taken with the two copper plates at 2 mms. apart, when the radium was moved through a more extensive range of distance. These results, which are recorded in Table XVII, and are represented by the curve given in Fig. 15, shew that the charge on the free plate did not continue to approach a steady value, but that as the radium was removed, very considerable variations occurred in the magnitude of the charge. Some readings were also taken of the potential acquired by the free copper plate without the use of radium, when both zinc and copper plates were placed at different distances above it. These results are recorded in the first column of Table XVIII. For the purpose

TABLE XVI.

Upper plate copper. Distance between plates, 2mm.

Distance of radium.	Deflection. (1 volt=540 mm.)
7.3 cms.	— 39.5
13.8	— 53
19.2	— 59.5
24.2	— 63.5
31.9	— 65.5
41.8	— 60.8
52.0	— 58.5
61.8	— 54.5
70.4	— 49.8
80.4	— 46.5

of comparison, the final maximum values obtained in the cases illustrated by the curves 12, 13, and 14, are also recorded in the second column of this table. From these results it will be seen that in every case the values obtained without the radium were more positive than those obtained with it.

TABLE XVII.

Upper plate copper. Distance between plates, 2mm.

Distance of radium.	Deflection. (1 volt=570 mm.)
7.3 cms.	— 47.8
10.5	— 47.5
16.0	— 50.5
24.7	— 55
31.2	— 57.5
41.7	— 56.5
59.0	— 54
80.1	— 55
108.0	— 56.2
156.3	— 51.5
204	— 54.4

TABLE XVIII.

Plates.	Column I. Without radium	Column II. With radium at greatest distance. (In Figs. 12, 13, 14, 15)
Zinc, 2 mm. from copper.........	+37 millivolts.	−57 millivolts.
Zinc, 10 mm. from copper.........	+27 millivolts.	+ 1 millivolt.
Copper, 2 mm. from copper........	−33 millivolts.	−90 millivolts.

One should have expected that as the radium was removed the values given in column II of Table XVIII would have approximated to those obtained without the radium and recorded in column I, but their failure to do so can probably be traced to the difficulty experienced in obtaining satisfactory readings when the radium was placed at the longer distances or entirely removed. Under these circumstances the rate of deflection was exceedingly slow and, consequently, the readings, owing to the comparatively small capacity of the plate system, were subject to large errors arising from disturbances to the measuring system which with the radium nearer were negligible.

In analyzing the observations made on the Volta effect in the plate experiments it is difficult to account for all the results. It is evident that at least two influences were present, namely, (1) the conductivity of the air between the plates, and (2) secondary radiation, and it is clear that each contributed, with the different combinations, to the magnitude and sign of the charge acquired.

That conductivity is an important factor in determining the limiting charge given to the free plate was shewn by simply blowing filtered air between the plates. It was found that in all cases, where the upper plate was positive to the lower, positive values were decreased by blowing. On the other hand, by using a carbon plate above, so as to make the copper plate below acquire a negative charge through the Volta effect, the negative deflection was also lessened by the same means.

It has been shewn by Prof. MacKenzie[1] that the secondary radiation from the back of metallic plates, upon which the rays from radium are allowed to fall, is of considerable importance. Negative particles will, under these circumstances, come to the lower plate from the upper, while there will also be an emission of negative particles from the lower one itself. The nature of the charge acquired by the lower plate

[1] Phil. Mag., July, 1907.

will be determined, therefore, partly by the ratio of the number of particles leaving it to the number coming to it. An alteration in this ratio would take place when both the thickness and the material of the plates were varied, when the distance between the plates was altered, and when the distance of the radium was increased, and it was quite conceivable, therefore, that this ratio could vary in such a manner as to give rise to the results obtained.

From the experiments which have been cited in this paper, it is evident that the manner in which insulated metallic cylinders surrounded by others joined to earth, or insulated plates of metal placed close to others of the same or of different metals become electrically charged is both complex and obscure. It is clear, too, that both the Volta effect and secondary radiation are influences affecting the process of charging, and, although the experiments of the present investigation throw considerable light on the relative influence of these two factors, it will be necessary to take more extensive observations before a complete explanation can be offered.

In conclusion, the writer wishes to express his sincere thanks to Prof. McLennan for his kindly interest and helpful suggestions during the progress of the investigation.

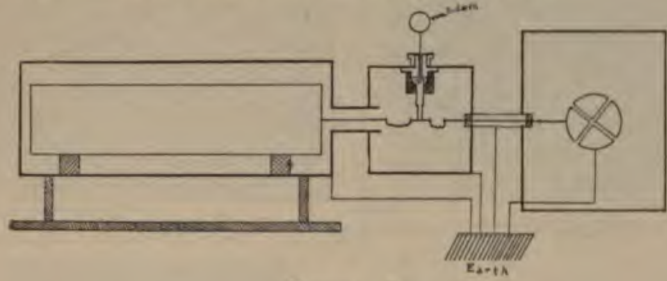


Figure 2.

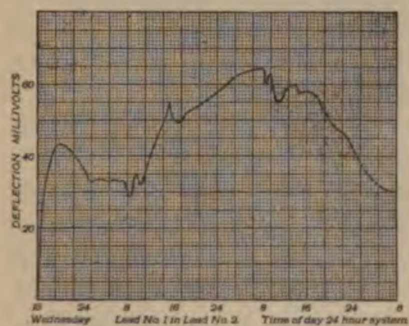


FIG. 1

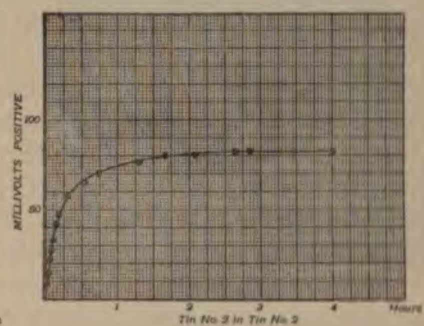


FIG. 3

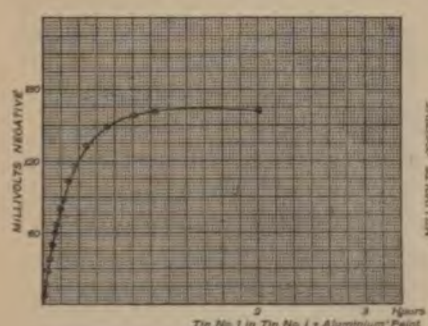


FIG 4

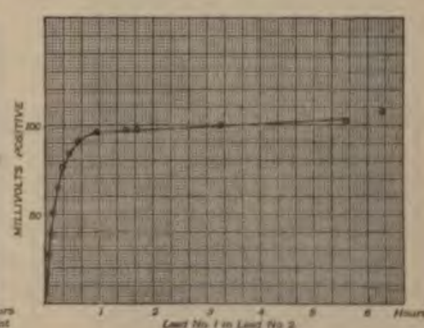


FIG. 5

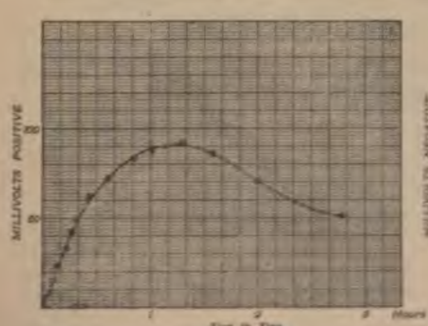


FIG. 6

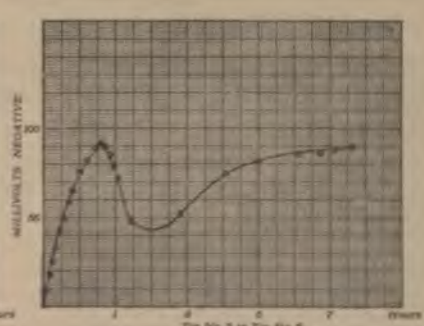


FIG. 7

IX.—*The Constitution and Properties of Heusler's Alloys, including a Study of their Microstructure.*

By H. A. McTAGGART, M.A.

(Communicated by Professor J. C. McLennan, and read May 26th, 1908.)

The ferromagnetic alloys discovered by Heusler have, in the hands of various investigators,[1] been found to exhibit physical properties which suggest a close connection between their magnetic behaviour and their crystalline structure.

Among other properties, the permeability of these alloys has been investigated and found to be a function of their percentage compositions.

Again, various kinds of heat treatment have been shewn to alter the permeability of the alloys as well as their magnetic hysteresis. Continued heating at about 110° C., followed by gradual cooling, has been found to produce a considerable increase in their permeability. Raising the temperature of the alloys above their transformation point (Ca. 200° C.) and then cooling them slowly, leaves a hysteresis effect, while sudden quenching above that point practically eliminates all magnetic properties. These, however, are again restored by ageing at 110° C., but such restoration is accompanied, as a rule, with very little if any hysteresis effect.

Further, the character of the magnetostriction phenomena exhibited by these alloys has been observed to change with the history and treatment of any specimen.

Similarly, their electrical resistance and the Hall and other allied effects which have been studied with them exhibit characteristics which vary with the relative proportions in which the manganese and copper enter into their composition.

Inasmuch as the different crystalline phases which have been studied with a number of alloys have been shewn to be largely determined by their percentage composition and by the treatment to which they have been subjected, it would appear that in view of the facts cited above,

---

[1] Verh. d. Deut. Phys. Gesell, 5, 219, 1903; Marburg Schriften, 237, 1904; Ann. d. Phys., 16, 535, 1904; Electrician, June 16, 1905; Phys. Rev., 96, 335, 1905; Verh. d. Deut. Phys. Ges., 7, 133, 1905; Proc. Roy. Soc., 76, 271, 1905; Phys. Rev., 23, 498, 1906; Bulletin of Bureau of Standards, Washington, Vol. 2, No. 2, p. 297, August, 1906; Verh. d. Deut. Phys. Gesell, March, 1907; Phys. Rev., 24, 1907; Verh. d. Deut. Phys. Ges., Jan., 1908.

a parallelism exists between the crystallographic structure of the Heusler alloys and the physical properties displayed by them.

As one of the most interesting and instructive ways of studying these phase changes it was decided to begin an investigation of the microstructure of the alloys in the hope of throwing some light on their magnetic and other properties, and in the following note an account is given of some of the results obtained in the investigation up to the present.

The method employed was that of examining under the microscope a polished surface of the metal, suitably etched by a reagent. This mode of procedure was initiated by Sorby in the study of the microstructure of iron and steel as far back as 1864, and has been developed more recently in the case of alloys with signal success by Rosenhain and Ewing, Haycock and Neville, Osmond, Stead, and others.

Before taking up the Heusler alloys a specimen of steel and also one of iron were examined to gain some experience in work of this kind, and results were obtained similar to those of other experimenters. This was then followed by an examination of the constituents of the alloys aluminium, manganese, copper, and Figs. 1, 2 and 3 give typical illustrations of their respective appearances under the microscope. A study of the alloys was then taken up.

Eight samples which had been cast in the form of rods were examined, representing four different percentage compositions as follows:—

Designation.	Percentage.			Atomic ratio of
	Al.	Mn.	Cu.	Al to Mn.
1a	8	32.1	59.8	.51
2, 2a	9.7	25.6	64.6	.77
3, 3a, 3b	14.3	28.6	57.1	1.01
4, 4a	15.9	23.9	60.3	1.392

Polished sections were made along and perpendicular to the axis of the rods, and these were examined under the microscope after being suitably etched.

The microstructure of the specimens shewed considerable variations with the percentage composition, and hence with their magnetic properties. Those having the same composition, however, were fairly uniform.

Alloy No. 1a, the least magnetic, shewed several types of microstructure, even over the same section, indicating a lack of homogeneous crystallization on cooling.

Alloys 2, 2a, were fairly uniform in appearance, occasional patches of a different structure appearing. From the fact that material of two colours was seen on the surface examined, it was evident that this alloy consisted of crystals of one composition embedded in a matrix of another. Small traces of what appeared to be manganese were met with, and were considered fairly well identified by the fact that this metal is dissolved by dilute acetic acid which attacks neither aluminium nor copper.

Alloys 3, 3a, 3b, were most magnetic, and upon etching gave a characteristic appearance. Distinct areas arranged like tiles in a floor were seen separated by thin layers of a material of another kind. Scattered through these areas, or along their edges, were a large number of fern-shaped or tree-like aggregations of what seemed to be manganese. Fig. 4 shews areas with these figures, and Fig. 5 shews one of the fern-shaped figures viewed with a higher power. All the areas presented a homogeneous appearance, the three rods being apparently quite uniform throughout.

Alloys 4, and 4a were slightly less magnetic than 3, 3a, and 3b, and shewed a similar microstructure. The larger areas were separated by thicker layers of material than in the last mentioned, while the fern-shaped figures were modified to smaller rosette or star-shaped aggregations.

As stated above, the highest magnetization was exhibited by the alloys 3, 3a, 3b, 4, 4a. With these there was found a definite form of crystallization consisting of an aggregation of uniform crystals enclosing a special form of what was apparently crystalline manganese.

Since in both alloys 4, 4a, as well as in 3, 3a, 3b, the larger areas seemed to be the same, it would seem reasonable to conclude that the magnetic properties were associated with and accompanied this special form of manganese. This, at least, appears to be a probable conjecture, but additional experimental work is needed before the relation indicated can be considered established. With this purpose in view the investigation is being continued.

The writer wishes to express in this place, his thanks to Prof. McLennan for his kindness in placing at his disposal the necessary apparatus, and for his many helpful suggestions given from time to time during the investigation.


Fig. 1.


Fig. 2.


Fig. 3.


Fig. 4.


Fig. 5.

Further Results on the Absorption of Thorium Emanation by Charcoal.

By R. W. BOYLE, M.Sc.

ɔmmunicated by Dr. H. T. Barnes, and read May 26, 1908.)

a previous paper to the Society[1] the writer showed that the ion of thorium emanation by cocoanut charcoal

.) follows the same law as for ordinary gases, viz., that the absorption is increased by a lowering, and decreased by a raising of the temperature of the charcoal,

(2) depends greatly on the speed of the gas current which conducts the emanation through the charcoal, so that the greater the speed the less is the absorption, and *vice versa.*

In the mathematical discussion in that paper, it was assumed, er conditions being the same, that the volume of the charcoal, or, what ıounted to the same thing, the mass of it, was the important factor determining the amount of absorption. But it was pointed out that ıe same considerations would hold if, as it was natural to think, the urface which the charcoal exposed to the emanation was the important factor instead of the mass.

Further, an experiment described in the paper showed that as the temperature of cocoanut charcoal was raised its absorbing power was decreased until at the temperature of 310° C. the charcoal had become non-absorptive.

The present paper consists of a few notes giving the results of experiments on these last two points, and of others which show the different absorbing powers of cocoanut, animal, and ordinary wood charcoal, and the effect of temperature on them.

APPARATUS.

A flow method of experiment was used.

---

[1] "The Effect of Temperature and of Velocity of Gas Current on the Absorption of Radioactive Emanations by Charcoal."—R. W. Boyle.—Trans. Roy. Soc. of Canada, May, 1907.

The apparatus is represented here by Fig. 1, and may be briefly described as follows:

An air-pump supplies a current of air through a tube of thorium hydroxide, where the emanation mixes with the air and thence passes through tubes, containing absorbing or non-absorbing material, as the case may be, into a testing vessel of the ordinary cylindrical type. An accurately calibrated manometer in the circuit measures the velocity of the air current. The testing vessel is connected to one pole of a battery of E. M. F. sufficient for complete saturation, the other pole of the battery being earthed. The central rod of the testing vessel is connected with a suitable electrometer, and a condenser of adjustable capacity is placed in parallel with it. It should be noticed that, with this arrangement,

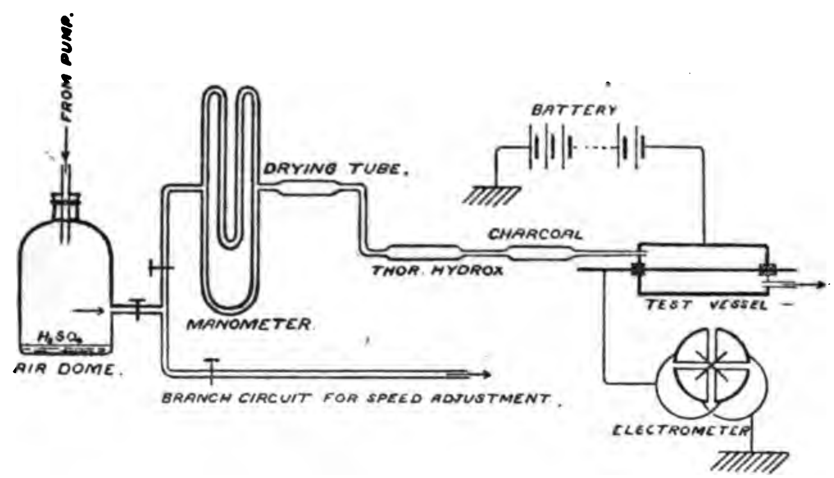


FIG. 1.

absorption of the emanation takes place when the charcoal has absorbed its full amount of atmospheric gases, under the existing conditions.

The weight of thorium hydroxide used was 37 gms.

The ionization current in the testing vessel is proportional to the number of emanation atoms breaking up per second in the testing vessel, and this is λ times the number of emanation atoms present, λ being the coefficient of decay of the emanation. Hence, the ionization current is a measure of the amount of emanation in the testing vessel, and by this means we can compare the amount of emanation present when it has passed through non-absorbent and absorbent materials.

In the paper referred to before, it has been deduced that when there is no absorbing material between the thorium hydroxide and the testing vessel the equation of this ionization current is

$$i_1 = K N e^{\frac{-\lambda V}{q}} \left[1 - e^{\frac{-\lambda W}{q}} \right],$$

where i = the ionization current,

N = the number of free emanation atoms given off by the thorium hydroxide per second,

q = the flow of the air current in c.c. per second,

V = the total free volume of the conducting tubes between the thorium hydroxide and the testing vessel,

W = the volume of the testing vessel,

K = a constant of proportionality.

This equation shows that the curve with values of i as ordinates, and of q as abscissæ, must have such a shape as that of curve I, Fig. 2, or, in other words, the ordinate must rise from zero to a maximum, and then fall off to nothing as the speed of the air current increases in infinity.

The equation also shows that, in comparing cases of absorption with those of non-absorption, it is necessary to have the free volume between the thorium hydroxide and the testing vessel a constant in all cases. In the experiments this condition was always, as nearly as possible, fulfilled.

When the absorbing material is inserted between the thorium hydroxide and the testing vessel, there is less emanation available for ionization, and the ordinates of the i-q curve are considerably reduced.[1]

In the results following the i-q curves, for the cases of non-absorption were obtained by substituting for the tube containing the charcoal a similar tube containing a non-absorbing sand of the same volume and same size grain as the charcoal used. This precaution was necessary in order to have the same volume between the thorium hydroxide and the testing vessel for non-absorption as for absorption.

In all experiments with a given sample of sand or charcoal, an attempt was made to have the grains of uniform size by sifting through a set of sieves and collecting separately the residues caught in the meshes of each sieve.

[1] Paper already referred to.

(a) *The Charcoal Surface Exposed to the Emanation.*

The ratio of the surface to the mass of a particle of any material increases as the size of the particle decreases; hence, one lot of charcoal, equal in mass to a second lot, will have a greater or less absorbing surface than the second, according as the size of its grains is smaller or larger than the size of the grains of the second.

TABLE I. (Fig. 2).

Multiply current by 616 x 10^{-15} for amperes.

Non-absorption.		Grains caught in mesh 10 to the inch.		Grains caught in mesh 20 to the inch.		Grains caught in mesh 30 to the inch.	
Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.
Nat. Leak at beginning	3.94	Nat. Leak at beginning	2.15	Nat. Leak at beginning	1.07	Nat. Leak at beginning	1.63
0.40	31.6	0.50	4.46	0.63	2.68	1.07	6.24
0.63	90.8	0.94	37.5	0.72	3.86	1.48	16.9
0.93	135.8	1. 44	73.1	1.17	20.3	1.89	30.1
0.33	161.1	1.99	92.5	1.54	39.7	3.07	42.8
1.83	169.9	2.49	93.4	2.31	54.1	3.47	46.1
2.34	157.7	3.21	86.5	2.50	61.2	4.15	45.7
2.74	149.1	3.80	82.1	2.88	61.2	4.91	44.4
3.46	124.3	4.77	75.0	3.32	59.6	6.09	43.7
4.20	105.9	5.85	71.8	4.07	56.8	8.77	42.0
4.78	92.3	7.00	69.3	4.46	54.4	Nat. Leak at end.	2.26
5.51	86.7	8.34	64.3	5.46	54.0		
7.10	78.0	Nat. Leak at end	3.28	6.73	52.4		
8.39	73.5			8.46	50.5		
9.99	67.0			Nat. Leak at end	1.34		
Nat. Leak at end	4.07						

In an experiment, the results of which are given here in Table I and Fig. 2, the i-q curves were taken for three equal masses, 2.17 gms., of the *same* sample of cocoanut charcoal of different size grains. I is the curve of non-absorption, II is the curve for grains which were *just* *caught* in a sieve of ten meshes to the inch, III for twenty meshes to the inch, and IV for thirty. It can be seen that as the grain of the charcoal is made smaller the absorption of the emanation by the charcoal is increased. The following facts, taken from Fig. 2 and tabulated,

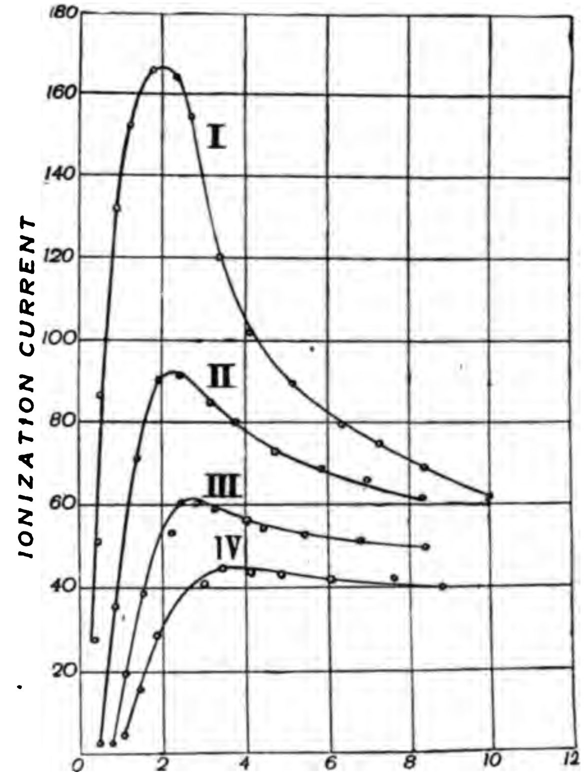


FIG. 2.

illustrate this point. The percentage absorption for any given speed is represented by

$$\frac{\text{the difference between non-absorption and absorption ordinates}}{\text{non-absorption ordinate.}} \times 100$$

Flow of air current	Percentage Absorption.		
	Smallest surface —Grains—10 meshes to the inch.	Intermediate— Grains—20 meshes to the inch.	Largest surface— Grains—30 meshes to the inch.
1.0 cc. per sec....	67.1	89.5	97.4
3.0	38.1	57.5	70.5
5.0	20.0	41.3	52.8
8.0	12.3	29.6	41.0

The experiment shows that it is not the mass of the absorbent on which the amount of absorption depends, but rather the amount of surface which the mass of charcoal exposes to the emanation. Of course, by increasing the quantity of charcoal of a given size grain the amount of absorbing surface is also increased and consequently there is increased absorption.

(b) *Temperature of the Charcoal.*

The paper referred to before showed that the absorption of thorium emanation gradually decreased as the temperature of the cocoanut char-

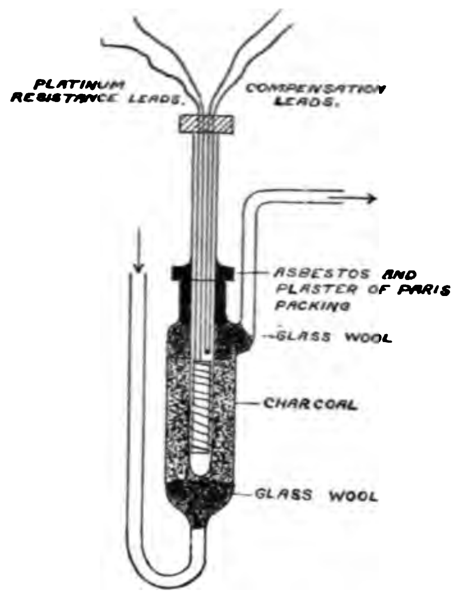


FIG. 3

coal was raised, and indicated that there was a possibility of the charcoal not absorbing at all at 310° C.

To test the latter point an experiment was performed in which observations of the ionization current in the testing vessel were taken as the temperature of the charcoal was gradually raised, the velocity of the air current being kept constant. The temperatures were measured by a Callendar platinum-resistance thermometer, the bulb of which was surrounded by the charcoal. The stem of the thermometer was sealed into the tube containing the charcoal by an asbestos and plaster of Paris packing, so that the joint was perfectly air-tight. The diagram shows the arrangement (Fig. 3).

The heating was carried out in a specially constructed oven, the greatest variation of temperature being not more than three or four degrees.

The air current, after passing through the charcoal, circulated through a short coil of copper tubing immersed in water, in order to cool the air entering the testing vessel to ordinary temperature. Corresponding curves of non-absorption were determined.

By using a large quantity of charcoal it was found that there was appreciable absorption up to a temperature of about 300° C., but here the ionization current in the testing vessel began to increase and soon gave the same value as in the case of non-absorption. It was found that the charcoal began to give off carbon dioxide at 211° C., so that the increase of ionization current just mentioned can be explained by the loss of absorbing charcoal by oxidation, and by the presence of carbon dioxide in the testing vessel. (For α ray ionization the conductivity of carbon dioxide is 1.5 times that of air.)

TABLE II. (Fig. 4).

Multiply current by 616 x 10^{-15} for amperes.

Non-absorption.		Wood charcoal.		Animal charcoal.		Cocoanut charcoal.	
Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.	Flow in cc./sec.	Ionization current.
Nat. Leak at beginning	3.10	Nat. Leak at beginning	0.81	Nat. Leak at beginning	1.46	Nat. Leak at beginning	1.63
0.40	31.6	0.53	32.7	0.37	3.48	1.07	6.24
0.49	53.9	1.07	113.9	0.60	26.8	1.48	16.9
0.63	90.8	1.52	141.0	0.97	73.0	1.89	30.1
0.86	123.6	1.95	147.0	1.34	88.4	3.07	42.8
1.26	161.1	2.37	136.4	1.67	97.1	3.47	46.1
1.62	169.4	2.84	123.2	2.39	98.0	4.15	45.7
2.34	154.5	3.62	101.7	2.48	86.9	4.91	44.4
3.14	130.8	4.76	83.6	3.23	76.1	6.09	43.7
3.77	110.5	5.95	75.2	3.30	71.1	8.77	42.0
4.78	91.5	6.80	70.7	4.33	54.8	Nat. Leak at end	2.26
5.51	84.1	8.40	62.9	5.40	52.5		
7.10	77.0	Nat. Leak at end	1.84	6.70	43.9		
8.66	67.3	....	....	7.86	39.4	.....	....
Nat. Leak at end	4.07	....	....	8.68	36.2	....	....
		....	....	Nat. Leak at end	3.42	....	....

The experiment showed that up to a temperature of 300° C., and beyond it, the cocoanut charcoal was still slightly absorptive. A curve of absorptive power on a temperature base would approach the temperature axis in an asymptotic manner.

(c) *Nature of the Absorbing Charcoal.*

Fig. 4 and Table II show the results of experiments, under the same experimental conditions, for the cases of absorption by cocoanut, animal,

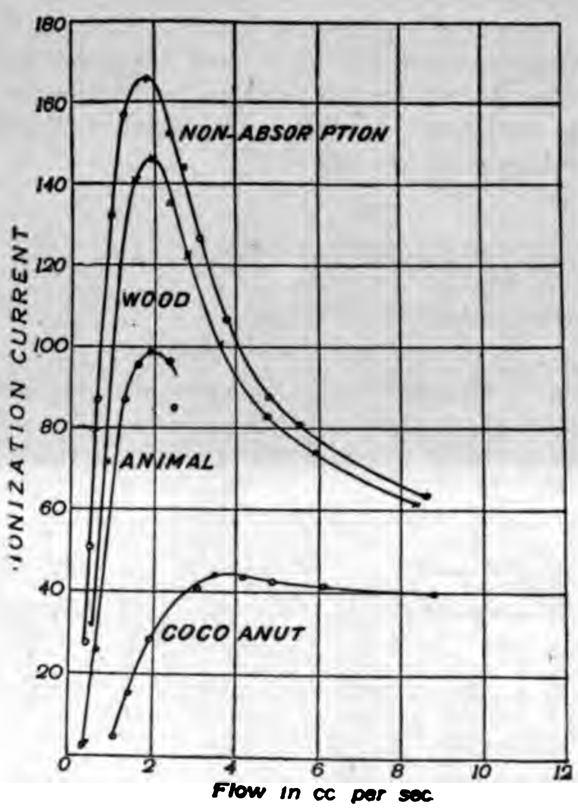


FIG. 4

and ordinary wood charcoal. The samples were all of the same volume and same size grain (just caught in a sieve of thirty meshes to the inch), and consequently, had the same absorbing surface. The cocoanut charcoal weighed 2.17 gms., animal charcoal 2.25 gms., and wood charcoal 0.77 gms. The curves show that the amount of absorption must always depend on the nature of the absorbent, cocoanut charcoal being the best and wood charcoal the worst absorber of the three. In fact, two samples of the same kind of charcoal can show appreciably different absorptive powers. I have had samples of cocoanut charcoal,

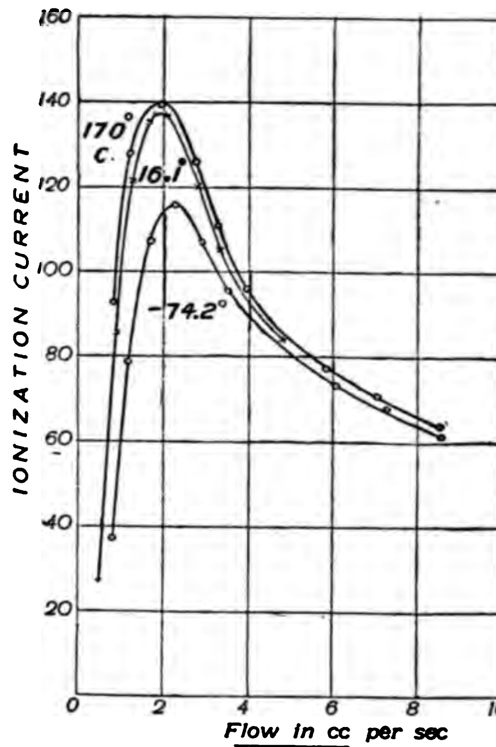


FIG 5

taken from different lots, showing considerable difference in this respect, the better absorbers being softer, less gritty, and less dense than the others.

Temperature affects wood and animal charcoals as regards their absorptive powers in the same way as it affects cocoanut charcoal.

The results are here given, Fig. 5, Table III, of an experiment which shows this fact in the case of wood charcoal. For animal charcoal the results are of the same nature and are not given.

TABLE III. (Fig. 5).

Wood Charcoal.

Multiply current by 613 x 10^{-15} for amperes.

170° C		16.1° C		−74.2° C	
Flow in cc./sec.	Ionisation current.	Flow in cc./sec.	Ionisation current	Flow in cc./sec.	Ionization current.
Nat. Leak at beginning	1.45	Nat. Leak at beginning	3.38	Nat. Leak at beginning	1.73
0.86	94.5	0.52	30.2	0.83	38.8
1.18	129.2	0.93	88.9	1.20	80.3
1.91	141.0	1.30	124.7	1.73	109.2
2.72	129.7	1.66	138.7	2.31	117.8
3.27	112.6	2.10	141.0	2.92	109.2
3.99	97.8	2.82	124.2	3.52	97.8
4.84	85.0	3.38	109.1	4.13	86.0
5.84	79.6	4.02	96.5	4.99	80.7
7.04	74.4	4.81	88.3	6.07	75.5
8.54	66.1	Nat. Leak		7.27	70.6
Nat. Leak	....	at end	4.51	8.61	63.8
at end	2.74	....	....	Nat. Leak	....
....	....	....	....	at end	2.61

Curves for non-absorption practically the same as that for 170°.

The wood charcoal was contained in a glass bulb, and the temperatures were measured by a platinum-resistance thermometer, as shown in Fig. 3; i-q curves were taken at temperatures of 170, 16.1 and —74.2 degrees Centigrade. The first temperature was obtained by heating in the specially constructed oven mentioned before, and the last from a mixture of solid carbon dioxide and ether.

Wood charcoal, under ordinary conditions, is not a good absorber, but the curves here show that it is affected by temperature in the same way as the other charcoals.

The following table, taken from Fig. 5, shows increasing absorption with decreasing temperature.

Wood Charcoal.

Flow of air current	Percentage absorption.		
	170° C.	16.1° C.	—74.2° C.
1.0 cc. per sec.	0*	12.0	38.9
2.0	0	2.9	18.2
3.0	0	2.5	11.4
4.5	0	2.0	5.8
7.0	0	—	3.8

* Practically.

Conclusion.

To conclude, it may be said that the amount of absorption of thorium emanation by means of charcoal,

(1) depends on the nature of the charcoal used, being greatest for cocoanut, intermediate for animal, and least for wood charcoal;

(2) is increased by increasing the charcoal absorbing surface;

(3) depends on the temperature, following the law for ordinary gases, viz., that a lowering of the temperature of the charcoal causes an increase, and a raising of the temperature a decrease in the amount of absorption, a curve of absorptive power on a temperature base approaching the temperature base in an asymptotic fashion;

and (4) is increased by decreasing the velocity of the gas current which conducts the emanation through the charcoal, the absorption being greatest at the slowest possible speeds.

XI.—*Wireless Time Signals from the St. John Observatory of the Canadian Meteorological Service.*

By D. L. HUTCHINSON.

(Communicated by R. F. Stupart, and read May 27, 1908).

In April, 1905, the writer suggested that the Marconi Wireless Station, then being equipped at Camperdown, near Halifax, N.S., be made use of to extend the time signal, which is sent daily to all Western Union Offices in the Maritime Provinces from the Observatory at St. John, to ships at sea within the zone of that Station. This recommendation was approved of by the Director of the Canadian Meteorological Service, R. F. Stupart, F.R.S.C.

After some unavoidable delay the apparatus was installed at the Marconi Station, Camperdown, N.S., and the following " Notice to Mariners " was issued by the Department of Marine and Fisheries in May, 1907: "The Meteorological Service of the Dominion of Canada is now sending time signals from the Observatory at St. John by telegraph to the Marconi Wireless Station at Camperdown, where special apparatus has been installed to automatically transmit the signal to ships at sea within the zone of that station.

" Time signals will be sent each week day morning as follows: Beginning at 9h. 58m., a.m., Atlantic time, dots are made each second up to and including 9h. 58m. 57s., then a pause of two seconds, followed by a dot at 9h. 59m., then a pause of two seconds follows, The clock then makes dots each second up to and including 9h. 59m. 50s., a pause is then made, followed by a dot at 10h. a.m., Atlantic or Standard time of the 60th meridian west longitude, equivalent to 2h. p.m. Greenwich mean time."

The electric transmission of time signals over a continuous wire is practically instantaneous, and the problem of repeating from the land line to wireless without the intervention of a human relay was solved by the construction of a simple apparatus at the Observatory, St. John, consisting of an automatic key which is thrown in circuit with the land line immediately before the time signal is received and out of circuit when the signal ceases. The wireless key is operated automatically by direct Western Union wire from the transmitting clock at St. John, with no more delay than would be caused by going through a repeater on the ordinary telegraph line. Thus to Canada belongs the honour of the first, and, so far as is known, the only daily wireless time signal of the world.

The following letter from the Commander of R. M. S. Empress of Ireland shows the practicability and usefulness of this service:

" Canadian Pacific Railway Company,
Atlantic Steamship Lines,
R. M. S. EMPRESS OF IRELAND,
25th April, 1908.

D. L. HUTCHINSON,
Director, St. John Observatory.

Dear Sir,

I am pleased to be able to report to you that, on the 23rd inst., while on a voyage from Liverpool to St. John, N.B., via Halifax, I was able to pick up the wireless time signal at a distance of 160 miles south-east of Halifax.

The signal was very distinct, and the method of sending the time is a very practical one for checking a ship's chronometers.

Yours faithfully,

J. V. FORSTER, Commander,

per H. L. WAIT, Navigating Officer."

Future developments in wireless telegraphy may eventually so overcome local disturbances that, by the Hertzian waves, time signals may be transmitted to ships at sea in all parts of the world and disasters, through miscalculation of longitude, be impossible.

XII.—*A Note on the Zamboni Pile.*

By A. S. EVE, D.Sc., McGill University, Montreal.

(Communicated by Prof. H. T. Barnes, D.Sc., and read May 28th, 1908.)

The Zamboni Dry Pile consists of many layers of paper disks, with zinc foil on one side and binoxide of manganese on the other. The internal resistance is enormous ; the E. M. F. notoriously inconstant. A dry pile of this sort has kept an electric bell, consisting of a small ball oscillating between brass hemispheres, ringing for more than fifty years. On the other hand, Professor Rutherford tried to use these piles at Montreal for charging electroscopes, but found them in a few months quite inefficient. I recently procured three piles from Germany, and found their E. M. F. to range from 270–330 volts, respectively. These were effectively used last autumn for charging wires out-of-doors to collect the active deposits, Ra C and ThC, from the atmosphere.

In February I resumed work with them, and found that they gave no E. M. F. whatever. I put one under the water tap, and steamed another for an hour before the spout of a boiling kettle. These drastic measures produced a slight improvement which did not last.

In April, when a marked thaw and a south wind arrived, and the furnaces of the building were allowed to go out, the piles entirely recovered the full E. M. F. of the previous autumn.

The variability is doubtless due to the dry Canadian winter removing all moisture from the paper disks until the resistance approaches infinity. The dry pile becomes too dry.

The Zamboni piles should therefore be kept in closed vessels, with some damp substance, such as a moist sponge, present.

It is possible that the pile could be adapted, with an electroscope or voltmeter, to form a sensitive hygrometer.

XIII.—*Local Temperature Forecasting by Differences in Temperature between Mount Royal and McGill College Observatory.*

By Professors C. H. McLEOD, Ma.E., and H. T. BARNES, D.Sc.

McGill University, Montreal.

(Read May 28, 1908).

In our third communication[1] which we had the honour to present before Section III last year, we dealt with a feature of our work which has proved very interesting and instructive. This was the ability to forecast from the differential records what the temperature conditions were likely to be for the succeeding day. The idea is not a new one as we pointed out, but the ease with which the temperature difference between our high and low level stations can be read makes the "advance changes" more noticeable.

There is another point in connection with our work which must be remembered and that is the extreme delicacy of our instruments when contrasted with the ordinary observatory thermograph. The fact that we can observe "advance changes" from so low a level as our mountain top is solely due to this cause. As we suggested, particularly in reference to Prof. Church's work on Mount Rose, a higher station might give us greater variations and therefore, with our instruments, earlier warnings.

It now seems to be well established, as a result of the numerous balloon ascensions, that the comparatively low regions of the upper atmosphere show advance changes over those at the earth's surface, whereas above the inversion layer there appears to be a lag.[2] It seems to the authors natural to expect a change of temperature conditions, which is usually accompanied by a change of wind direction or velocity, to be first manifest in the region just above the earth. We often note a change of wind direction by the movement of the clouds before such a change has produced an effect on the earth's surface.

RECORDS DURING THE PAST YEAR.

Our series of records was again greatly interfered with during the past year from the giving out of the insulation of a portion of the cable near the tower. Owing to the absence of one of the authors from

[1] Trans. Roy. Soc. Can., 3 Series, Vol. 1, p. 3 (1908).

[2] Compare H. H. Clayton, Monthly Weather Review, Vol. 35, p. 457 (1907).

Montreal, who had paid particular attention to the insulation of the cable, the fault was not located until late in the autumn (1907). Our records are incomplete so far as the differential thermometers are concerned from May to October (1907). Fortunately we succeeded in obtaining thermograph records in the tower by placing a 10-day thermograph of the usual pattern in the thermometer cage and making weekly visits to the tower. In this way the temperature trace at the tower could be compared with the daily thermograph records taken at the Observatory, and the differences obtained. Calibrated mercury thermometers were placed in the tower to set the thermograph by each week, and to compare the trace with at each week end. No record was made of the error of the thermograph during the week; the mean between the beginning and end comparisons being taken as the correction for the readings. In this way it will be seen that our past summer records of the mountain differences are not so accurate as those obtained from the differential recorder. We have, however, decided to include them here since they are probably not in error more than one or two degrees Fahrenheit.

During October the mountain line was again made available by renewing a small portion of the extra piece of cable, which had been put in to bring the connections from the cable head up the tower to the thermometer cages at the top. During all our trouble we least suspected this wire, owing to its having been only recently installed. It consisted of four No. 20 wires, rubber and braid insulation, encased in a lead sheath. The wire had become very brittle, and an examination showed that it must have been "burnt" during annealing. After removing the faulty pieces, records were resumed during part of October, November and part of December. Further trouble was experienced the latter part of December, when it was found that the low temperatures had further deteriorated the wire in the remaining extra cable length. This decided us to remove all this faulty wire, about 20 feet down to the cable head at the middle of the tower. When this was done, our main cable was tested for insulation and found absolutely perfect, even though the tests were carried out during some mild and rainy weather in January.

Owing to the difficulty of working on the top of the tower during the severe winter weather, we decided to place the thermometer temporarily in the lower box containing the cable head and connect it directly with the wires from the cable. Our thermometer cage being in a very flimsy condition we took advantage of the circumstance to install a new cage which through the kindness of Prof. R. F. Stupart, Director of the Meteorological Service, was sent to us. At the same time (March 30th) a new weather-proof four strand length, which was also passed through a length of lead tubing, was used to connect the cage with the cable head box, and after repeated tests of the insulation and zero of the instrument, the mountain thermometer was put in its old place. Records have since been made in a perfectly satisfactory manner up to the time of writing, except for about a week, when a thunderstorm during the middle of May produced some slight damage. It is to be hoped that the records will now go on without interruption. The first few days of every month are devoted to bringing the mountain thermometer down to the Observatory and testing the zero of the instrument, which means tracing on the record sheets the line of equal temperature. This is done, as before described, by looping the mountain wires and connecting the upper level thermometer into the circuit in the observatory cage, side by side with the low level instrument.

Our differential records during a part of January, and all of February and March, are incorrect during a part of the day, owing to the thermometer being enclosed in the cable head box. This box was almost entirely closed to keep out rain and snow. As a result, the sun, shining on the box and heating the interior, caused a large positive departure of the record from the line of equal temperatures. No abnormal effect was noticed at night or during dull cloudy days. Nocturnal radiation may have produced some effect in cooling the box, but this is small as compared with the effect of the sun's radiation, and no abnormal negative departure of the trace was observed. The monthly averages for February and March are therefore computed, leaving out of account the effect of the sun during such time as that was observed. So few traces were obtained in January that we have not been able to give a value of the monthly average difference for that month.

The values from June to September, 1907, were taken solely from the thermograph charts. The values for October, November and December were from both thermograph and mountain instruments; the thermograph was discontinued after December. It is interesting to compare the differences obtained by the two methods during the three end months of 1907. Thus the differences are as follows:—

TABLE I.

Month 1907	Difference by Thermograph	Same by Differential Recorder
October	—3.°0 Fah.	—2.°9 Fah.
November	—4.°0 Fah.	—2.°9 Fah.
December	—3.°4 Fah.	—3.°6 Fah.

The deviation is considerable in November, but we must remember that an agreement of better than a degree by an ordinary thermograph is not to be expected. The difference for October in the case of the differential recorder was computed from only eight charts at different dates throughout the month, so the agreement here is accidental. The agreement for December is more satisfactory.

In the following table we reproduce the table of differences for the several years, including the results during the past year, 1907-08.

TABLE II.

	1903–04	1904–05	1905–06	1906–07	1907–08
July	—5°.5 Fah.	....	....	—2°.6 Fah.	—1°.9 Fah.
August	—4°.7 "	....	....	—2°.5 "	—4°.4 "
September	—5°.8 "	....	....	—4°.4 "	—1°.6 "
October	—7°.6 "	....	....	....	—3°.0 "
November	—4°.6 "	....	....	—5°.7 "	—2°.9 "
December	—8°.2 "	....	—3°.0 Fah.	—8°.2 "	—3°.6 "
January	—11°.2 "	....	—2°.2 "	—6°.3 "	....
February	—8.°1 "	—2°.7 Fah.	—1°.6 "	—4°.3 "	—1°.5 "
March	—5°.9 "	—2°.0 "	—2°.5 "	—2°.9 "	—1°.8 "
April	—6°.8 "	—3°.1 "	—3°.7 "	—4°.6 "	—2°.8 "
May	—3°.7 "	—2°.6 "	....	—2°.6 "	....
June	....	—2°.2 "	—2°.5 "	....	....

Temperature Forecasts.

As an example of the way our records afford a means of forecasting the temperature conditions of the next day, we include the following table of predictions, taken from the April records. It is from a careful study of the general variation of the differences for each daily chart, as well as from the actual magnitude of these differences. No single observation at one time can give anything like as accurate a prediction as a general examination extending over several hours. We always have to consider what has happened before, going back over as much as 24 or even 48 hours by inspection of the continuous variations in the temperature gradient in the lower strata of our atmosphere.

TABLE III.

PREDICTIONS FROM APRIL RECORDS.

	Prediction from the chart.	Actual change in temperature on the following day shown by thermograph record.
On April 2nd	Little colder.	About 10° F. colder.
3rd	Continued cold to little colder.	About 2° or 3° F. colder.
4th	Not much change in temp. to warmer.	Warmer.
5th	Warmer.	About 8° warmer.
6th	Not much change.	About same average temperature
7th	Decidly colder.	About 20° colder.
8th	Not much change.	Not much change.
9th	Cooler followed by warmer.	Warmer.
10th	Warmer.	Not much change.
11th	Cooler.	Cooler.
12th	Not much change.	Not much change.
13th	Not much change.	Same average temperature.
14th	Warmer.	Warmer.
15th	Warm at first, then colder.	Colder.
16th	Not much change; warm waves.	About 20° warmer.
17th	Warmer.	Warmer.
18th	Not much change	No change.
19th	Colder.	Colder.
20th	Same temp. (Cooler).	Cooler.
21st	Cooler followed by warmer.	Cooler followed by warmer.
22nd	Warmer.	About 20° warmer.
23rd	Warmer.	Warmer.
24th	Warmer.	Warmer.

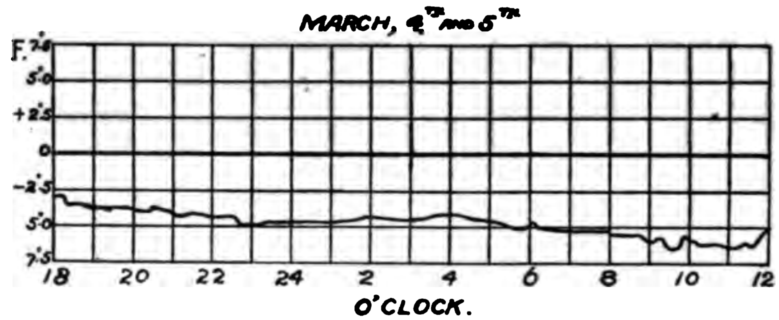
As an example of the method of judging, we reproduce some typical curves in one instance, where the value of our method to meet local conditions is illustrated.

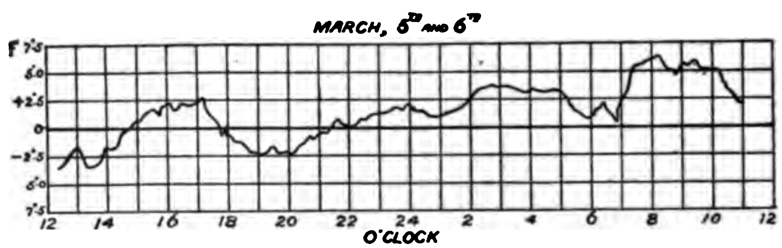
Fig. 1 shows a trace from 6 o'clock in the afternoon of March 4th, extending to 12 o'clock (noon) on March 5th. This shows increasing negative difference over a period of 18 hours, indicating change to colder weather for the afternoon and night of the 5th. The temperature actually remained on or about 0° F. all day of the 5th, and fell on the morning of the 6th to 10° below zero.

Fig. 2 shows the trace obtained from noon on the 5th to noon on the 6th. The temperature gradient in the upper strata becomes less and inverts several times. The departure of the trace towards the positive commenced a little after noon and showed that warmer conditions were likely to follow. From the character and extent of the warmer waves lasting so long we predicted at once a decided change to warmer weather, although the temperature at the Observatory was still falling. This change actually took place at noon on the 6th, when the temperature rose steadily until the early morning of the 7th, when the snow and rain predicted for the night previous, arrived. The early part of the record, before 6 p.m. on March 4th-5th, is not given on account of the effect of the sun during the day on the cable head box as described.

We must still further emphasize the value of these temperature records for local temperature predictions. A host of examples could be presented if space permitted, showing the accuracy of our records, but we believe that the examples cited will be sufficient. It is very much desired that more stations be established elsewhere for similar observations, in order fully to develop this method.

We desire to thank Mr. C. H. Hood for assistance in reducing observations and in taking care of our thermograph when in place on the tower.





XIV.—*The Construction and Calibration of Very High Resistances and a Standard of High Resistance.*

By HOWARD L. BRONSON, Ph. D.

Lecturer in Physics, McGill University.

(Communicated by Prof. H. T. Barnes, D.Sc., and Read May 28th, 1908).

The study of the passage of electricity through gases and its application to the phenomena of radio-activity has required us to extend our field of accurate electrical measurements. These ionization currents, which we measure, are in general too small to even be detected by the most sensitive galvanometers. It has, therefore, been found necessary to resort to the use of the electrometer or the electroscope. The principle of the method is the same for both instruments, and involves the measurement of the change of potential of some system of known capacity. All who have used these instruments in the measurement of currents have found the method slow and liable to many sources of error.

It is evident that we could easily measure these small currents by measuring their drop in potential across a sufficiently high constant resistance, whose actual numerical value was known. Such a resistance would be found very useful as a standard of high resistance, and could be used to advantage, not only in radio-active measurements, but also in insulation testing, and in the measurement of capacity, especially in cases where ordinary methods would be difficult to apply.

The writer has been applying the above principle in making radio-active measurements for the past four years, and has found it very satisfactory. Fig. 1 shows the arrangement of the apparatus.

If one pair of quadrants of an electrometer is connected to earth, and the other pair is not only connected to the testing vessel, but also to earth, through a very high resistance, it is easily seen that any current in the testing vessel will charge the quadrants, until the discharge current through the high resistance is equal to the current in the testing vessel. (This latter current is not diminished by the rise of potential of the quadrants, because the voltage on the testing vessel is always high enough to produce practical saturation.) In this case, the current is proportional to the potential on the quadrants—that is, to the deflection of the needle. If the sensitiveness of the electrometer and the actual value of the high resistances are known, then we have at once an absolute measure of the ionization current in the testing vessel. Further, by placing some form of potentiometer between the standard high resistance and the earth, the range, over which we can measure currents, can be made very large.

The great difficulty in getting a resistance, which is sufficiently high and at the same time constant, is probably the reason that the method has not come into more general use. The purpose of the present paper is to discuss the possibility of getting such a resistance, and to describe the results that have been obtained by the writer in this direction. These results are still far from satisfactory, but it is hoped that they may be a step in the right direction.

It is well known that resistances from one to ten megohms can be made from fine carbon lines or films, or from certain liquids, such as xylol, or amyl alcohol. One of the most satisfactory of these

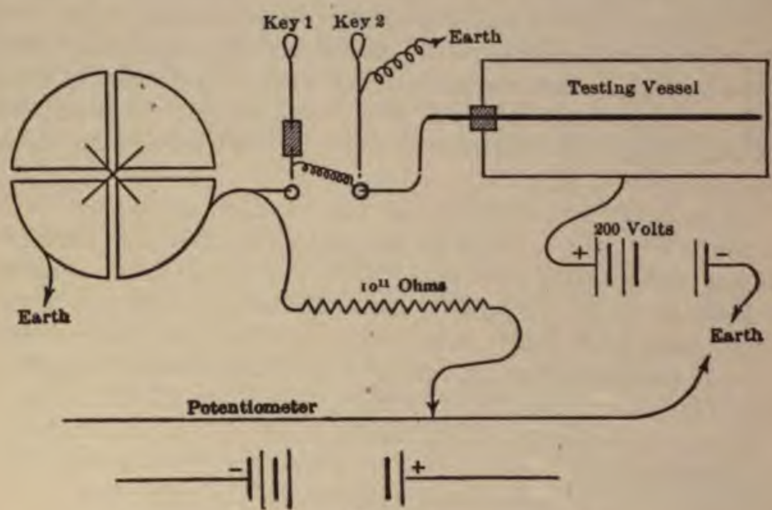


Fig. 1.

liquid resistances, known as Hittorf's solution, is a solution of amyl alcohol containing 10 per cent of cadmium iodide. If the electrodes are of cadmium, this resistance should show no polarization. Recently C. W. Stewart (Physical Review, Vol. XXVI, page 302, 1908) has described a new form of carbon resistance. It is obtained by mixing lamp-black with a lacquer called "Zapon," and spreading the mixture on an insulating surface. In this way he obtained resistances varying from 0.3 to 3 megohms, and he speaks very highly of their small temperature coefficient (.001 to .0015), and of their permanency and constancy, there being only very slow changes in the resistance with the time. The films used by Stewart were about 4 mm. long and 2 mm. broad, and he did not attempt to deal with resistances larger than 3 megohms. However, he states that resistances of 40,000 megohms could be made from a film 4 meters long and 0.2 mm. wide, and he assumes that it would behave just as satisfactorily as the ones with comparatively small resistance. This is probably not the case, as we shall see later.

The writer spent considerable time trying to make a satisfactory high resistance by means of carbon lines on ebonite or ground glass, as well as out of various liquids in capillary tubes. It was found possible in nearly all cases to get resistances that were large enough (about 10^{11} ohms), but there was always considerable variation and uncertainty. The carbon line seemed to have its entire resistance at one point and to be merely a case of bad contact, which was bound to be very uncertain and subject to all kinds of external conditions. The liquid resistances have very large temperature coefficients, and seem to be subject to a variable polarization. It is possible that this variation was not due to polarization at all, but to the electrical absorption caused by the relatively large amount of insulating material, which was necessarily present. The fact that the carbon resistances exhibited the same effect to a less extent would also point to this conclusion.

The effect of this electrical absorption is quite noticeable in most condensers and is very marked in the case of insulation testing. It decreases with the time, but may continue for some hours. It is evident that this absorption will be relatively greater, the greater the resistance, that is, the smaller the conduction current. It will also be increased by an increase in the amount of the insulating material in contact with the conductor. It is therefore not at all certain that a satisfactory resistance of 40,000 megohms could be made as suggested by Stewart, for, as we have seen above, we should expect that the disturbance due to absorption would be from 10^5 to 10^{10} times as great in a resistance of 40,000 megohms as in a resistance of 3 megohms. This difficulty seems to be inherent in the very nature of all this class of resistances. In order to avoid it, it would be necessary to have a conductor of large cross section and short length, so that a relatively small amount of surface would be in contact with the insulating material.

This condition has been fulfilled in a large measure by the use of an ionized gas as a high resistance standard. Professor Rutherford suggested the possibility of doing this, as he had previously shown that the current, through a gas, subject to a constant source of ionization, was approximately proportional to the difference in potential, as long as this difference was small. The writer has been using this principle successfully for the past three years in making radio-active measurements, and is satisfied that, for this purpose, it gives as accurate results as any of the other methods. It is also much less troublesome, when it is once arranged, and is adapted to measurements for which the other methods are unsuited.

The high resistance standard itself has gone through quite an evolution during the past three years. The one at present in use is shown in Fig. 2. The shaded portion is ebonite, the electrodes are of aluminum, and the active material consists of about a tenth of a milligram of radium bromide. In general, the relation between the ioniza-

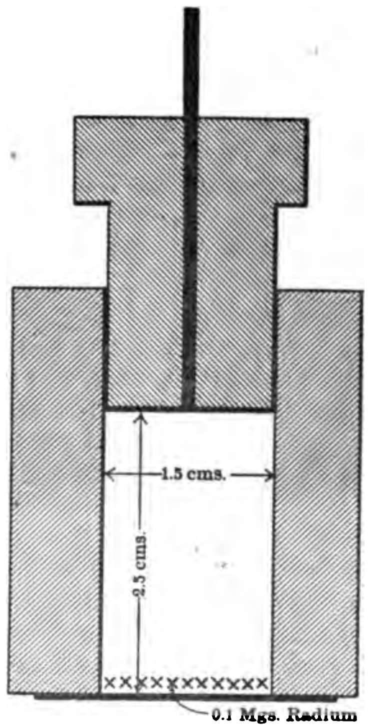


FIG. 2.

tion current in such a vessel and the potential difference between the plates is not linear, but depends upon the nature of the active material used, the kind and amount of insulation, and the distance between the plates. However, it is generally possible to so adjust the distance between the plates that a linear relation will exist for a considerable range of potential. Nevertheless, it is necessary to get a calibration curve for every such vessel. This can only be done by some form of the rate method, which must ultimately be the basis of all such measurements. However, in the case of a calibration curve, the rate method is used under the most advantageous conditions.

Even under these favourable conditions, there are many difficulties which are not easily overcome. This is not surprising when it is remembered that the standard testing vessel has a resistance from 10 to 100 times as great as the values usually given for the resistance of condensers. In calibrating the standard, the condenser is put in place of the testing vessel of Fig. 1 and the system is charged through the standard vessel.

In order to eliminate as far as possible any leakage from the electrometer and condenser, the average potential during the time of charging is kept about zero, and the total change of potential of the system is never more than 0.2 volts. The error due to absorption by the ebonite of the standard is not very large, and can be largely eliminated by applying the potential to the standard a few minutes before taking a measurement. In order to calibrate the standard over a considerable range of voltage, for example, from 100 to 0.1 volts, and at the same time not have too great a change in the rate of movement of the electrometer needle, it is necessary to change the capacity of the system. The accurate comparison of these capacities offers the greatest difficulty to the calibration. The writer used a subdivided mica condenser, the sections having capacities from 0.5 to 0.001, microfarads. Several methods were used in calibrating this condenser. The different methods gave very concordant results for the larger sections, but gave values for the smaller sections which differed in some cases by more than 10 per cent from one another. There is the added difficulty in the use of these small capacities that the potential on the standard is also small. Thus, with one volt on the standard, a change of 0.2 volts in the potential of the quadrants will change the potential on the standard by 20 per cent.

It has, therefore, been found advisable to use a double method of calibration. If we have some radio-active material whose rate of decay has been accurately determined (which, of course, originally involved the rate method), we can use this rate of decay as a means of calibration. The active deposit from actinum is probably the best substance for this purpose, as its rate of decay has been carefully determined by a number of observers and their results agree very well. The following are some of the best values of the time taken for it to decay to half-value:

Godlewski	36 minutes
Meyer and Schweidler	35.8 minutes
Hahn and Lochur	36.4 minutes
Debierne	36 minutes

If we take 36 minutes as the mean value, it cannot be far from the truth.

Fig. 3, curve A, represents the logarithmic decay curve of the active deposit of actinium, as measured by one of the standard vessels. The ordinates represent time in minutes, and the abscissae the log. of the voltages on the standard. The straight line, B, represents the relative values of the ionization current at the different times, on the assumption that the active matter decayed to half-value in 36 minutes. If the current through the standard vessel were proportional to the

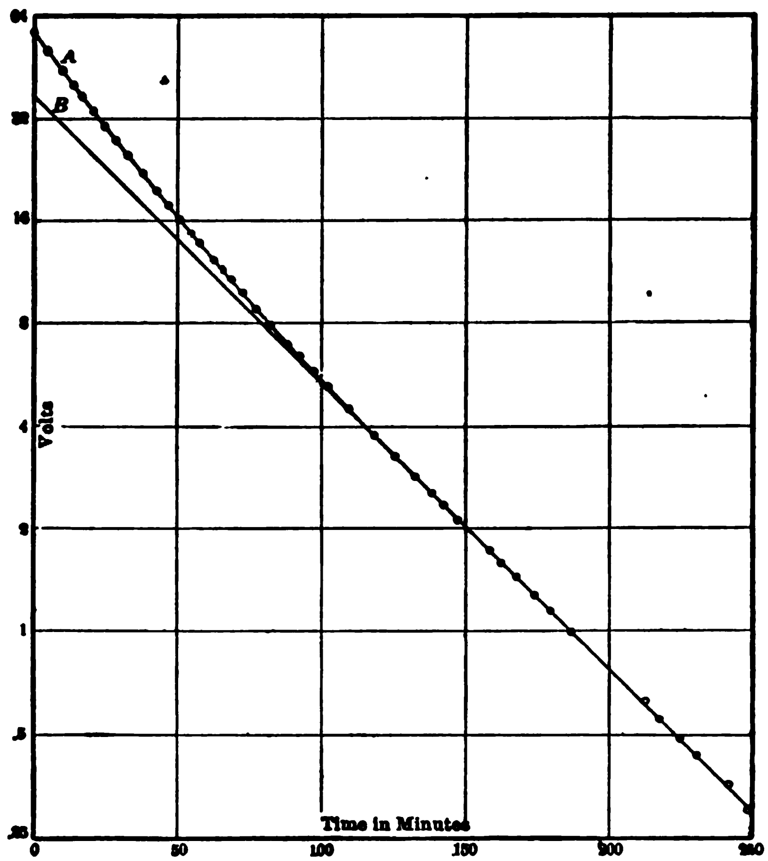


FIG. 3.

potential difference between its plates, then curve A would coincide with B. It is evident, from the figure, that the potential increases more rapidly than the current; that is, the apparent resistance of the standard begins to increase when its voltage rises above about 5 volts. The ratio of the abscissae of curves A and B at any time is a measure of the resistance of the standard vessel for that voltage. If we thus compare the resistances at 20, 40 and 60 volts, we find their ratio to be 1:1.16:

1.28. In order to verify these values, the actual current through the standard for these voltages was measured by the condenser and rate method. The actual resistances were found to be 0.971 x 10^{11}, 1.14 x 10^{11} and 1.25 x 10^{11}. The ratio of these resistances is 1:1.17: 1.28. We thus see that the two methods agree when fairly large voltages and capacities can be used. For the smaller currents, the use of a decaying radio-active substance is much the best method.

Of course this high resistance standard, as I have called it, is not a true resistance, because it does not obey Ohm's Law. It does, however, make a very satisfactory substitute, when once a calibration curve has been obtained.

The results given in this paper would suggest the possibility of making standard vessels, similar to the one here described, and preserving them as permanent high resistance standards. They would have a much higher resistance than any standards with which the writer is acquainted, and ought to remain constant over a long period, if the active material used is radium or some permanent radioactive substance.

XV.—*Production of Hydrogen Peroxide by contact of Metals with Water containing dissolved Oxygen.*

By G. W. SHEARER, M.Sc.

Demonstrator of Physics, McGill University.

(Communicated by Professor H. T. Barnes, D.Sc.)

(Read May 28th, 1908.)

When two aluminum electrodes are placed in air or oxygen-free water they show no potential difference, but if one is placed in air-free and the other in air-charged water, a large potential difference of 0.7-0.8 volts is developed. The electrode in air-free water is electro-positive to that in the air-charged water.[1] Other metals were tried, and some gave similar, but smaller results, while still others showed no effect, notably magnesium.

Thus, if we make up a cell with aluminum and magnesium electrodes in air-charged water, we obtain a potential difference of almost a volt as the result of the following cycle:

+		+
Mg+	0.02 to	Mg(0)
0.21		.97 ,
to		to
A1 +	0.80 to	A1 (0)

where Al (0) and Mg (0) stand for aluminum and magnesium in air or oxygen-charged water.

Cells of the above type have been studied by several investigators, and show some very interesting characteristics. For instance, in a cell made up of $Mg\text{-}A1_2\ (So_4)_3\text{-}A1$, the e.m.f. is about 1.3 volts. This is raised to 1.7 on addition of hydrogen peroxide and rises to about 2 volts when short circuited. This rise is gradual, and after reaching a maximum there is a slow fall; addition of fresh peroxide always sending it back to its high value.

It has been found that this peculiar action is associated with the presence of the H_20_2 about the aluminum electrode, and with the surface film, which is present upon all aluminum surfaces exposed to air or to electrolytic oxidization. But the abnormally high e.m.f. developed between two metals (A1 and Mg), which are so close together in the electro-chemical series, was not so easy to explain. Prof. Bancroft sug-

[1] Am. Electrochem Soc., Vol. 3., p. 95 (1903). Ibid. Vol. 12, p. 54 (1907).

gested[1] that aluminum in the presence of water containing dissolved oxygen, formed hydrogen peroxide, and thus formed a cell with H_20_2 as electrode. He suggested the following reaction:—

$$2\ A1+6H_20+30_2=A1_2\ (0H)_6+3H_20_2$$

The series of experiments, which form the subject of this paper, were made to test this point. A very simple one was first tried. Some carefully cleaned aluminum sheet was placed in well aerated distilled water. After standing for 48 hours, the starch potassium iodide test for the peroxide was applied, and a comparatively strong reaction for peroxide obtained. A sample of the water, which had not been in contact with the aluminum, showed no trace. The starch and KI test was performed as follows: To the sample to be tested a drop of lead acetate was added, followed by a very little weak (1|2%) K1, some starch solution, and lastly a drop or two of weak 3% acetic acid. A blue colour denoted the presence of hydrogen peroxide.

Having obtained this indication that the peroxide was formed, several somewhat more elaborate experiments were made. A long glass tube of about 3 cms. bore was filled with clean A1 foil and water, and air drawn up through. The yield of H_20_2 was greatly increased by this treatment, and reached a maximum in about two hours, after which the action was stopped by the film which had gathered on the aluminum surface. As an electric current tends to remove this film when the aluminum is the cathode, it was thought that it might increase the yield. Accordingly this was tried, a platinum anode being used and air bubbled through the water. But when the test was applied no peroxide could be detected, showing that what caused the removal of the film also caused decomposition of the peroxide. The experiment was then repeated with the direction of the current reversed, and when tested it was found that the yield had been greatly increased, showing that the film and peroxide were formed together. This would indicate that the film and the hydroxide $A1_2(0H)_6$ were the same.

The above reaction may be represented as follows:—

$$\xleftarrow{\text{A1 as cathode}}$$
$$2\ A1 + 6H_20 + 30_2 = A1_2\ (0H)_6 + 3H_20_2$$
$$\xrightarrow{\text{A1 as anode}}$$

The yield was also increased by mechanical agitation and by cooling the water to increase the solubility of the oxygen. Air and oxygen

[1] Jour. Phys. Chem., Vol. 12, p. 155, (1908).

gave similar results. The great dependence of the action upon the amount of dissolved oxygen present is already shown by the following test:—Some foil was cleaned and placed in boiling distilled water, then after boiling for some minutes, to expel all air, the heat was removed and the flask tightly corked. The water was allowed to cool and shaken frequently, but when opened and tested, no H_2O_2 could be detected. The same foil, however, when placed in aerated water developed the peroxide in a very few minutes. The greatest yield was obtained when the water was cooled by packing the flask in cracked ice, and at the same time passing an electric current through the water from a mass of aluminum scrap to a small aluminum wire, which served as cathode. A continuous stream of air was, at the same time, passed through the water.

It is stated that zinc and iron also form the peroxide with water. In order to test this, zinc in the form of a powder was treated in the same manner as the aluminum, but no peroxide could be detected.

The iron treated was in the form of fresh turnings, and although a great deal of rust was formed, no peroxide could be detected.

A second trial with zinc, in a coarse granulated form, gave a marked peroxide reaction about equal, if not stronger, than in the case of the aluminum.

If the water was allowed to stand in contact with the zinc, no air being bubbled through, the peroxide was in every case completely decomposed after 7 or 8 hours, but in the case of the aluminum, this decomposition took place only after several days. A more rapid action of decomposition with finely divided substances probably explains the failure to get the test in the case of the trial with zinc powder.

Other metals as copper, platinum and magnesium, were tried, but the only one which gave a yield strong enough to be detected by the starch KI reaction, was magnesium. Several other tests for the detection of the peroxide were tried, but the only one which was at all successful was that known as Bach's. This is as follows:—Add 2 or 3 drops of 5% oxalic acid to equal parts of the solution to be tested and a .003% solution of potassium bichromate, which contains 6 drops of pure anilin per litre. A pale pink colour denotes the peroxide.

Quantitative tests for the approximate strength of the yield of H_2O_2 from the different metals, were carried out as follows:—a solution of ordinary 3% peroxide was diluted to 1 part in 2,000 and this was again diluted to 1 in 30,000, 60,000, etc., up to 1 in 600,000 and solutions of each obtained. The starch KI test was applied to each of these, the result being labeled and kept for reference. The test was then applied to the sample to be estimated and compared with those obtained from the solutions of known strength. Considerable difficulty was experienced, for the various tests upon the same solution did not always agree, probably due to the addition of a little too much or too little of one or the other re-agent. As the colour of the test changes with age, fresh tests from the known solutions had to be taken from time to time.

The Bach test referred to, while much more convenient to apply, is not as sensitive and did not give as good quantitative results as the starch KI test. The colour from the strong solutions was hardly any deeper than that from much weaker ones. The stronger the solution the quicker the colour appeared, but it also faded quicker. About 1 part in 200,000 was the limit of this test. The titanium sulphate test was tried, but failed altogether, as 1 in 40,000 was its limit.

From the results of the starch KI test the greatest yield with the aluminum was judged to be between 1 in 50,000 and 1 in 100,000, while that from the zinc was between 1 in 50,000 and 1 in 70,000.

Magnesium gave not more than 1 in 300,000.

In reviewing these results we see that the metals whose oxide or hydroxide is not protecting decompose the peroxide rapidly, while those whose oxide or hydroxide is more adherent do so very much more slowly. When air is bubbled through the water, the formation takes place in spite of the counter reaction of decomposition, but decomposition takes place when the air current is not kept up.

It seems probable that the yield of H_2O_2 is not always checked by the fouling of the metal, but that at some point the formation and decomposition balance. This is borne out by the fact that in some of the experiments with aluminum the yield was the same, although there was more metal surface in one than in the other. If too little surface is supplied the action is checked by the fouling of the surface. Owing to the form of the metals used, turnings, scrap, etc., it was impossible to estimate the surface exposed.

Whether in the case of iron the peroxide is formed and immediately decomposed or not formed at all, is a question on which there is considerable difference of opinion, but as far as the writer is aware, it has never been detected.

XVI.—*The Mineral Constituents of the Ottawa River Water, 1907.*

By FRANK T. SHUTT, M.A., AND A. GORDON SPENCER, M.Sc.

(Read May 26th, 1908.)

Analyses of the water of the Ottawa river have been made from time to time by several chemists, but so far as is known by the writers all the examinations, with one exception, have been made from the sanitary standpoint and had for their sole object the determination of the purity of the water at different places along the course of the river. Many such analyses have been made by the writers in the past and it might be interesting in connection with the present investigation, as showing the general character of the water, to record herein some of the data which have been obtained at the Laboratory of the Experimental Farms, Ottawa.

SANITARY ANALYSES OF THE OTTAWA RIVER WATER

From records of the Chemical Laboratory, Central Experimental Farm, Ottawa, Ont.

Date	LOCALITY.	Free Ammonia.	Albuminoid Ammonia.	Nitrogen in Nitrates and Nitrites	Chlorine.	Total Solids at 105°C.	Solids after Ignition.	Loss on Ignition.
		p. p. m	p.p.m.	p.p.m	p.p.m	p.p.m	p.p.m	p.p.m
Dec. 22nd, 1887	Mouth of clear water inlet, in front of screen, Ottawa	.020	.120	.148	.5	53.0	...	...
Oct. 18th, 1895	Tap in Laboratory, Central Exp. Farm, Ottawa	.008	.145	.059	.6	55.6	34.0	21.6
Dec. 7th, 1896	Tap in Laboratory, Central Exp. Farm, Ottawa	.015	.233	.099	.2	42.4	28.0	14.4
May 8th, 1899	Tap in Laboratory, Central Exp. Farm, Ottawa	None	.177	.107	.3	48.8	22.8	26.0
Aug 22nd, 1905	Intake No. 4 Crib, Ottawa	.010	.220	.100	.6	62.4	36.4	26.0
March 12th, 1907	Above Chaudiere Falls, Ottawa	....	....	....	...	54.6	30.6	24.0
July 16th, 1907	" " " "	....	....	....	...	46.1	30.3	15.8

REMARKS: Water generally clear with marked brownish yellow colour, odourless; phosphates present in traces only.

As will be observed the analyses here presented extend over a number of years, and represent the water as collected at different seasons. The data show that the character is that of an "upland, peaty" water. It is evidently of fairly constant composition, judging from the hygienic standpoint, and can be classed as a good, potable water. The most notable feature of these analyses is the high percentage of organic and volatile matter (indicated by the figures in the columns marked Albuminoid Ammonia and Loss on Ignition), as compared with the total solids which are, comparatively speaking, very low. This organic matter is chiefly, if not entirely, of vegetable origin, and, so far as is known, is of a harmless nature. The free ammonia, nitrogen as nitrates and nitrites and chlorine are low, indicating freedom from excrementitious matter. The reason for the comparatively high albuminoid ammonia has already been accounted for in referring to the dissolved vegetable organic matter present. The total solids, as already remarked, are very low, even for a river water. They vary slightly with the season of the year, but always indicate a water that would prove useful for domestic and manufacturing purposes.

The determinations of the mineral constituents of the Ottawa, the estimation of which forms the basis of this investigation, was undertaken at the suggestion of Dr. R. A. Daly, geologist to the International Boundary Commission, and the *raison d'être* can best be given by quoting from a letter from him to one of the writers in this connection. "The purpose of the two (winter and summer water) analyses is to secure an approximate annual average composition of the dissolved materials in the Ottawa as what may be called a typical pre-Cambrian river. I mean by this that the Ottawa above the Capital drains an immense and nearly average rock area of the pre-Cambrian terrane in Canada. The later (Palæozoic) formations occur in but very small or negligible patches above Ottawa City, while the various Huronian and Laurentian formations are mostly all represented on a great scale. This area of pre-Cambrian rocks drained by the Ottawa is certainly one of the very largest known to be underlain by these old formations within a single river-basin.

The samples of water from which the determinations were made were collected by Dr. Daly from the main course of the river above the Chaudiere Falls at two seasons of the year. The first sample was taken on March 12th, 1907, before the melting of the snow had commenced along the upper stretches of the tributaries of the Ottawa, or the ice on the river itself had "broken up." The river was then passing through the stage of the lowest water known in the last fifty years.

Only seventeen litres were obtained at this time and it was consequently found impossible to make the analysis of this sample as complete as was later found desirable. The second sample was taken on the 15th of July of the same year; at which time we may suppose the river had still nearly its summer flood level. They therefore represent the water of the Ottawa river at this locality under low-water (winter) and high-water (summer) conditions.

By reason of the small mineral content of this water, as large quantities were used for each determination as the sample permitted. Needless to say the work was performed with the greatest of care, and, wherever possible, duplicate, and in some cases triplicate, determinations were made.

In the following tables the data are reported in three forms:—As basic and acid radicles, as ions, and as compounds possibly present in the water.

Table No. 1 gives the uncombined results in the form that has been most customary in the past and which will probably be best understood:

I. Analysis of Ottawa River Water at Winter and Summer Levels.

	March 12th 1907	July 15th 1907
	p.p.m.	p.p.m.
Silica (SiO_2)	6.52	7.06
Sulphuric anhydride (SO_3)	3.70	2.51
Carbon dioxide (CO_2) (by calculation)	....	18.34
Phosphoric oxide (P_2O_5)	not det.	.43
Chlorine (Cl)	.50	.50
Iron Oxide (Fe_2O_3)	.34	.70
Alumina (Al_2O_3)	.38	.52
Manganese Oxide (Mn_3O_4)	not det.	.86
Lime (CaO)	12.57	8.18
Magnesia (MgO)	3.87	2.77
Potash (K_2O)	not det.	.67
Soda (Na_2O)	not det.	2.14

Table No. 2 presents the data expressed in terms of the ions; probably the most correct method of recording the results:

II. Results of Analysis expressed as ions.

	March 12th 1907	July 15th 1907
	p.p.m.	p.p.m.
SiO_3''	6.52	7.06
SO_4''	4.43	3.01
H_2CO_3' (by calculation)	....	25.43
PO_4'''	not det.	.58
CL'	.50	.50
Fe'''	.23	.49
Al'''	.20	.28
Mn''	not det.	.62
Ca''	8.98	5.84
Mg''	2.33	1.67
K'	not det.	.56
Na'	not det.	1.59
Oxygen to form Fe_2O_3 Al_2O_3, Mn_3O_4	.19	.69

Table 3 shows the combinations of the mineral constituents as they possibly exist in the water. It is true that any such combination is open to objection on the ground that it is necessarily of a more or less hypothetical nature, but as it has been customary in the past to report the results of analyses of mineral waters in such a form, it has been thought well, more particularly for the purposes of comparison, to prepare this table. As the March analysis is incomplete it is only possible to report the results of the July sample according to this scheme.

From these data it will be seen that the mineral matter of this water is composed mainly of the carbonates of the alkaline earths with some silica and small quantities of the alkalies, iron, alumina, and manganese.

Comparing the results of the two analyses as given in Tables Nos. 1 and 2, a marked difference in the amounts of lime is to be observed. Thus, in March the lime (CaO) was 12.57 p.p.m., while in July only

III. **Results of Analysis combined as they probably exist in the river water.**

	July 15th 1907
	p.p.m.
KCl	1.05
Na_2SO_4	4.45
$Ca_3(PO_4)_2$	.94
$NaHCO_3$	.54
$Ca(HCO_3)_2$	22.17
$Mg(HCO_3)_2$	10.10
SiO_2	7.06
Al_2O_3	.52
Fe_2O_3	.70
Mn_3O_4	.86
	48.39

8.18 p.p.m. were present. The smaller amount on the latter date is possibly due to the higher temperature of the water at that time—which would necessarily mean a greater decomposition of the bicarbonates of the water with precipitation of the lime as mono-carbonate. The magnesia is also lower in July than in March, and probably for the same reason.

The silica content is approximately the same for both samples, and constitutes somewhat more than one-fourth of the total mineral matter.

To quote from Dr. Daly's letter acknowledging our results, "The analyses show clearly the small content of calcium in the Ottawa river water and suggest that the pre-Cambrian ocean received far less calcium from the inflow of rivers than the present ocean receives for the same volume of inflow. Your analyses show that the River Ottawa annually delivers to the St. Lawrence and the sea, per volume, only 20 per cent of the amount of calcium now annually delivered to the sea by the average river of the globe. If (as is very probable) the pre-Cambrian lands were much smaller in area than the total of the present continents, the annual receipt of calcium by the pre-Cambrian ocean may have been much less than the 20 per cent, possibly only 10 per cent or less."

"These estimates suggest that the animals had relatively little calcium for the "manufacture" of hard parts in the pre-Cambrian time.

Hence, possibly, one reason for the lack of calcareous fossils in the pre-Cambrian formations."

It is not the purpose, however, of the writers to discuss the composition of the water from the standpoint of the geologist, but merely to place on record analytical data which may prove of value not only in the solution of geological problems, but also in the consideration of sanitary and industrial questions.

XVII.—*The Nitrogen Compounds in Rain and Snow.*

By FRANK T. SHUTT, M.A., F.I.C.

(Read May 26th, 1908.)

At the meeting of this society last year the writer presented a short paper entitled "The Fertilizing Value of Snow," in which were given the amounts of the various nitrogen compounds found to be contained in the snow as it fell near Ottawa during the latter half of the winter 1906-7. Nitrogen present as free ammonia, albuminoid ammonia and as nitrates and nitrites had been determined and the average total nitrogen content of the snow found to be .471 parts per million, of which the largest part was in the form of free ammonia. With the average snowfall at Ottawa, 90 inches, our results showed that the winter's snow furnished, approximately, per acre, 1 lb. of nitrogen valuable as a fertilizer.

This investigation has been uninterruptedly continued, samples representative of each fall of rain and snow that furnished a sufficient quantity for examination, being collected and analysed, so that now we can place on record the data for the year ending February 29th, 1908. In all, 78 samples were analyzed, 46 of rain and 32 of snow. The results obtained for each month have been averaged, and from these averages the total monthly amounts of nitrogen in the various compounds, per acre, calculated, using therefor the precipitation data recorded on the Experimental Farm. This has furnished approximately the amount of nitrogen in the snow and rain during the twelve months.

The monthly totals for the precipitation, the average amounts of nitrogen present in the three forms and the pounds of nitrogen per acre so supplied, are given in the following table:

Rain and Snow at Ottawa, for year ending February 29th, 1908.

Month and Year.	Precipitation in inches			Nitrogen parts per million				Pounds of Nitrogen per acre.
	Rain	Snow	Total as inches of rain.	In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites	Total	
Marcn............1907	1.55	11.50	2.70	2.25	.049	.193	.467	.286
April............. "	2.59	7.25	3.32	.320	.056	.120	.496	.372
*May.............. "	1.56	7.50	2.31	.082	.033	.065	.180	.094
June .... "	2.20	....	2.20	.490	.156	.147	.793	.395
July.............. "	3.73	....	3.73	.275	.117	.145	.537	.454
August........... "	1.13	....	1.13	.369	.102	.114	.585	.150
September........ "	3.32	....	3.32	.503	.129	.137	.769	.579
October........... "	2.70	1.00	2.80	.434	.085	.193	.712	.452
November........ "	3.37	5.50	3.92	.349	.063	.064	.476	.423
December......... "	.81	34.75	4.28	.349	.096	.171	.616	.597
January..........1908	.13	30.25	3.16	1.56	.059	.149	.364	.260
February......... "	.96	35.25	4.48	.098	.053	.106	.257	.261
Total for 12 months...	24.05	133.00	37.35	......	......	......	......	4.323

* Only one analysis was made this month, the work being interrupted by the making of necessary changes in the collecting apparatus.

One or two of the more important facts brought out by the foregoing data may be briefly considered.

1. The amount of nitrogen in the rain and snow at Ottawa during the year was 4·323 lbs. per acre. Of this, 74 per cent or 3·199 lbs. was present as ammonia and ammonium salts, and 26 per cent or 1·124 lbs. as nitrates and nitrites.

In this connection it is of particular interest to note that in a paper entitled "Composition of Rain-water at Rothamsted," (Journal of Agricultural Science, Vol. I, Part 3, Oct. 1905), Dr. N. H. J. Miller reports that the average amount of nitrogen in the forms of ammonia and nitric (and nitrous) acid in the Rothamsted (Herts, England) rainfall during 13 years ending 1900-1, is 3·84 lbs. per acre per annum, and the relative amounts of ammoniacal and nitric nitrogen were 70 and 30 per cent, respectively, of the total.

During the year ending February 29th, 1908, practically twice as much water fell as rain as in the form of snow—24·05 inches of rain and 13·3 (equivalent to 133 inches of snow) as snow, and we estimate that of the total nitrogen furnished per acre during this period (4·323 lbs.), approximately 75 per cent, or 3·243 lbs., was present in the rain and 25 per cent, or 1·080 lbs., in the snow.

Finally it will be of interest to compare rain and snow from the point of view of their nitrogen content.

Average Nitrogen Content of Rain and Snow.

Precipitation.	Number of Samples	Precipitation in inches.	Nitrogen						
			Parts per million				Percentage of Total		
			In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites.	Total	In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites.
Rain	46	24.05	.396	.114	.142	.652	61	17	22
Snow	32	133.00	.216	.038	.132	.386	56	10	34

In free and albuminoid ammonia the rain, it will be seen, is much richer than the snow, but as regards nitric nitrogen there is not much difference. The total nitrogen content of the rain is almost twice that of the snow, which, if the atmosphere is fairly constant in respect to nitrogen compounds throughout the year, would go to show that rain possesses a greater solvent power, is a more thorough cleansing agent, than snow.

Considering the proportion or distribution of the nitrogen compounds, the averages of the year show that in both rain and snow the proportion of nitrogen as free ammonia is the largest and that of the albuminoid ammonia (largely derived, no doubt, from dust, etc.), the smallest.

The richness of any specific fall of rain or snow in nitrogen compounds is largely influenced, no doubt, by the period that has elapsed since the previous precipitation, though the amount of rain or snow falling, naturally, determines to some degree the composition in this regard. One or two examples to illustrate these points may be taken from the year's record. Between the 18th and 26th of June there had been no rain. On the morning of the 26th 0.05 inches rain fell and again in the evening of the same day, 0.16 inch. The analytical data are as follows;

	Precipitation inches.	Nitrogen		
		As Free Ammonia p.p.m.	As Albuminoid Ammonia p.p.m.	As Nitrates and Nitrites. p.p.m.
June 26th, Morning.......	.05	.640	.205	.164
June 26th, Evening.......	.16	.225	.105	.072

Again in July, after a period of three days without rain, similar results were obtained.

	Precipitation inches.	Nitrogen		
		As Free Ammonia. p.p.m.	As Albuminoid Ammonia. p.p.m.	As Nitrates and Nitrites p.p.m.
July 24th, Morning.......	.08	.330	.085	....
July 24th, Evening.......	.42	.230	.050	....

From the smaller percentage of nitrogen compounds in snow, to which we have already referred, it might be conjectured that the solvent or absorbent action of snow was less than that of rain, and this appears to be the case. Thus, snow fell to a depth of 8·75 inches during the early hours of December 30th, which on analysis was found to contain 0.09 p.p.m. nitrogen as free ammonia, 0.086 p.p.m. as albuminoid ammonia and 0.115 p.p.m. as nitrates and nitrites, a total of 0.291 p.p.m. of snow water. Later in the day, about 10-30 A.M., the temperature rose slightly and the snow turned to a light rain, of which a precipitation of .15 inch was recorded. Upon analysis this rain water gave .238, .271, and .582 p.p.m. of nitrogen in the form of the compounds mentioned, making a total of 1.101 p.p.m.

The rain and the snow, as we have seen, by their cleansing action upon the atmosphere furnish our soils annually with a notable amount of that important constituent of plant food, nitrogen, in a form extremely available for crop use. It is important, however, to point out that while our data support the widely accepted view that snow is a direct fertilizer it is very evident that its value in this respect has been considerably over-estimated by many of our farmers.

XVIII.—*Deficient Humidity of the Atmosphere.*

II. *Comparisons of various forms of Hygrometers.*

By T. A. STARKEY, M.B., D.P.H., F.R.S.I.,
Professor of Hygiene,

and HOWARD T. BARNES, D.Sc., F.R.S.C.,
Professor of Physics, McGill University, Montreal.

(Read May 28th, 1908.)

In a previous paper [1] on Deficient Humidity of the Atmosphere, we gave some comparisons of the wet and dry bulb hygrometer with the Regnault instrument and chemical estimation—the results showed that the readings by the first were far from satisfactory in a dry atmosphere, —the wet and dry bulb instrument always indicated too much moisture.

In the examples cited in that paper our instrument gave a relative humidity of 45% in the laboratory where the actual moisture content was only 6%. By causing the air to circulate round the wet bulb, the reading was reduced to 26%, but this was so much in error that, together with a large number of other similar erroneous readings, we felt justified for the time being, in condemning the ordinary wet and dry bulb instrument for reading indoors during the winter when the air becomes so dry.

We do not wish to leave the impression that we are trying to undermine the value of an instrument on which most observers rely. Such a procedure is open to criticism as tending to throw discredit upon an old "standby," without offering something reliable in its stead. This, however, is not our object.

Our aim is to find out under what conditions precisely the wet and dry bulb instrument gives accurate readings or deductions.

As will be shown in the course of the paper, the instrument can be manipulated so as to give fairly approximate results, but hitherto no conditions have been attached to its use; the well known tables of Glaisher have always been taken as correct and sufficient without further data, but, as we shall show, results may be obtained differing widely in their nature by simply altering the conditions of the instrument, and of the currents of air around it, etc.

We think that Glaisher must have had some good foundations, consisting of empirical observations, on which the tables were based, and we cannot imagine otherwise than that he checked the correctness of his observations by some system of chemical hygrometry, for after all this is the real and absolute determination; and any instrument which does not give approximate results when compared with the exact chemical estimate, cannot be said to be of much value.

[1] Trans. Roy. Soc. Can. 12, 203. (1906).

We have endeavoured by a process of experimentation, e.g., by altering the size of the thermometer bulbs, using different kinds of wick, changing the position of the reservoir; varying the temperature of the feed water, and using currents of air at different speeds, to find out under what conditions the readings of the wet and dry bulb instrument are approximately true.

As will be seen, we have obtained some results which promise to reward further investigation; but as will be readily recognized, this must be a question of time, in order to collect sufficient data on which to form trustworthy conclusions.

Comparisons were made, in the first instance, with three wet and dry bulb instruments, set up in such a way that a draught of air could be drawn across them by means of a motor fan.

Our original instrument had a rather small spherical bulb, and a comparatively large wick. Our second instrument had a much larger spherical bulb, and a rather smaller wick; while our third instrument had a cylindrical bulb, about 2 cms. long, and a wick attached to the lower end.

The bulbs, in all cases, were covered with cheese-cloth, which had previously been chemically treated to remove fats, etc. Chemically treated silk was used at first in place of the cheese-cloth, but the results were not so satisfactory. We believe the coarse structure of the latter, which exposes the bulb to view in the meshes, is more advantageous than the closely woven silk, in that it gives greater sensitiveness.

Ample reservoirs of distilled water were provided, and the length of wick above the water varied. This did not appear to make much difference provided there was always a sufficient supply of water to keep the entire bulb wet.

The need of having a continuous current of air about the bulb was shown at the outset, and in this respect we have established *one* essential condition, viz., the rate, provided there is a perceptible current does not matter whether it be fast or moderately slow as long as the bulb be kept moist. With the higher rates of speed this is rather difficult, the upper part of the wick tends to dry quickly. On the other hand, there is obviously a minimum limit, which we have not been able to determine as yet; but we have shown that a stationary atmosphere does not give correct readings owing to diminished evaporation.

The following table brings out this point very well:—

TABLE I.

Instrument.	Difference in temperature between bulbs before supplying current of air.	Same after.
No. 1	14.9° F.	18.8° F.
No. 2	16.2° F.	20.5° F.

These observations were taken on a day when the Regnault instrument gave a relative humidity in the laboratory of something over 6%.

No. 1 shows a smaller difference between the wet and dry bulbs than No. 2, and appears to give always a higher value of the humidity. This we attribute to the small bulb it possesses, compared to the size of the theromometer and wick.

No. 2 shows a large enough difference to give a correct value of the humidity=6½ per cent.

No. 3 instrument, with the cylindrical bulb, also gave correct indication in the draught, and agreed with the No. 2.

A wet and dry bulb sling hygrometer was specially made for us in Germany, and was included in these comparisons.

This type of instrument is now generally used, except where continuous observations are required, and for that reason a record of its readings under different conditions is interesting. In the first place the wick was coiled round the lower part of the stem of the thermometer just above the bulb, so that when slung the water descended from the wick into the covering over the bulb.

When exposed to the rapid rotation it was found that no steady reading of the difference could be obtained before the water had become so completely evaporated as to be no longer useful. The difference gradually became greater after each series of rotation until it indicated a relative humidity much lower than that calculated by the dew point hygrometer.

This defect was rectified by protecting the moist wick above the bulb from evaporation, by a covering of tin-foil. After this was done repeated rotation did not alter the relative differences, and the readings agreed closely with the Regnault hygrometer. This fact is an important one to bear in mind when using this instrument, and shows that the correct difference between the wet and dry depends upon keeping the feed-water as nearly as possible at the air temperature, or that of the dry bulb.

This may be shown in the case of a stationary instrument by heating or cooling the feed-water.

We have found as a result of our tests on a suitable wet and dry bulb instrument, both stationary and sling, that correct indications can be obtained for very low relative humidity in a warm room, when Glaisher's tables are used. As we have no record of Glaisher's procedure when compiling his tables, we presume that the differences in the columns between the wet and dry bulbs are those for the feed-water at the temperature of the dry bulb.

Feed-water at a temperature lower than this will, in a dry atmosphere, cause a considerably larger difference. This discrepancy is met with when trying to use a wet and dry bulb instrument for outdoor work, when the temperature is near or below freezing point.

The following table (No. 2) tends to prove that the wet and dry bulb instrument can be made to give satisfactory indications.

TABLE II.—Comparisons of Various Hygrometers for Very Low Conditions of Humidity.

Type of Instrument.	Date 1908.	Out-door Temp.		In-door Temp. F°.	Relative Humidity Per Cent.	Dew Point F°.	REMARKS.
		Max.	Min.				
No. 1—Wet and Dry Bulb	Jan. 29	24.3	−8.6	69.2	22.5	....	Faulty Instrument.
Regnault	"	"	"	69.2	7.5	6.5°	Hoar Frost.
"	" 30	−5.5	−20.0	67.0	6.8	2.5°	" "
No. 2—Wet and Dry	"	"	"	66.5	6.6	....	
No. 1— "	"	"	"	67.6	16.1	....	Faulty Intrument.
No. 2— "	" 31	3.6	−16.9	65.4	10.0	....	
No. 1— "	"	"	"	65.9	16.7	....	
No. 2— "	Feb. 3	−1.8	−10.5	66.9	7.7	....	
No. 2— "	" 4	−3.5	−20.0	64.4	8.0	....	
Sling— "	"	"	"	64.9	4.5	....	Exposed Wick.
Regnault	"	"	"	66.2	5.2	−2°	Hoar Frost.
"	" 5	−6.4	−20.6	63.1	5.1	−5°	Dew Point too low to read easily.
Sling—Wet and Dry	"	"	"	62.6	2.8	....	
No. 2— "	"	"	"	65.3	3.3	....	
Regnault	" 6	27.0	−9.9	70.7	12.6	17.5°	Moisture or Hoar Frost.
No. 2—Wet and Dry	"	"	"	70.2	16.0	....	
Regnault	" 7	23.3	1.6	70.6	10.1	13.5°	Moisture or Hoar Frost.
No. 2—Wet and Dry	"	"	"	70.2	11.7	....	
No. 2— "	" 8	2.0	−8.0	68.0	7.5	....	
Sling— "	"	"	"	68.0	5.8	....	Covered Wick.
Regnault	"	"	"	69.0	5.5	−1°	Hoar Frost.
Sling—Wet and Dry	" 11	30.0	15.8	68.5	10.7	....	Covered Wick.
Regnault	"	"	"	66.2	5.2	−2°	Hoar Frost.
"	" 14	39.8	34.2	73.5	21.9	32°	Moisture.
Sling—Wet and Dry	"	"	"	73.3	24.4	....	Covered Wick.
No. 2— "	"	"	"	73.7	21.3	....	
No. 2— "	" 15	35.0	29.5	72.0	27.1	....	
Sling— "	"	"	"	71.2	26.0	....	Covered Wick.
Regnault	"	"	"	71.2	25.2	34.5°	Moisture.

In the first column of the table we give the type of instrument. No. 1 wet and dry represents our original hygrometer with the very small bulb which gives high values. No. 2 wet and dry is the second hygrometer with the larger bulb, which we found much more satisfactory. No. 3 wet and dry we do not include here because it never differed to any extent from No. 2: This shows that there must be some limit to the bulb surface for accurate readings. Thus a small surface does not permit of sufficient evaporation to cool the glass and stem enough to offset the attainment of heat from the warm room of the laboratory. The wick and covering of this hygrometer were altered several times, but in no case did its indications approach the true ones. This shows, we think, the importance of checking a wet and dry bulb instrument before it is used by an absolute instrument like the Regnault or the chemical hygrometer.

The second column of the table gives the date, and the third gives the maximum and minimum air temperature, which of course determines the dryness indoors. The fourth column gives the air temperature of the laboratory at the time of experiment.

The fifth column gives the relative humidity, calculated from Glaisher's tables, in the case of the wet and dry bulb instruments; and from the vapour pressure at the dew-point for the Regnault hygrometer.

The dew-point, as found on the silver surface, is given in the sixth column.

An interesting question arises here as to the deposition of moisture in the form of vapour or hoar-frost. The vapour pressure of hoar-frost is considerably smaller than that for supercooled water. The use of the vapour pressure of water in place of frost for calculation would give results as much as 25 per cent too high at 0° F.

In the last column of table No. 2, we remark on the observations for the Regnault, where we thought hoar-frost was deposited, or where we had supercooled water.

We think there is no question that for very low observations of the dew-point, we got in all cases hoar-frost. In some of the higher ones there was a doubt, and we believe that this will introduce some error for temperatures not far below 32° F.

Our chief difficulty always lies in reconciling the results of the chemical estimation with those of the methods involving the dew-point, throughout the whole range of temperature and degrees of humidity.

As has been seen from table No. 2, conditions have been arrived at where the different instruments, all involving a dew-point, can be made to agree approximately as to their readings, but when we turn to the chemical results, there we get marked divergence in some cases.

However, in table No. 3, wherein comparisons between chemical estimation and a good wet and dry bulb instrument are made, several points stand out prominently.

In most of the instances the chemical results are lower by about 13-16%.

The regularity of these differences is striking; but it will also be noticed that this only applies for moderately low degrees of humidity, e.g., 25-40%, below that the differences become erratic.

At higher degrees, the correspondence becomes closer and closer until we reach the region of 70-100 per cent, when the results of both methods of observation coincide fairly well.

TABLE III.

Date.	(a) Vapour Pressure in ins.	(b) Relative Humidity Inside.	(c) Rel. Hum. by Hygrodiek.	(d) Calculated Relative Humidity.	(e) Meteorological Reports (outside).	Remarks.
Feb. ..	.075	13	31.1	35.1	..	....
" 13	.156	24.5	41.0	44.0	93%	....
" 15	.....	....	31.0	38.0	96	....
" 21	.148	25.3	37.	34.	83	....
" 25	.131	24.3	37.	41.85	75	....
Mar. 13	.191	34.4	37.	48.9	84	....
" 16	.179	36.5	47.	48.6	72	....
April 24	.157	26.5	47.	44.5	48	....
May 25	.262	33.4	47.5	44.9	..	....
" 26	.419	55.2	63.25	69.0	..	Reg. 57.4

In table No. 3, column (a) is the vapour pressure in inches, of the water vapour actually present in the air at the time of observation; ascertained by chemical hygrometer; column (b) is the relative humidity, calculated from column (a).

Column (c) is the direct reading by the hygrodeik and column (d) is the relative humidity calculated from an ordinary wet and dry bulb instrument by using Glaisher's tables.

The wet and dry bulb instrument was simply subjected to the ordinary air currents in the room, and therefore represents the instrument as used under ordinary conditions.

Where such instruments are placed under circumstances such as we have found to favour accurate readings, they agree approximately. Compare tables Nos. 2 and 3 on dates from February 13-15 inclusive.

[Note added November 7th, 1908. The very elaborate tables prepared by the Weather Bureau at Washington, are for a special form of sling hygrometer. The general adoption of this instrument would bring about a uniformity of measurement very much to be desired.]

XIX.—*Some Phenomena of the Persistence of Vision.*[1]

By PROFESSOR FRANK ALLEN, Ph.D.

Communicated by Professor H. T. Barnes, D.Sc.

(Read May 28th, 1908).

The experiments which are discussed in this paper were suggested by some described in a communication [1] to the *Physical Review* some years ago. A full description was there given of the method of measuring the persistence of vision, which was originally devised by E. L. Nichols. The essential features of this method are few and simple. In front of the slit of the spectrometer is placed a sectored disk, which, when

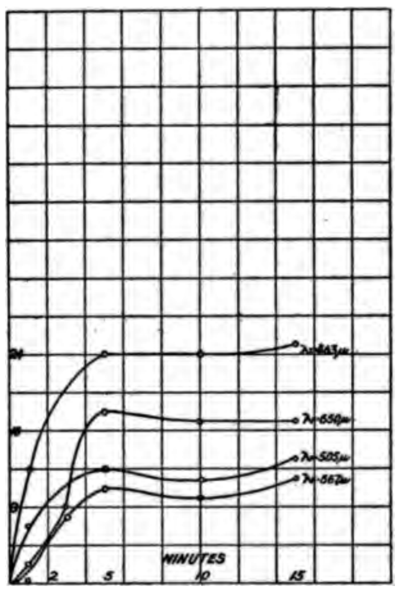


FIG. 1.

rotated by an electric motor, interrupts the light, causing a flickering of the part of the spectrum under observation. By electrical means, the speed of the disk is recorded on paper on a rotating drum, which enables the duration of a single flash of light upon the eye to be determined when the speed of rotation of the disk is such that the flickering just disappears. The duration of these light impulses varies with the lumin-

[1] Frank Allen, Phys. Rev., Vol. XI., 1900, p. 257.

[illegible] [illegible] [illegible], and, when plotted with the wave lengths of the [illegible] [illegible] as [illegible] gives a persistence of vision curve.

[illegible] It was [illegible] that when the eye is protected from light by [illegible] [illegible] or by remaining in a dark room, the time of the per[illegible] [illegible] [illegible] impressions was increased. Experiments were [illegible] made to determine how this effect varied with the time of [illegible] [illegible]. Observations of the persistence of vision were made [illegible] [illegible] [illegible] [illegible], green and blue, after intervals of darkness [illegible] of [illegible] [illegible], five, ten and fifteen minutes. The wave lengths of the [illegible] [illegible] and other measurements, are given in table 1, and the [illegible] are shown graphically in figure 1. For convenience in [illegible], the [illegible] are the differences between the normal readings and those made after the different intervals of adaptation. The curves are of the '[illegible]' type, and show that, as far as the persistence of [illegible] is [illegible], darkness adaptation produces its maximum effect [illegible] [illegible] [illegible] [illegible], the measurements after the ten and the fifteen [illegible] [illegible] showing no increase over those for five. There is, [illegible], an [illegible] in the curves of a partial return to the normal [illegible] of the [illegible] between the five and the fifteen minute intervals of adaptation.

It will also be noticed that the maximum is least in the case of the [illegible] [illegible] [illegible] – $\lambda = .567\ \mu$ –, and greatest for the feeblest [illegible] [illegible].

TABLE I.

[illegible]	[illegible]	Observation Color. $\lambda = .505\ \mu$ Persistence	Diff.	$\lambda = .650\ \mu$ Persistence	Diff.	$\lambda = .463\ \mu$ Persistence	Diff.
[illegible]	[illegible]	.0133 sec.	0	.0135 sec.	0	.0193 sec.	0
[illegible]	[illegible]	[illegible]	6	.0137	2	.0206	14
[illegible]	[illegible]		..	.0143	8	.....	..
[illegible]	[illegible]	[illegible]	12	.0153	18	.0216	24
[illegible]	[illegible]	[illegible]	11	.0152	17	.0216	24
[illegible]	[illegible]	[illegible]	13	.0152	17	.0217	25

[illegible] [illegible] of curves was obtained after fatiguing the [illegible] [illegible] light of certain definite hues. Readings of the [illegible] were made after intervals of fatigue of one, two,

[illegible]

three, five and ten minutes. Observations were made upon the same, or nearly the same, portions of the spectrum as the fatiguing colours. The measurements are shown in table 2 and are plotted in figure 2, according to a convenient scale of numbers so chosen that the curves are all exhibited in one figure. The zero of each curve, which corresponds to the normal persistence of the particular colour, is the intersection of the curve with the axis of ordinates.

With all colours the fatiguing effect reaches its maximum in about three minutes, further exposure to light seeming to make no difference with the duration of the light impressions.

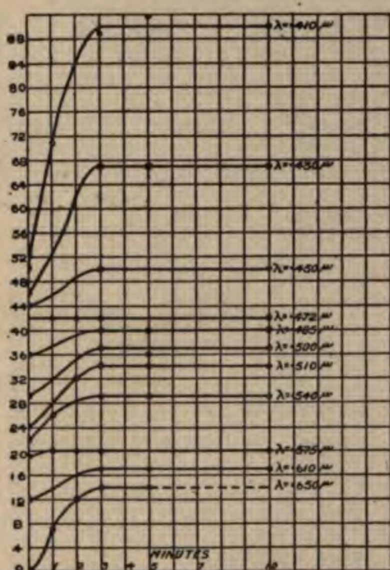


FIG. 2.

Perhaps the most remarkable curves are those for the yellow and the blue colors, whose wave lengths are .575 μ and .472 μ respectively. The latter of these is a straight line and the former nearly so. For these colours the retina does not seem capable of being fatigued, as the duration of the colour impressions always retains its normal value. The differences between normal and maximum readings of the various curves vary in magnitude, and are shown in figure 3. This curve is characterized by three elevations, corresponding to the red, green, and violet of the spectrum, which are separated by two depressions corresponding to yellow and blue of wave lengths .575 μ and .472 μ respectively.

It is noteworthy that these two depressions agree with the fundamental yellow and blue of the Hering theory of colour vision, while the blue is nearly that chosen by Helmholtz and by König and Diderici (viz: $\lambda = .470\ \mu$) as one of their fundamental colours. The wave lengths of the maxima of the red and the green elevations also are the fundamentals of those colours which have been selected by the last two writers.

This curve with its three elevations seems to support the view that there are but three fundamental colour sensations which are primarily excited by certain hues of red, green and violet.

TABLE 2.

Time of Fatigue	Obs. colour $\lambda = .650$ Fatig. colour $\lambda = .675$		$\lambda = .610$ $\lambda = .610$		$\lambda = .575$ $\lambda = .589$		$\lambda = .540$ $\lambda = .540$		$\lambda = .510$ $\lambda = .523$	
	Persist		Persist		Persist		Persist		Persist	
	sec.		sec.		sec.		sec.		sec.	
Normal	.0136	0	0.123	12	.0118	19	.0125	22	.0126	24
1 min.	.0143	7	.....	..	.0119	20	.....	..	.0128	26
2 "	.0149	13	..	..	.0119	20	.....	..	.0134	32
3 "	.0150	14	.0128	17	.0119	20	.0132	29	.0136	34
5 "	.0150	14	.0128	17	.....	..	.0132	29	.0136	34
10 "	......	..	.0128	17	.0119	20	.0132	29	.0136	34

Time of Fatigue	Obs. colour $\lambda = .500$ Fatig. colour $\lambda = .500$		$\lambda = .485$ $\lambda = .485$		$\lambda = .472$ $\lambda = .470$		$\lambda = .410$ $\lambda = .413$	
	Persist		Persist		Persist		Persist	
Normal	.0140	29	.0156	36	.0165	42	.0334	50
1 min.	.....	..	.....	..	.0165	42	.0355	71
2 "	.....	..	.....	..	.0165	42	.....	..
3 "	.0148	37	.0160	40	.0165	42	.0373	89
5 "	.0147	36	.0160	40	.....	..	.0376	92
10 "	.0148	37	.0160	40	.0165	42	.0374	90

TABLE 2—Continued.

Time of Fatigue	Obs. colour $\lambda = .450$ Fatig. colour $\lambda = .450$		$\lambda = .430$ $\lambda = 430$	
	Persist		Persist	
Normal	.0225	44	.0280	46
3 min.	.0231	50	.0301	67
5 "	.....	..	.0301	67
10 "	.0231	50	.0301	67

III. It was noticed from time to time that the persistence of colour impressions was not constant over all parts of the retina. When no flickering of the colour under observation was perceptible in the centre of the retina, a slight movement of the eye in any direction, which

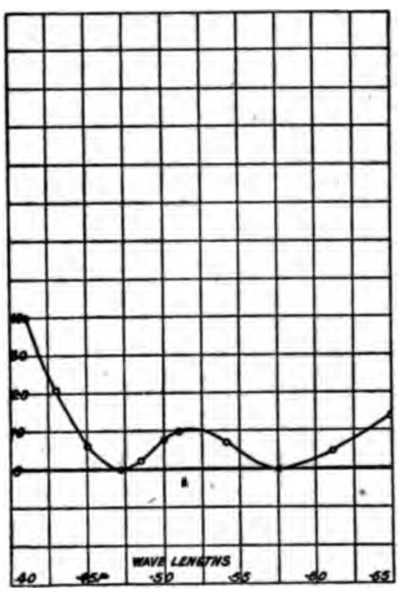


FIG. 3.

allowed the light to fall upon the peripheral portions of the retina, was always sufficient to destroy the apparent continuity of the light.

To investigate this, a short piece of platinum wire, heated electrically so as to be just plainly visible, was placed in such positions, that, when viewed directly by the eye, the flickering light of the spectrum fell at determinate positions on the outlying parts of the retina.

Two sets of observations were made at two regions on the temporal side of the retina, about ten and twenty degrees from the centre. Measurements were attempted at other regions farther out, but the results were too uncertain to be of any use.

The measurements are shown in table 3, and are plotted in figure 4, in comparison with a curve for the centre of the eye.

TABLE 3.

λ	Persistence			λ	Persistence		
	Centre of Retina	10° Region	20° Region		Centre of Retina	10° Region	20° Region
μ	sec.	sec,	sec.	μ	sec.	sec.	sec.
.418	.0372	.0361	.....	.562	.0127	.0122	.0117
.446	.0274	.0238	.0233	.588	.0126	.0123	.0120
.472	.0196	.0185	.0174	.620	.0132	.0125	.0119
.495	.0163	.0148	.....	.670	.0158	.0150	.0144
.520	.0141	.0132	.0128	.705	.0198	.0184	.0170
.538	.0135	.0120	.0120	.720	.0220	.0216	.0185

The curves show that the duration of all colour impressions diminishes as the distance from the centre of the retina increases; or, in other words, the peripheral portion of the retina is more sensitive to fluctuations in the intensity of the light than the centre.

The ten and twenty degree curves also show a remarkable elevation in the part corresponding to the yellow and greenish yellow. In direct vision the light rays fall upon the macula lutea or yellow spot where the greatest distinctness of vision occurs. This spot, however, is small and would not be stimulated by the light falling on the outer regions. As the lowest point of the persistency curve corresponds to the brightest part of the spectrum, the curves show that for the outer regions of the retina under consideration the most luminous point of the spectrum is nearer the green than it is for the macula lutea.

An elevation in a persistency curve has always been found associated with some induced or natural abnormality of colour vision. Here, however, it is found in the normal persistency curves for the outer parts of the retina, and indicates some slight modification in the perception of yellow. The macula lutea contains a yellow pigment and no visual purple, while the retina in other parts has only the visual purple. This latter substance absorbs light of all parts of the spectrum, but in amounts varying with the wave length, the absorption being very slight in the red and greatest in the yellowish green. This latter colour also most rapidly bleaches the visual purple. The region of the spectrum, therefore, which is most absorbed by the visual purple coincides with the elevation of the persistency curves. This absorption of light is therefore the very probable cause of the elevations.

IV. In the paper to which reference has been made an experiment was described, in which a persistency curve was obtained when the eye was fatigued with white light from an arc light. This curve and its

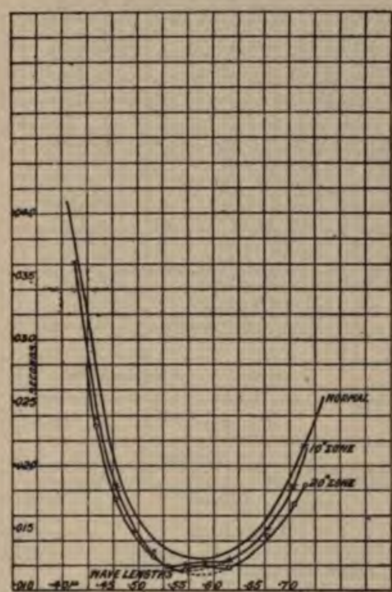


FIG. 4.

comparison normal curve are shown in figure 5, which is taken from the paper previously cited.

As white light, indistinguishable from ordinary white, may be obtained by mixing two complementary colours, observations of the persistence of vision were made after fatiguing the retina with proper combinations of colours. Two overlapping spectra were formed with a Helmholtz colour mixing spectrometer, and the selected complementaries combined in a shutter eye-piece. By means of Nicol prisms in the collimators, the intensities of the two spectra were adjusted until the narrow field of light in the eye-piece was white. The first complementary colours used were yellow ($\lambda = .577\ \mu$) and blue ($\lambda = .474\ \mu$) as determined by Von Kries. The readings are given in table 4, with the corresponding normal values, and are shown graphically in figure 6. The second complementaries were red (λ = .656 μ) and green (λ = .492 μ), determined by Helmholtz. The data in this case are given in table 5, and plotted in figure 7, with the same normal as the preceding curve.

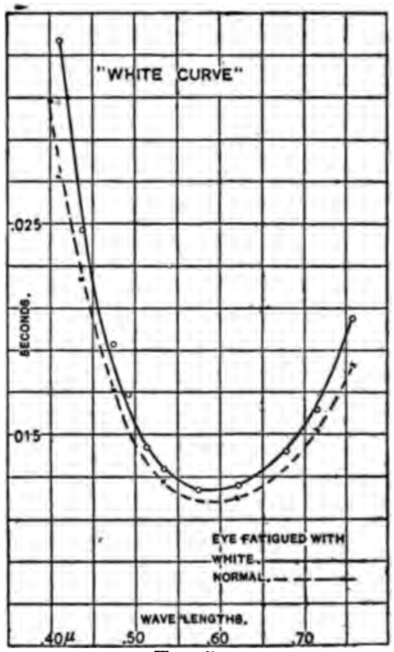


FIG. 5.

TABLE 4.

λ	Normal Persistence	Eye fatigued with λ = .577 μ λ = .474 μ	λ	Normal Persistence	Eye fatigued with λ = .577 μ λ = .474 μ
μ	sec.	sec.	μ	sec.	sec.
.725	.0295	.0350	.530	.0138	.0127
.710	.....	.0307	.515	.0148	.....
.698	.0209	.0254	.505	.0155	.0141
.670	.0157	.0166	.495	.0166	.....
.643	.0135	.0142	.483	.0190	.0182
.615	.0125	.0128	.463	.0251	.0225
.590	.....	.0121	.445	.0334	.0371
.580	.0127	.....	.428	.0398	.....
.565	.....	.0115	.410	.0451	.0491
.554	.0130	.....	....	.....	.....

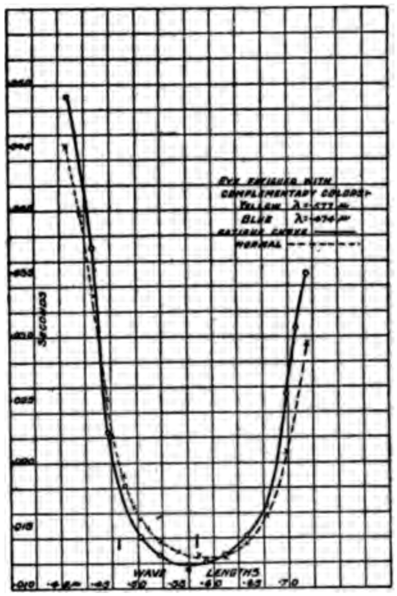


FIG. 6.

TABLE 5

λ	Eye fatigued with λ = .656 μ λ = .492 μ	λ	Eye fatigued with λ = .656 μ λ = .492 μ	λ	Eye fatigued with λ = .656 μ λ = .492 μ
μ .725	sec. .0353	μ .566	sec. .0122	μ .470	sec. .0204
.710	.0335	.548	.0125	.463	.0238
.698	.0230	.530	.0130	.454	.0293
.670	.0161	.517	.0137	.445	.0395
.643	.0136	.505	.0151	.428	.0522
.615	.0122	.492	.0167	.410	.0527
.590	.0120	.483	.0182	....	.....

On comparing the figures, both curves will be seen to be essentially the same, and also to differ greatly from the curve shown in figure 5. The fatigue curves obtained with the complementary colours are elevated above the normal at both ends, which correspond to red and violet, and are depressed below the normal in the middle which corresponds largely to green. The intersections of the curves in each figure (figs. 6 and 7) occur in the blue at about $\lambda = .455\ \mu$, and in the orange near the yellow at about $\lambda = .62\ \mu$.

Though the effect on the retina of white light of the comparatively few wave lengths comprised in the complementary colours must of necessity be different from that of the complex mixture of waves forming the white light from an electric arc, yet the eye is unable to see any difference in the appearance of the two lights when both are of the same intensity. Measurements of the persistence of vision made in the way described are, however, capable of showing, in a most striking manner, the difference in the effect of the two white lights.

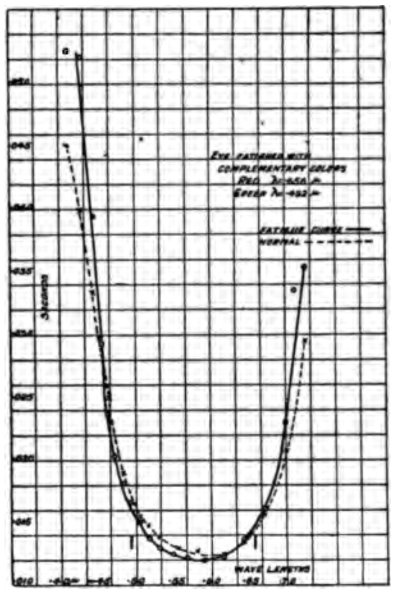


FIG. 7.

It is most remarkable that the curves in figures 6 and 7 are depressed below the normal in the part corresponding to green. For, when the eye is fatigued with yellow light ($\lambda = .577\ \mu$) alone, for example, the resulting persistency curve has two elevations, one in the red and the other in the green, as shown in figure 8, which is plotted from the data in table 6.

No persistency curve has been obtained when the eye was fatigued with the complimentary colour, blue, of wave length $.474\ \mu$. Figure 9, however, is a persistency curve obtained when the fatiguing stimulus was another hue of blue, the wave length of which was ·440 μ. This figure is taken from the paper previously referred to. Assuming that the curve for λ = .474 μ, would be practically the same as that for λ = . 440 μ, an assumption which is almost certainly correct, it is seen that fatiguing the eye with blue produces two elevations in the

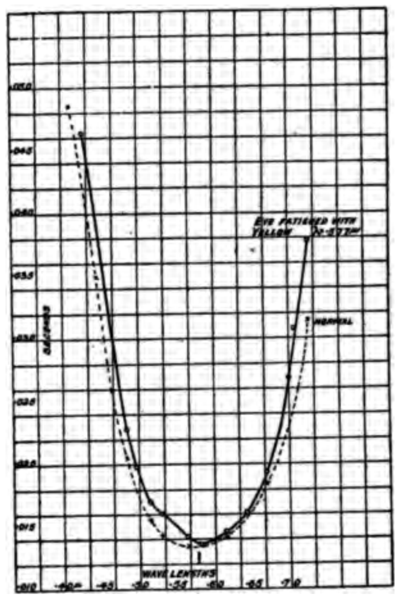


FIG. 8.

TABLE 6.

λ	Normal Persistence	Eye fatigued with λ = .577 μ	λ	Normal Persistence	Eye fatigued with λ = .577 μ
μ	sec.	sec.	μ	sec.	sec.
.725	.0315	.0377	.566	.0135	.0142
.706	.....	.0308	.530	.0144	.0160
.698	.....	.0268	.514	.0156	.0170
.670	.0185	.0194	.497	.....	.0198
.643	.....	.0161	.483	.0206	.0228
.615	.0142	.0146	.445	.0352	.....
....	.....	.....	.427	.....	.463
.581	.....	.0136	.410	.0486	.....

curve, one in the violet and the other in the green. It would seem natural to expect the curve obtained when the eye was acted upon by both colours of wave lengths .577 μ and .474 μ, to have *three* elevations to correspond with those in figures 8 and 9, viz: in the red, green and violet. Instead of this, however, the persistency curve in figure 6 shows two elevations—in the red and violet—and a *depression* in the green: the anticipated *double* elevation in the green is actually replaced by a depression. As the duration of colour impressions on the retina is an inverse function of the luminosity, we have the paradoxical conclusion that doubly fatiguing the green sensation with blue and yellow light

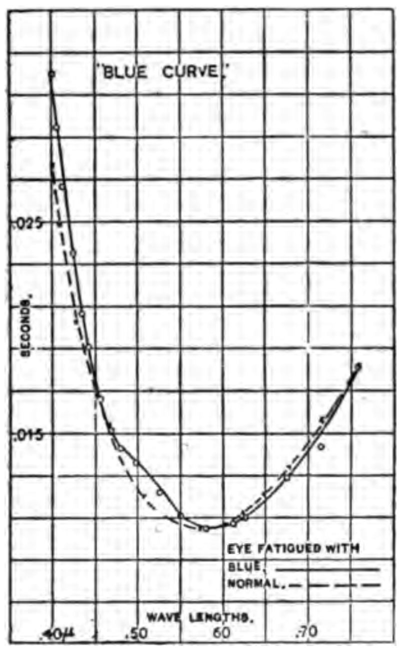


Fig. 9.

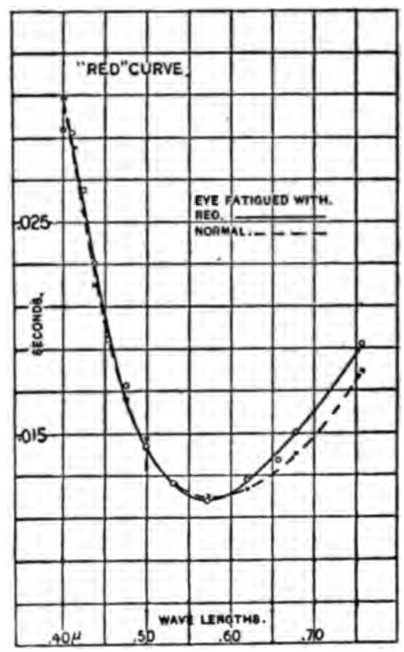


Fig. 10.

together causes green light to make a more luminous impression than it does normally. Further, since the parts of the curve disturbed by fatiguing the retina with blue and yellow are those corresponding to red, green and violet, it follows that none of the colour sensations are independent of each other; while the fact that the curve suffers disturbances in three parts seems to favour the theory of three fundamental colour sensations.

The persistency curve in figure 7 was obtained, as explained before, when the eye was fatigued with red and green of complementary hues. Now, when the retina is acted on by red, or by green separately, a persistency curve with but one elevation is obtained, which occurs in the part of the curve corresponding to the colour used in fatiguing the eye.

This is shown in the curves in figures 10 and 11, which are taken from the paper referred to several times.

When, however, the eye is fatigued with complementary red and green colours together, the curve (figure 7) has an elevation in the red, a depression in the green, and a pronounced elevation in the violet. It is remarkable that there is no green elevation, and still more remarkable that the violet sensation is affected at all, or at least, to any very perceptible amount. It is, perhaps, possible that the white light formed by combining complementary red and green hues is a compound with properties of its own quite different from those possessed by the separate

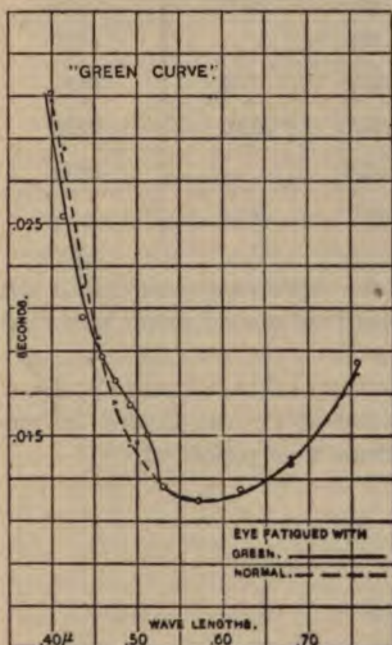


FIG. 11.

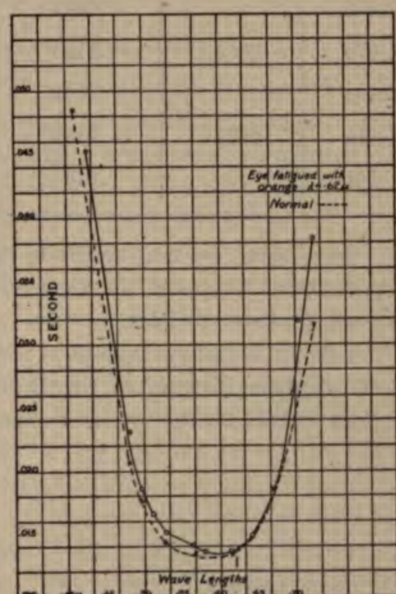


FIG. 12.

components, and, in virtue of its being *white*, stimulates all three sensations, red, green and violet, even though no violet light is present. The same idea would also apply to the curve in figure 6, though, as we have seen, the occurrence of the elevations there is susceptible of another explanation.

Both persistency curves obtained when the retina was fatigued by the compounded complementary colours intersect the normal in two places, one of which is in the orange at $\lambda = .62\mu$. This colour was used as a fatiguing stimulus and a persistency curve obtained which is plotted in figure 12 from the data in table 7. The curve shows two elevations, one in the red and the other in the green, indicating the generally admitted composite character of the sensation of orange light.

TABLE 7.

λ	Normal Persistence	Eye fatigued with $\lambda = .62\ \mu$	λ	Normal Persistence	Eye fatigued with $\lambda = .62\ \mu$
μ .725	sec. .0315	sec. .0383	μ .566	sec. .0135	sec. .0140
.706	.....	.0319	.530	.0141	.0151
.698	.....	.0261	.514	.....	.0166
.670	.0185	.0183	.497	.0177	.0186
.643	.....	.0149	.483	.0207	.0231
.615	.0133	.0136	.427	.....	.0453
.581	.....	.0135	.410	.0485	.....

In general, we may conclude that the experiments described in this paper strongly support the view that the fundamental colour sensations are red, green and violet.

I desire to acknowledge my indebtedness to the kindness of Professor E. L. Nichols, director of the Department of Physics, Cornell University, in whose laboratory these experiments were performed.

XX.—*The Need of a "Rational Almanac."*

By MOSES B. COTSWORTH, F.G.S., of York, England.

[PREFATORY NOTE. — Mr. Cotsworth was introduced to the Section by Sir Sandford Fleming, K.C.M.G., who spoke of him as a gentleman who had given prolonged attention to the subject—one of universal importance—which he was about to discuss. Sir Sandford proceeded to make a few remarks on the general subject of "A Reformed Calendar." It has been thought desirable to prefix his observations to Mr. Cotsworth's paper.]

SIR SANDFORD FLEMING'S ADDRESS.

The calendar of days, weeks and months, which we have inherited from past ages, is found in many quarters to be inadequate for our modern requirements, especially in many branches of industrial life, in business operations and various spheres of human activity; it is especially felt by railway and other transportation companies. The defects of the calendar are borne with equanimity by the community generally, apparently under the belief that no change can be made; that the months, for example, varying in length from 28 to 31 days, are fixed by some natural law and as unalterable as the motion of the heavenly bodies. There are a few persons, however, who begin to see the matter in a different light. A spokesman in favour of some change and improvement has recently been heard in the Parliament of the United Kingdom. I hold in my hand a proposal for a simplified calendar by Mr. Alexander Philip, of Brechen in Scotland, and we have here with us to-day, a gentleman from the City of York, England, who has given the subject prolonged consideration. For myself I warmly approve of the movement to simplify the calendar, and my earnest desire is to see the Royal Society of Canada take a leading part in promoting a needed change—a change which would benefit the great human family for all future time.

That such a change can be effected I have no doubt whatever, provided we take the right course, and the right course to follow is to begin by seeking the proper means of gaining the assent of all interested in the proposal.

The question arises: who are interested? and the answer is, everybody,—all civilized nations are concerned in any proposition to modify the calendar of days and months which has come down to us through the centuries.

Members of the Royal Society will remember a cognate case which presented itself on this continent thirty or forty years ago. The development of the Railway System of this country was the direct means of forcing the matter on our attention. The establishment of the Canadian Railways, extending from the Maritime Provinces westerly towards the Pacific, brought to light difficulties in reckoning time. It was discovered that generally speaking every town and city had its own standard by which the hours of the day were reckoned. It was found that there were nearly a dozen standards of time between Halifax and Sarnia, and there was every prospect, in the absence of a proper system, of having eventually nearly a hundred standards between the Atlantic and the Pacific. This was suggestive of confusion, and worse than confusion, in operating the railway system of the future. Among the records of the Royal Society will be found a detailed account of the means taken to avert these evils. A scheme was evolved by which the difficulty which presented itself was completely solved, and not only Canada and the American Continent, but all countries on the face of the globe were benefited.

In May, 1870, the matter was brought to the attention of the Marquis of Lorne, then Governor-General of Canada, by a memorial from the Canadian Institute, Toronto. His Excellency took means to bring the question to the notice of Her Majesty's official and scientific authorities in London, and through the Home Government the attention of foreign governments was directed to the subject.

This was the first practical step taken, and the world is more indebted than it knows to the representative of the Queen in this Dominion—to the same British nobleman who, a few years afterwards, became the founder of the Royal Society of Canada. This step led eventually to an International Conference being held at Washington from which, as a direct outcome, the meridians of the globe were standardized, and the reckoning of the hours of the day simplified by having one definite standard for the world.

I venture to think that the question of simplifying the almanac can be dealt with similarly. I see every reason for memorializing the Governor-General on the subject, in the hope that His Excellency may take the first practical step in a movement of such general and wide importance. May we not be justified in the expectation that in due time an international conference may be assembled, possibly in Ottawa, to consider the matter, and that, as a result, all civilized nations would have a simplified and greatly improved calendar for their common use and benefit in reckoning the days, the weeks, and the months throughout each and every year.

MR. COTSWORTH'S PAPER.

We naturally assume that the methods of our ancestors are best until necessity, the mother of invention, causes someone to initiate an improvement which we adopt when convinced it will benefit us.

Thibetans continue carrying merchandise on pack-horses between their cities, over mountains and valleys; whilst we speed across the Rocky mountains, through tunnels and over bridges, along tracks now being reduced in grade to economize time and expense.

Similarly, we may avoid the needless and tiresome almanac ups and downs of our 28, 29, 30 and 31 day months, and ensure the smoothest possible gliding of the almanac register of our 365 days' year, in weeks and months through all future years, if we simply legislate that either Christmas Day, or New Year's Day, shall not have a week-day name, and that our easiest present month of February shall permanently measure future months as per the following:—

MODEL MONTH.

Sundays	1	8	15	22
Mondays	2	9	16	23
Tuesdays........	3	10	17	24
Wednesdays	4	11	18	25
Thursdays.	5	12	19	26
Fridays.	6	13	20	27
Saturdays.	7	14	21	28

We most easily recognize the month's length in February, especially when it begins on Sunday, as it consists of four of the weekly units by which we work and pay. The fact that the 28 days are exhausted by the regular multiple of 7 days per week, which expires with the month, makes it very easy to remember both the day of the week and the date.

If all other months were of that length, the week-day names for those dates would be permanent and many important advantages would result, giving increased facilities to everybody. But when the 1st of February registers successive week-days in the following years, that simplicity and convenience disappears, as the month then contains three complete weeks, with parts of two other weeks as the first and last days of the month. That confusing result, unfortunately, affects other months, which never can, under the existing almanac, both begin and end with the week. They always have, at least, one fraction of a week beyond four weeks, and in nine or ten months out of the twelve there are two portions of weeks to be computed.

Those shifting factors so confuse our ideas of a month that few persons can mentally gauge the month, which, beyond the weeks, is the most used unit of time we are constantly needing. The reason is that the months are unequal and their dates persistently changing their week-day names; whereas, if the "model month" were adopted, the respective week-days would never deviate from the four fixed dates therein assigned to them. Then we could instantly call to mind the identity of both week-day names and dates for any day in the year, and forgetful people could be sure of the current day of the week and date when it would be so easily shown by a pointer on our watches when Sundays are lettered at the quarter-hour points, and the six week-days in each quarter.

This subject in its practical bearing upon trade, and industrial life and general convenience has engaged my attention during twenty-four years. That accounts for my having been requested to bring the question before you.

Origin of the Suggested Reform.

The world-wide need for reform of the almanac has yearly engrossed me the more its everyday value to us all was ascertained by investigation, travel, discussion, and correspondence during the exceptional opportunities provided by professional work on both sides of the Atlantic, in expert business methods to avoid waste labour.

The waste directly caused by our unequal months was evidenced early during my twenty-five years of statistical work, abstracting the weekly, monthly and yearly earnings, etc., for the railway company carrying the largest tonnage in the world, who are also the largest dock owners in the world.

In non-leap-years all the twenty-eight days of February, being repeated during the first twenty-eight days of March, with the same week-day names to the respective dates, made all statistical comparisons easy and exact between these two periods, but then only. The regular weekly sailings of the continental and coasting steamers fitted both periods in the current and preceding non-leap-years.

Everything in earnings and expenditure was on the same time basis, as, although the preceding year began a day earlier in the week, there were four constant periods of four weeks each. That enabled us to ascertain the cost of working with less labour, and, further, we gained greater accuracy. We were thus able to get home earlier and happier, without working unpaid overtime.

Being desirous of doing so every month, my attention was directed to the loss and anomalies developed by our imperfect almanac system. Whilst investigating the origin of our anomalous months and the shifting weeks therein, as explained later, an easy way was disclosed by which all our almanac troubles can be avoided.

Noticing that as business became more exacting in accelerated ratio each following year, the chief officers required more precise explanations of the differences in the cost of handling the traffic each successive month, to avoid waste and increase efficiency; the cause was so generally found in the needless variations of our almanac (especially after the moon-wandering of Easter began), that the child-born assumption as to the almanac system of our ancestors being best, gradually vanished, as the extent of our almanac created inconveniences, difficulties and waste of labour forced on governments, railway and canal companies, shipowners, manufacturers, traders and workers became evident.

The crude and imperfect system of having twenty-eight to thirty-one day months fixed nearly two thousand years ago by the Cæsars, sufficed when the work of the world was done by unpaid slaves; but the freedom and enterprise won since then have developed new conditions needing better almanac facilities. The exclusive barriers of nations have been broken down and interchange of trade is universal, necessitating duplicate dates by buyers and sellers where different almanacs exist. Few persons realize that the one-third of Europe's population (in Russia, Turkey, Roumania, Greece, etc.) trade with us in duplicate dates, involving interest calculations and legal difficulties. The introduction of steamships, railways, telegraphs, cables, telephones and modern business and social methods have very extensively changed our almanac requirements for equal months, etc., since the 7-days week was established in Europe by Constantine nearly four centuries after the irrational months were fixed by Augustus Cæsar.

The business and social inconvenience evidenced during the Christmas weeks of 1894 and 1895 (when Christmas Day came in the middle of the week), disturbed regular ideas of the week. Market-days and weekly appointments had to be altered, causing trouble, confusion, expense and disappointments.

Noticing the heart-burning caused to shop-assistants and other toilers, whose cherished Christmas family re-unions were curtailed to get them back for Friday and Saturday's business (when they could not link up the nearest week-end with the holidays), brought the idea to my mind that as Christmas Day was kept like Sunday, the boon of a *fixed almanac* and Christmas Holidays always extended over the week end without splitting the week, might be secured if we simply kept its name as "Christmas Day," and relieved it from being enumerated as a day of the week—a "*Dies-non*" inserted as a public holiday between Sunday and Monday, where it naturally occurs in the year 1916.

Further, I saw that by similarly giving "Leap-Day" its proper name and letting it "leap the week-day name" as a "*Dies-non*" and public holiday, (rightly due to salaried servants who work that day for nothing), we might by relieving those exceptional year days from being enumerated as date of the month, permanently win the many increased facilities and benefits which the easiest possible working month of four weeks would always bring by ending on Saturday,—and establish the easiest possible permanent almanac. Thus the golden key to solve our almanac difficulties and perfect the calendar appeared to be found in the "*Dies-non,*" and simpler months. Those form the essential features of the various proposals which have since been made to improve our yearly register of time, as the source of the mischief in changing the week-day names through all the dates in each year and separating Christmas and New Year's Day from the week-end, was then located in the odd 365th day beyond the fifty-two weeks of the year.

Possibly the last day of the year as a "*Dies-non,*" or duplicate Saturday might be preferred by business people for stock-taking, or New Year's Day be preferable to some nations; but the prospective advantages of adopting Christmas Day as the "*Dies-non*" at this stage in the world's history seem very much more important (for reasons which cannot be discussed in this condensed paper), in view of the earlier adoption of the simplified calendar by that more than two-thirds of the world's population who now use lunar almanacs, as in India, China, Japan, etc., they could only adopt it when the moon was *new* at the winter solstice to which Christmas is the nearest, and would naturally revert in subsequent years by omitting three leap-days, after the advantages of the proposed almanac lead those nations (who are now rapidly being aroused to realize the practical benefits of such improvements), to negotiate by international conference for general adoption.

We should remember that Christmas was not fixed as the exact date of Christ's birth, but because the first new moon after the *Winter Solstice* shone on December 25th, when the first public celebration of that festival necessitated long pilgrimages and the moon was the monthly guide to the masses of the illiterate people. For the same all-powerful, practical reason, Julius Cæsar fixed January 1st to begin the new era, because the "*first new moon after the winter solstice*" then shone, knowing that his subjects, then scattered through Europe, Africa and West Asia, had to make long journeys in slow stages, depending upon the moon entirely as their indicator for the date, after they had been warned to prepare for the new era's inauguration when they noticed the lowest sunrise and sunset at the solstice,— just as the Red Indians and the Hudson's Bay traders had to do when Europeans first came to America.

We know that the Indians did so during our lifetime, as their moon-sticks, now in my possession, prove, and their huge mounds in the Mississippi Valley indicate.

History of our Almanac.

When the Roman Cæsars fixed the irregular lengths of our months, Northern Europe was being colonized, like Canada now is. Between three thousand and four thousand years before, the wise Egyptians had by their stupendous efforts in building pyramids won the most valuable secret of the length of the solar year, at such a cost that they naturally kept it secret (as also did the Babylonians and Chinese, etc.), knowing that the lives of their people depended upon intense culture of the two narrow strips of land between the Nile and the sandy hills, which for more than a thousand miles up the meridian confine the fertilizing waters of that river to its narrow valley. Within that area three crops per year could be grown without any manure when they knew the right crops to sow and precise days of the year for each agricultural operation, in that constant sunny climate, by simply measuring the daily variations in the length of pyramid shadows as shown, after investigations throughout Egypt, on page 78 of my book.[1] The usefulness of that knowledge leaked out to Southern Europe through Greek traders, and it is significant that Julius Cæsar obtained the advice of the great astronomer from Egypt's University at Alexandria to arrange the most useful principle of *fixity* in the Roman months and years then drifting with the moon.

Europeans then generally registered months by the moon's phases, like the Red Indians of the North-West still do by their Spring Festival beginning their twelve-moons year with the *first new moon after the first thunder*, as I found the Sarcees doing. The next five moons counted on one hand register Sarcee summer moons, and after the Autumn Festival moon, the five winter moons are counted on the other hand. Before they were thus able to count twelve, they tallied ten moons as the Arabs did. Indeed, the Romans counted ten moons per year, which

[1] The "Rational Almanac," price 5s., ex M. B. Cotsworth, York, England.

drifted through all the true seasons until Numa, about 713 B.C., added January and February. That is evidenced in our almanacs by September (7), October (8), November (9), December (10) still ending the year, which then began with March.

The quarters of the moon originated our 7-days week, as the moon's cycle is 29.53 days, one-fourth of which is 7.38 days. The adoption of the nearest day was inevitable and was most wisely ordained in the Mosaic Law and adopted by the early Christians, whose consistent observance of the Sabbath gradually impressed the Romans with its practical advantages over their ten days counted thrice on the hands as thirty days per moon. That led the Emperor Constantine, after he adopted Christianity, to worthily derive his title of "the Great," by decreeing the observance of every seventh day as Sunday, under the name *"Dies-Solis"* in 321 A.D., when Europeans rejoiced on receiving that greatest blessing of the almanac's *fixed* seven-days week and day of rest.

It is the glory of the Christian Church that it thus secured that priceless boon to humanity. Will its sections now unite for their common good with their governments to relieve us from moon-wandering Easters, which never do good by drifting, that tends to empty the churches of people?

Citizens feeling the inconvenience caused by the churches maintaining shifting Easters, blame the church authorities on seeing the children catch cold by wearing Easter costumes in early Easters. Then the change from the warming winter football, etc., games to the standing cricket tempts youths to cripple their health, whilst toiling farmers, labourers, and artisans are tempted to take the first opportunity of planting potatoes, etc., in early Easters and have their crops ruined by subsequent frosts.

The adherence to wandering Easters has been a constant drag upon church usefulness. Numerous churches continue to keep parish accounts from Easter to Easter, as in your modern Cathedral at Ottawa. That antiquated accounting resulted in fifty weekly collections for last year and fifty-five for this, and a prospect of fifty-one for next. Such old fogey methods tend to confusion and fail to profit anybody.

The churches have an excellent opportunity to remedy all those evils by simply agreeing to permanently establish Easter (like Christmas), when it falls most conveniently for their people on April 23rd in 1916, and support reform of the months which have neither Church origin nor Bible authority, as their history proves them to be of Pagan origin by direct decree of the Cæsars, who, at least, understood the benefit of *fixed arrangements* for good government.

The Roman Pontiffs, as High Priests in Pre-Christian times, secretly controlled the declarations as to whether twelve or thirteen moons should be counted in the coming year. As there was no *fixed* date in the solar year known to the common people, the populace could not detect when the year was declared one moon wrong, because the system, if loyally followed, varied the moons nearly three-fourths of a month from the solar seasons, because 365.24 days divided by 29.53 per lunation, equals 12.37 moons per year; hence two years being 24.74 moons, indicated Agricultural seasons .74 of a moon, or 22 days *behind* at the end of the second year. To rectify that, 13 moons were required in the third year, which registered the seasons three days too early. Next, the fourth year's seasons were 19 days behind. and so on, like the confusing Easter wanderings we foolishly continue that way.

The Pontiffs abused their high powers when bribed by Roman rulers to extend their periods of lucrative office by declaring thirteen moons when there should have been twelve, to personally gain another month's taxes. That naturally developed the harmful system of public plunder (now called "graft") and led to political patronage thrusting unworthy men to the front, regardless of the serious fact that farmers were thereby misled into sowing seed, etc., too late or too early; with the inevitable result that bad crops caused famine and impoverished the people the farther their sowing moon (then known by its number in the year), was drifted from the season. Thus, their "New Year's Day" varied in solar date, and as the Pontiff was in collusion with the Consul when he directed the heralds to announce the New Year by the Roman Consul publicly hammering the *annual nail* into the Temple of Minerva, the Goddess of Wisdom and Science, the people accepted the year's length then regulated in that crude way.

The great object of our calendars and almanacs is to register the beginning of each new year on the same fixed date of the solar year and correctly tabulate the 365 days in *fixed* order throughout the seasons, which are daily indicated by the sun's noon elevation. The moon cannot be wisely used to register either the true seasons nor measure months of any *fixed length in days,* which Julius Cæsar found were absolutely necessary for good government to help the people and prevent the abuses which had drifted the almanac eighty days from the true seasons by the year 46 B.C. He realized that the grave public loss and confusion caused by that moon-wandering from the seasons could best be avoided by having *fixed lengths* for each month, *entirely independent of the moon,* and always beginning the year upon *one precise day* of a *fixed* season.

Julius Cæsar, therefore, established the basis of our almanacs by his great reform which *fixed* alternate months of thirty-one and thirty days, and began the 1st of January in the year 45 B.C. with the "*first New Moon that shone after the Winter Solstice.*" The urgent public need did not permit of delaying that great change until the new moon appeared on December 22nd [as it does at 23.50 o'clock this year (1908) on the Standard Meridian of Greenwich], so that first noon, 45 B.C., accidentally fixed the commencement of our ye--s ten days from nature's year's end.

That discrepancy he could not avoid when the illiterate peasantry scattered throughout the Empire could only understand that signal to begin the new era, but as the great object of that reform was to confer the permanent benefits of a *fixed year* to locate the season for each day's work, the days were arranged accordingly in thirty-one and thirty day months.

July, then named in honour of Julius Cæsar's birthday therein, had thirty-one days, but when Augustus Cæsar was enthroned, after Julius Cæsar died, vanity led him to alter the name of his birthday month from Sextilis (6th) to August, and as it had only thirty days his pride led him to add one day to August. For reasons best known to himself he took that day from February.

That gave the third quarter of the year ninety-three days, leaving only ninety in the first quarter, and by disturbing calculations for rents, interest, etc., caused public outcry.

To sustain his pride from publicly acknowledging Julius Cæsar's superior plan, Augustus took one day each from September and November, to make the 31st of October and 31st December. Thus the pride and arrogance of Augustus Cæsar has during 1,900 years inflicted the present irrational months upon European races with the consequent inequalities of 90, 91, 92, 92 days in the quarters of the year, and the disparity of three days between the 181 days in the first half, and the 184 days in the second half of the years.

Those inequalities not only disturb the computations for interest, rents, etc., but they unequalize the annual sub-divisions of salaries, etc., and have a far more potent effect upon the most desired net earnings of large railway and other corporations whose influences are yearly becoming more powerful, *e.g.*, the three days difference between the half years inflate the dividends for the half year ending December 31st, by about 2 per cent, and that disparity is further disturbed by the present needless changing of the week-day names for the days throughout successive years, owing to the odd 53rd week-day beyond 52 weeks recurring on the last day of each year. Those with the inequalities of the months cause stocks and shares to vary in value beyond trade variations, giving rise to stock exchange gambling, and with their attendant evils inflict loss upon thrifty workers variously paid by the week and month, paying rents and other charges by the existing unequal months, which cannot be equated by the indispensable week that divides February alone into the four weeks best suited to modern requirements.

The difference between the 28 days of February and 31 days in January and March, approximates 11 per cent, and renders accurate comparisons impracticable, whilst fair adjustments can only be approximated after elaborate calculations are made. Similar difficulties arise from the disparities between the other months of the year. They cannot be truly compared either with each other, nor with the corresponding months in the preceding years, because their week-day earning times are different. Those differences are developing serious drawbacks in all kinds of statistical work and investigation dependent thereon, such as the growing need for the exact ascertainment of the costs of production per ton or per article, the costs of transportation required by railway, canal and shipping companies, coal, iron, and other mining companies, and manufacturers generally. Banks, insurance companies, medical, city, and government authorities, need more precise comparisons for records of immigration, births, deaths, etc., best obtained each four weeks.

To meet the growing need for accurately apportioning costs of production and comparison, the practice of sub-dividing salaries, wages, etc., into the varying monthly payments proportionate to the number of working days in each month, has rapidly spread through the United States, "because it pays," and for that reason vitally affecting competition, tends to spread through Canada and the world's manufacturing countries, entailing many millions of waste calculations and much inconvenience, all of which will have to be endured under more intensely developing conditions, unless our months are adjusted in the near future to meet the controlling needs of commerce for monthly accounts commensurate with the working week. Neither months of 30 nor 31 days can overcome the inherent difficulty of fitting the inevitable week of seven days into any other month than that of the simple 28 days *to adequately meet public convenience*, which must dominate all other considerations.

Existing Anomalies and Inconveniences.

The defects of unequal months changing week-day names for dates trouble everybody. Think of the number of times we want to know what day of the week and month it is, or will be on future dates, the intervals between which are so complicated to calculate by our irregular months. When the Cæsars fixed those months that difficulty was scarcely felt, references were few, and they had neither the week nor Sundays changes day names in the months; but now the weekly Sunday's rest from business has developed special duties and recurring engagements for particular week days and weekly payments needing better almanac facilities for reference than sufficed when nearly all days were equally available for every purpose, as with the Red Indians.

Our confusing system of changing day names for the same *fixed dates* each year, makes it needlessly difficult to decide in advance upon any particular dates in the month for special purposes. We cannot select the occasion and fix a yearly date without involving annual alteration of its week-day name and the erratic occurrence of Sunday on that date postponing the event until a day later. Therefore, fixed market fairs, etc., are delayed and located as the first Monday, second Wednesday, etc., of a month. The months sometimes contain five Sundays, at others four. Those vary from month to month, and year to year, so that the number of working days per month is never constant in any month. The varying four to five Saturdays in a month also affects all estimates of commerce and industry, as workmen usually work only half that day, whereas more steamships sail on that day than any other.

Those divergencies disturb the comparative value of all statistical work now of growing importance industrially, and to the governments whose imports, exports, immigration, etc., returns are distorted by our changing almanac system. All these cause needless work and detract from useful results, as one month's record cannot now be fairly compared with another, nor with the corresponding records in previous years. The confusing months inconvenience everybody.

The most important anomalies and inconveniences thus created by our antiquated almanac system may be summarized as below:—

The months are unequal, involving fractions of weeks, changing week-day names for dates, Christmas and other festivals, fairs, etc.; disturbing market days, periods for legislative, laws, university and school terms; stock exchange settlements, payment days for bills of exchange, trade accounts (now being tried at 28 and 30 days); moving dates of recurring business and social engagements, etc.; causing financial trouble to retail trades people, and householders, when five week-end payments for groceries, rent, etc., are required out of a monthly income, or monthly rents out of weekly wages. These operate to the disadvantage of poor people, as the fluctuations of the pawnbroker's business testify.

These inequalities, together with the unequal quarters of the year, disturb the computations for interest, salaries, rents, and all periodical payments. Other inconveniences beyond those named result, but those suffice to show the growing need for improvements in our calendars and almanacs for universal use.

The changing week-day names through dates of the year, and fractions of the week beyond the 28 days each month cause the trouble and confuse ideas of time.

Two main remedies are needed:—(1) Treat "Christmas Day," or "New Year's Day," or the 365th day of the year as a holiday, either week-day name or monthly date, and likewise raise leap-day to be a *holiday,* without either week-day name or monthly date; (2) arrange the most convenient regularly recurring month of four weeks, with thirteen weeks in each quarter of the year.

Having arrived at the conclusion that reform was highly desirable, the next consideration was to ascertain what was practicable.

REFORM DESIRABLE AND PRACTICABLE.

That led to the submission of those suggested remedies to the late Dr. Gott, the Bishop of Truro (England), to whom I also explained in 1898 the advantages of fixing Easter, having known him well in Leeds. He considered "they would benefit the entire human race," and cordially encouraged me to work for the reform, as also did the Dean of York, Cardinal Stonor (whom I was privileged to meet in Rome), Dr. Tempest Anderson, of York, and many others. My proposals of 1899 were then published.

Knowing that progressive reform would be more quickly taken up by the free, untrammelled minds of Americans, I visited the United States in 1903, and was highly pleased when President Hadley, of Yale University, told me that he thought the month of four weeks "*would come as a commercial necessity.*" Prof. Geo. F. Wright, D.D., and others said the reform would surely be accomplished in reasonable time if tactfully worked for—whilst prominent bankers and business men agreed that it was highly desirable and practicable. Indeed the United States Trust Co. and other bankers had, by printed interest cards, etc., already begun to charge interest every four weeks, and the U. S. A. comparative table of working days in each month (as reproduced on page 35 of the "Rational Almanac") was in regular use in the leading offices.

The governments, railway companies and other large employers had, through changing days and unequal months, long been burdened with vast numbers of monthly calculations to apportion yearly salaries, rents, etc., to the varying number of work-days in each month, to ascertain truer costs as against monthly revenue, traffic, sales, etc. They had elaborate tables printed and some offered to pay for shorter methods of calculation to meet their increasing needs, as my publications to economize such work were widely known.

That experience in America was emphasized when the four-week (28 days) system was found to have spread to the British and German iron and steel trades, steamship companies, etc., whilst all nations were feeling the increasing need for equal monthly periods of service and pay, as instanced by the Belgian Government having to adopt the four weekly period for the employers' and employees' contributions to provide the best designed pension system for old age.

Then, feeling that the time had arrived to publicly advocate the reform, my book on "The Rational Almanac," was published in 1905.

Since that time increasing interest has been aroused by the advocacy for reform in both Europe and America. The celebrated French astronomer, Camille Flammarion, with others in Germany, etc., have joined with Lord Avebury, Sir Norman Lockyer, Sir Oliver Lodge, Mr. Alex. Philip, and other British advocates, in urging for improvement.

Sir Sandford Fleming, who is so widely known for his valuable experience in the establishment of International "Standard Time" has personally told you "*that the desired change can be effected I have no doubt whatever.*" Such testimonies commend the subject to your consideration. Now he has pointed out the right course to take.

As investigators have almost unanimously been led to realize the world-wide advantages which would result in everyday convenience to us all if the odd 365th day of the year (beyond the 52 weeks of 7 days) could be calendared without a week-day name to obviate the changing week-day names of dates through successive years, by simply naming "Christmas" or "New Year's" day apart from week-day names; which of the two is best may be left as a matter of detail for an international conference to decide. Similarly the minor question of the proposed fixity of Easter may suitably be left open for the churches to consider as the masses of the people evidence desire for a permanent almanac, bearing in mind the main point that the church and Sabbath were made for men, and not men for those worthy institutions.

To fit working weeks into months and quarters is the most important consideration to aim at in almanac reform. Whether that can be best done by three months of 30 days, plus one public holiday as a *dies non* each quarter, or two months of 30 days plus one of 31 days, as Mr. Philip and others have suggested (possibly without the world-wide consideration needed), or whether the thirteen months of four weeks each, as I originally proposed in the years 1896 to 1899, or some other scheme should be adopted, are subject to discussion, and whatever is best should prevail for public convenience.

It is important that we should consider the best methods that have been suggested by persons who have given most thought and investigation to the subject of simplifying our months. As these can be readily grouped under four typical methods, A, B, C, and D, and will be easiest understood in comparative form, the Comparative Table for A, B, C, and D is printed opposite.

COMPARISON OF METHODS A B C AND

Respectively Proposed to Simplify the Months.

A B and **C** divide 12 months of 30 and 31 days into **Fixed Quart** **Years,** each consisting of 13 weeks, with week-day names for the same dates the month **recurring every 3rd month;** whilst **D** is designed to secure 13 equ months of 4 weeks each, with fixed Quarter Years, and week-days **recurring** **the same dates every month.**

METHOD	Week Days	JANUARY	FEBRUARY	MARCH
A	Su.	1 8 15 22 29	6 13 20 27	4 11 18
	M.	2 9 16 23 **30**	7 14 21 28	5 12 19
3 months of 30 days	Tu.	3 10 17 24	1 8 15 22 29	6 13 20
with ✦ the last day	W.	4 11 18 25	2 9 16 23 **30**	7 14 21
in each Quarter as a	Th.	5 12 19 26	3 10 17 24	1 8 15 22
Saturday Holiday.	F.	6 13 20 27	4 11 18 25	2 9 16 23
	Sa.	7 14 21 28	5 12 19 26	3 10 17 24
B	Su.	1 8 15 22 29	6 13 20 27	4 11 18
	M.	2 9 16 23 **30**	7 14 21 28	5 12 19
	Tu.	3 10 17 24	1 8 15 22 29	6 13 20
	W.	4 11 18 25	2 9 16 23 **30**	7 14 21
2 Months of 30 days.	Th.	5 12 19 26	3 10 17 24	1 8 15 22
1 Month " 31 "	F.	6 13 20 27	4 11 18 25	2 9 16 23
	Sa.	7 14 21 28	5 12 19 26	3 10 17 24
C	Su.	1 8 15 22 29	5 12 19 26	3 10 17
	M.	2 9 16 23 30	6 13 20 27	4 11 18
	Tu.	3 10 17 24 **31**	7 14 21 28	5 12 19
	W.	4 11 18 25	1 8 15 22 29	6 13 20
1 Month of 31 days.	Th.	5 12 19 26	2 9 16 23 **30**	7 14 21
2 Months " 30 "	F.	6 13 20 27	3 10 17 24	1 8 15 22
	Sa.	7 14 21 28	4 11 18 25	2 9 16 23
D	Su.	1 8 15 22	1 8 15 22	1 8 15 22
	M.	2 9 16 23	2 9 16 23	2 9 16 23
	Tu.	3 10 17 24	3 10 17 24	3 10 17 24
13 Equal Months, con-	W.	4 11 18 25	4 11 18 25	4 11 18 25
sisting of 4 Common	Th.	5 12 19 26	5 12 19 26	5 12 19 26
Weeks.	F.	6 13 20 27	6 13 20 27	6 13 20 27
	Sa.	7 14 21 **28**	7 14 21 **28**	7 14 21 **28**

METHODS SUGGESTED TO PROVIDE SIMPLER MONTHS.

Various suggestions have been made to bring simpler and more equal months into use, and as nearly all plan the repetition of the week-days and datal order of January, February and March in each succeeding three months of the year, we may most easily consider the respective advantages and disadvantages of the four most typical methods, A, B, C, and D, if we concentrate attention upon those three months, bearing in mind that now January has 31 days, February 28, and March 31, and that the proposed months by methods A, B, and C would be exactly repeated in triplets after January February March

	January	February	March
as	April	May	June
	July	August	September
	October	November	December

Method D provides for the insertion of a new month of four weeks between June and July.

All the four methods provide for the "odd day of the year" as a "*Dies-non*' and public holiday, also for "leap-day" as a summer holiday.

The "*Dies-non*" is suggested as "Christmas Day" in both methods A and D; whilst B proposes it as "New Year's Day," and C reserves it as the "last day of the year."

They all rightly begin the year with Sunday and are planned to provide a fixed calendar for permanently locating equal quarterly and half-yearly terms and give *fixity of dates* for law, unversity, and school terms, statutory meetings for public authorities, markets, fairs, local festivals, and other anniversaries, such as the Royal birthdays and our own occurring on their respective permanent week-days for their particular dates each year — whilst D further provides for the desired convenience of *fixed Easters* and their contingent festivals, and *four fixed dates in every month for each week-day*. They offer those many practical advantages over the shifting system we have been content to use, because we did not know any better, until recently some people dared to think improvements could be made.

The table for comparison of methods A, B, C, and D, records in the heading their proposed sub-divisions of the year, and below each bold indicator letter in the front column details the method by which the days in each three months opposite are proposed to be apportioned. We will now proceed to consider the merits of each.

The fixity of the week-day names and dates to be repeated each three months being arranged for by all the methods leads to the first and highly important consideration of the convenient working of the weeks within the three repeating lengths of months, which by A end on Monday, Wednesday and Friday, respectively.

by B end on Monday, Wednesday and Saturday, respectively.
by C end on Tuesday, Thursday and Saturday, respectively.
by D end on Saturdays always.

A and C have the slight advantage over B of being more easily remembered as alternate days, but A's advantage is merely nominal, as the suggested Saturday holiday is practically a week-day, and other nations would not add those extra public quarter-day holidays to the more numerous holidays they have in Italy, Spain, etc., as they would make those poor people poorer.

D has the supreme advantage over the others of *always ending the month with the week on Saturdays,* to give the fullest public convenience by which we must always gauge the respective merits of the various methods.

The second test of usefulness is equality in the total number of days in each month. B and C have equal merit, as the 31st of March in B, is equated by the 31st of January in C. Here again A has the nominal advantage of equal months of 30 days, plus the Saturday holiday, after March 30th, but D has the most valuable advantage over all, of *absolute equality* in *every month.*

The third, but very important practical consideration in business matters, is the equality in the total number of *working days* the proposed months respectively contain. They are as follows:—

	January.	February.	March
Method A	25 days	**26** days	**26** days
" B	25 "	**26** "	**27** "
" C	*26* "	*26* "	*26* "
" D	*24* "	*24* "	*24* "

C and D have equality in each of their three months, as shown in *italics.*

In this test B makes the most serious mistake of giving March two more days than January, and as that would give March an inflation of 8 per cent in earning time, and likewise inflate June, September and December with double the disparity they now bear to their adjoining months, whilst the object of reform is to remedy their present differences — *that seems a fatal objection* to B.

Both A and B propose for January, April, July, and October, one day or 4 per cent less earning time than the other months—a serious disadvantage.

That disadvantage was overcome by my preliminary method C, which gave 26 working days to each month; but it had to give place to the superior advantages in D of 24 working days of exactly the same total working value in every month of four working weeks and four pay-days, when practical experience so manifestly indicated the far superior advantages to be derived from months of four weeks each.

By proposals A, B and C there would always be five Saturdays in every third month, and, with the slight variation by method C, the the other six week-days would be repeated a fifth time in pairs at the end of each successive month, changing not only the week-day names for those dates *beyond the 28th in every case,* but unfortunately altering the names of week-days for every date through all the second and third months of each quarter of t' e year. That would leave no two consecutive months alike, and perpetuate unceasing changes in names of dates each successive month, similar to those which now confuse our minds.

We have already proved that nearly all our almanac inconveniences are caused by the needless changing of week-day names for monthly dates, and as that is the supreme test which neither methods A, B, nor C can pass,— the crowning advantage rests with method D, which perfectly meets the complete case of *providing for the return of the week-days in their ordinary course to the same fixed dates in every month.*

A glance down the table showing the Comparison of Methods enables us to see how by all the first three methods A, B, and C, the weeks are split between January and February, and between February and March, causing the former part of a broken week to be counted in January, and the latter part of February's last week to be computed in March, whilst the other portions of both those broken weeks would have to be accounted for in poor February, which has been so easy to us all, and sets such an excellent and practical example in modesty below its rivals in the February column, and, moreover, is decidedly proved to be the best month we now have in yearly use, or thus far experienced.

Its 28 days are practically as near the original moon-month's length of 29.53 days as are the 31 day months which A, B, and C unitedly ask us to dethrone from regulating the length of the majority of our months, when the logical sequence of Christians substituting the 7 days week for the Pagan 7.38 days quarter moon in the time of Constantine the Great (page 5) should be to proportionately reduce the months to equal periods of four weeks.

Having agreed that reform is both desirable and practicable, let us strive to make sure that when we do change it shall be to the *best* method.

COMPARISON OF THE PROPOSED CHANGES IN LENGTHS OF MONTHS.

As the extent of the changes in the length of months proposed by A, B, and C are so nearly the same, we will consider their central one B as representative in this question of the actual changes proposed from the lengths of our present months, to compare with those suggested by D.

B would add two days to February, and one day each to June and September, whilst reducing January, May, July, August and October by one day each.

D, on the other hand, simply reduces all the months to the 28 days' length of February, and inserts a 28 day month after June—all exactly equal. That regular levelling down to the four common weeks would be easily understood by everybody, whereas the confusing additions and deductions to the various months proposed by A, B, and C would prejudice the advantage of change and leave their new months little better in usefulness than the present months for the masses of the people we need to consider most.

Such improvements as A, B, and C suggest would only give the advantages of fixed comparative week-day names to dates repeating *each three months,* but clearly the most insistent and constant public need is for the regular return of week-day names to the same dates in *every month* and months to end with the week.

We need not be surprised that the relatively very few lawyers and landlords who use the quarters of the year most and are least in touch with the almanac needs of the masses of the people, should, by repetition in legal documents, have attached undue importance to those three-monthly periods; but if they do not realize the vast changes effected during the last two thousand years, that have resulted in replacing the Roman system of quarter year payments by the vastly more numerous monthly and innumerable weekly payments and engagements now necessary, we who consider the merits of proposed improvements must give the most weight of opinion to that dominant fact of changed conditions having led to the quarterly periods being so little used now even in Europe, whilst you scarcely use them in America.

The few times the quarter years are used when compared with the constant recall of the month so frequently every day when reading and writing dates in our busy world, makes the practical value and convenience of having the quarter years end with the month, of very minor importance to that of ending the months with the week. But when the extension of method D is considered as the proposed "Rational Almanac" on the following page, the needs of fewer persons who use the quarter years are better met by the quarters there ending on Saturdays with the respective first, second and third weeks of the fourth, seventh and tenth months, than by each third month end of unequal months.

Indeed, it would be more convenient in many businesses to locate the quarter-day at those week ends when the pressure of monthly work was passed, as we now do in England by the 6th of April, and in Scotland by the 15th of May and 11th of November, for rentals and like payments.

Table D.

Proposed "RATIONAL ALMANAC," by M. B. COTSWORTH.

WEEK DAYS.	JAN. 1	FEB. 2	MAR. 3	APR. 4	MAY 5	JUN. 6	NEW MONTH 7	JUL. 8	AUG. 9	SEP. 10	OCT. 11	NOV. 12	DEC. 13	WORK DAYS
Sundays	**1**	Sun. **1**	Sun. **1**	Sun. **1**	EASTER MAY DAY Sun. **1**	Sun. **1**	***Leap Day*** WHIT SUN. Sun. **1**	Sun. **1**	Sun. **1**	Sun. **1**	Sun. **1**	Sun. **1**	Sun. **1**	
Mondays	2	2	2	2	2	2	2	2	2	2	2	2	2	Mondays
Tuesdays	3	3	3	3	3	3	3	3	3	3	3	3	3	Tuesdays
Wednesdays	4	4	4	4	4	4	4	4	4	4	4	4	4	Wednesdays
Thursdays	5	5	5	5	5	5	5	5	5	5	5	5	5	Thursdays
Fridays	6	6	6	6	6	6	6	6	6	6	6	6	6	Fridays
Saturdays	7	7	7	7	7	7	7	7	7	7	7	7	7	Saturdays
				1st Quarter										
Sundays	**8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	Sun. **8**	
Mondays	9	9	9	9	9	9	9	9	9	9	9	9	9	Mondays
Tuesdays	10	10	10	10	10	10	10	10	10	10	10	10	10	Tuesdays
Wednesdays	11	11	11	11	11	11	11	11	11	11	11	11	11	Wednesdays
Thursdays	12	12	12	12	12	12	12	12	12	12	12	12	12	Thursdays
Fridays	13	13	13	13	13	13	13	13	13	13	13	13	13	Fridays
Saturdays	14	14	14	14	14	14	Dom. 14	14	14	14	14	14	14	Saturdays
							HALF YEAR							
Sundays	**15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	Sun. **15**	
Mondays	16	16	16	16	16	16	(July 4) 16	16	16	16	16	16	16	Mondays
Tuesdays	17	17	17	17	17	17	17	17	17	17	17	17	17	Tuesdays
Wednesdays	18	18	18	18	18	18	18	18	18	18	18	18	18	Wednesdays
Thursdays	19	19	19	19	19	19	19	19	19	19	19	19	19	Thursdays
Fridays	20	20	20	20	20	20	20	20	20	20	20	Thanks. 20	20	Fridays
Saturdays	21	21	21	21	21	21	21	21	21	21	21	Day. 21	21	Saturdays
										3rd Quarter				
Sundays	**22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22**	Sun. **22** ***Xmas Day***	
Mondays	23	23	23	23	23	23	23	23	23	23	23	23	23	Mondays
Tuesdays	24	24	24	24	24	24	24	24	24	24	24	24	24	Tuesdays
Wednesdays	25	25	25	25	25	25	25	25	25	25	25	25	25	Wednesdays
Thursdays	26	26	26	26	26	26	26	26	26	26	26	26	26	Thursdays
Fridays	27	27	27	27	27	27	27	27	27	27	27	27	27	Fridays
Saturdays	28	28	28	28	28	28	28	28	28	28	28	28	28	Saturdays

There would be a distinct trade advantage in allowing time for the monthly cash to circulate for the relief of the strain of quarterly payments.

That is emphasized by the increasing tendency now shown all the world over, to pay dividends on consols, bonds, stocks and shares in railways and other industrial companies on various dates of the month for financial convenience, though their accounts are nearly all made up half-yearly. But whether accounted quarterly or half-yearly, those ending with the week on Saturdays would be far more convenient to all concerned than with the months now irregularly beginning and ending with parts of weeks.

Advocates of methods A, B, and C unitedly urge the advantages to be derived by locating fixed week-days to dates in each three months, but surely now that by our countless numbers of invoice and account entries, and constant reference to dates on letters, newspapers, etc., we use the month many thousand of times more often than quarter years, *it is more than a thousand fold more practically important that we should, if possible, end the month with the week, and always have the same week-day name attached to the same date in every month as proposed in D.*

That immense advantage of D is of such supreme practical importance, that in view of the fact that D also provides all the other advantages of A, B, and C (excepting the two quarters and one-half year ending with the week instead of the month,— which D so conveniently provides for), it directs our attention to D's complete plan as the "Rational Almanac," which on the opposite page displays the thirteen months of four weeks each, with the "New Month" inserted between June and July.

"THE RATIONAL ALMANAC."

This includes not only the arrangement of simpler months, but also the fixing of the "*Dies-non*" and festival dates.

The simplicity of the uniformly arranged four weeks per month can be seen at a glance. The 24 work-days per month, as detailed in the last column, are kept uniform in dates by the insertion of "Christmas Day" between the Sunday and Monday of the last week of the year, on the exact corresponding day to the present 25th of December, both being seven days from the year's end. But if the International Conference prefers the "*Dies-non*" to be located on "New Year's Eve" as the 365th day of the year, that will just as well maintain the 24 work-days per month, though it would longer defer and make it more difficult for China, Japan, etc., to adopt the simple almanac for universal use.

Throughout all the 365 days thus registered on the "Rational Almanac," every present almanac date as it occurs in 1916 would be ıcing the new month between June and July existing ideas rse of the months would be maintained, and the days beyond ;ht each month would be easily adjusted per Table E from 28 to the maximum difference of fifteen days on the proposed , and thence decrease to nothing in December.

ıt greatest difference occurring near mid summer, when the ıture is most permanent, would scarcely be felt, as weather variare greater in other months.

he Conference would be the best authority to decide the name " New Month," which should be brief, and a root-word common ost nations. "Sol" is suggested in Table E, but "Mid," or a lar name might be better.

The groups of three columns between the heavier rulings down ɔle E indicate, 1st, the dates for the year 1916 (with Leap-day rejusted); 2nd, the days of the week; 3rd, the equivalent dates in the oposed almanac, to which the week-days names in 1916 would be ermanently fixed for all future years. Hence, Table E could be used ıfter 1916 to transpose any legal, birthday or other date from the present to the proposed style of almanac.

The removal of "Leap-Day" (which should be a public holiday) to precede the 1st of the "New Month" is desirable to give the workers that holiday near mid-summer, and link it up with the week-end and the Whitsuntide holidays, so highly appreciated in Europe, as the best holidays the masses of toilers enjoy.

The "Whitsunday" printed between "Leap-Day" and the 1st Sunday of the "New Month" is merely the fixed Ecclesiastical name transferred to that Sunday which is proposed to be permanently celebrated a week later than its date in 1916, to begin the Mid-Summer Month for general convenience.—But if the Churches adhere to the 1916 date, as seven weeks after Easter, we shall not lose much.

Easter Sunday as the "key-date" of the Church Calendar is located on the proposed May 1st where it is due by the present style in 1916, and all the other dates under the "proposed style follow exactly the same successive order as in 1816, except (1) the adjustment of one day from February 29th to the end of June consequent upon the removal of "Leap-Day," and (2) through the last six days of the year following the insertion of the "Dies-non."

The Church Festivals affect the public convenience of the larger populations of Europe far more than is the case in America, therefore, due weight must be accorded to their needs. To that end the following comparative list of Festivals and Holidays is recorded for comparison on Table E.

	Year 1916 Dates.	Suggested Dates.
St. David's Day	March 1	March 4
St. Patrick's Day	March 17	March 20
Lady Day	March 25	March 28
Good Friday	April 21	April 27
{ Easter Sunday	April 23	May 1 }
{ St. George's Day	April 23	May 1 }
{ Leap Day (Holiday)	Feb. 29	June 28 }
{ Whit-Sunday	June 11	*Sol.* 1 }
Dominion Day (Canada)	*July 1*	*Sol. 14*
Independence Day (U.S.A.)	*July 4*	*Sol. 16*
August Bank Holiday	Aug. 7	Aug. 2
Michaelmas Day	Sept. 29	Sept. 20
Martinmas Day	Nov. 23	Nov. 19
Thanksgiving Day (U.S.A,)	*Nov. 24*	*Nov. 20*
St. Andrew's Day	Nov. 30	Nov. 26
Christmas Day	Dec. 25	Dec. 22

After the International Conference decides upon the best *fixed* order of the 365 days of the year in weeks and months, each nation will continue free to fix its own Holidays, but for the convenience of their people it is hoped that they will tend to hold holidays adjoining Sunday, and preferably on the Monday, to increase the enjoyment of their workers, *e.g.* In Canada "Dominion Day" would fall on Saturday the 14th of the new month, and though much better there linked with Sunday than on Wednesday (as happens this year), would be more conveniently held on the Monday 16th to avoid disturbing the Saturday markets when most of the workers do their shopping. They would like the Saturday half-day to extend their holiday visits.

It is suggested to our American friends that they could gain more from their national holidays, if they were thus permanently combined with the week-ends for public convenience, by merely moving "Independence Day" one day forward, and "Thanksgiving Day" one day later, just as they now do temporarily when those holidays fall on Sunday.

If those suggestions were adopted these vigorous nations of North America whose interchange of commerce and interests are so rapidly increasing, might derive mutual advantage and greater convenience by both celebrating those national holidays on the 16th of the new month. That would be fair to both, as each would have adjusted its date by one working day for their united benefit.

DISADVANTAGES OF THE PROPOSED THIRTEEN MONTHS.

1. Yearly salary, rents, etc., divided by 12=.083 per dollar, whereas division by 13=.077, and though both are .003 from the simple eight cents per month, 13 is more difficult to divide. The printing of the simple Quotient Table (as on page 51 of the Rational Almanac) with future almanacs would make divisions by 13 easier than we now divide by 12.

The natural result would be the adoption of simpler rates for the many times more frequently used months, based on the most easily divisible 24 working days which would prove a far larger saving.

2. The 1st, 2nd and 3rd quarters and 1st half year would not end with the month,—*but they would gain the better convenience of ending with the week, and so save split abstracting and adjustments, as periods of earnings and weekly expenses would coincide.*

3. The slight inconvenience during the initial year in which the 13 months may be introduced.—*That would easily be overcome by suitable provisions in the Act of Parliament by which the change would be brought into effect, and by the printed almanacs wherein 13 cycles of the permanent month would prove so highly useful that these minor disadvantages would scarcely be felt, as they would fall subservient to the merits of the smooth working and efficient month of four weeks that most completely solves our almanac difficulties.*

These disadvantages sink into insignificance when compared with the before-mentioned advantages and the world-wide gain in facilitating international commerce and intercourse.

The few people who superstitiously regard the number 13 as unlucky are answered by the fact that we have already 13 weeks per quarter year, and that we could gain so many more useful facilities by 13 equal months per year.

ADVANTAGES OF THE PROPOSED CHANGE.

The advantages in favour of a "Rational Almanac" are so numerous and obvious that beyond the removal of the many existing anomalies and inconveniences recorded on page 8, I need only allude to the International benefits which would result from this reform, by promoting harmony and good-will between the world's greatest populations in Asia and other nations. Upon the cultivation of mutual respect the peace and happiness of the bulk of humanity will assuredly depend during years to come, and never more than in the next few years.

However, earnest a missionary may be, he cannot impress a cultured Chinaman that our ways are right when we record time as say 10.0 a.m. on the 27th May, 1908, when the Chinese know that the year should be first and the month, etc., follow in nature's order as 1908, May 27—10.0 a.m.

We are industrially ahead of them, but they can by example teach us thrift, industry, courage, perseverance and other virtues including tolerance and open mindedness to see the good in both white and yellow races—as those who last year saw the sturdy Japanese rush into the icy stream near Field, B.C., to fix the timbers needed to support the C. P. R. bridge, admiringly admitted when the failure of white men to do that had necessitated sending some miles to get the plucky Japs to do it.

We abandoned crude earthenware and fading inks when we found how the Chinese made China cups, etc., and indelible inks, because they benefitted us. That all sufficient reason of personal benefit will lead the great peoples of Asia to quickly adopt the four week-month, as they use the seven days week, and when every third year their 13 moon-months approximate our 13 months of four weeks the practical advantages of the latter will speedily lead to general adoption.

Similarly the use of the "Dies-non Holiday" after the proposed almanac is used by European races will every few years unite the Mahommedan, Hindoo, Chinese, etc., sabbaths through all the 52 Sundays of a year, during which we can unite with those creeds in worship to the all wise Creator, instead of Mahommedans doing that on Fridays, Jews on Saturdays, etc. That almanac created unity will unconsciously develop the interests of peace and good-will amongst all races and creeds, just as you are doing with such immigrants in America who enjoy our Sunday's rest.

Ease with which the Change can be Made.

Some persons who have never fairly considered the subject imagine that before this beneficial change can be accomplished some great difficulties have to be overcome; but all who have been open-minded enough and given time to consider the facts have been convinced that the desired reform will be easily effected at an early date.

Uninformed people are apt to think that an alteration of the almanac involves difficulties like the introduction of the metric or decimal system of weights and measures, whereas there will be scarcely any difficulty as will presently be shown.

Others erroneously jump to the conclusion that there would be similar trouble to that you experienced in America during the change to decimal coinage; but glad as Americans were to make that change they may rest assured that though these proposals would, when carried into practice yield similarly increased facilities, there would not be one thousandth part of such practical difficulties occasioned by almanac reform.

We have not the grave difficulties in the path of reform that confronted Julius Cæsar who had to expand the year 45 B. C. by 80 days amongst the uneducated peoples of Europe. Neither have we to deal with the awkward case which Pope Gregory the Great had to decide in 1582 A. D. when ten days had to be deducted from that year, nor the 11 days which Protestant England foolishly deferred deducting until 1752, when few people could read or write, nor get the 13 days which Russia must from necessity leave out within the next few years.

The proposed almanac neither requires additions to, nor deductions from the regular 365 days year.—On the contrary every day therein would become fixed and regular.

That most vital consideration makes this reform infinitely easier to carry into effect, although the practical advantages that can be derived by the adoption of the "Rational Almanac" are believed by competent authorities to be very much greater in public convenience than those great and wise reforms, which after all simply adjusted the length of the civil year and anchored January 1st to begin on the same solar date.

The practical convenience Europeans derived from Constantine the Great's substitution of the quarter-moon by the seven days week in the year 321 A. D. has probably preceded that of the combined reforms of Julius Cæsar and Pope Gregory XIIIth. It was the fixity they gave to the year's length and the settled order of dates therein, that gave those reforms pre-eminence.

In the reform now proposed, the object is to fix the date and name for every day permanently and remove all uncertainty by three successive governmental operations well within the powers of the representatives of all countries to accomplish for the good of all, as no selfish interests are involved.

1. The governments will be asked to assemble an international conference to decide the best method of reforming the months and locating the "Dies-non," also to determine the date upon which the new almanac shall begin.
2. Next each country will in accordance with these decisions pass their own Acts of Parliament to carry the solutions of the conference into effect and regulate their national holidays.
3. Finally the almanac makers and printers in their respective countries will under the powers of such Acts print and circulate the new almanacs as we do now, but with permanent week-day and other names attached to the 365 days individually. The Farmers' Almanacs will record the dates for sowing, etc. Law and University Calendars will have fixed term dates; whilst

markets, fairs, festivals, etc., would all be *fixed* in the public almanacs as now.

But those almanacs would be permanent as the changing of week-day names for dates would then cease. The fixed four weeks per month would permanently anchor each of our seven week-days to the 4 *fixed dates* opposite their respective names in the "Model Month" on page 1. Then the date would always indicate the day of the week *e.g.* 7, 14, 21 and 28 would denote Saturdays; 1, 8, 15 and 22 Sundays and so forth.

That eminently practical fixed month would speedily become so easily imprinted on our minds that we could by that one month's dates, instantly call to mind the week-day names for any dates in the year, and our watches would indicate the day of the week and date of the month as regularly as they now do the hour we look for on waking. The incessant efforts now necessary to remember the day of the week and month for all purposes would vanish.

The numerous references we now make direct to almanacs, or mentally grope for along the 12 antiquated Roman tablet months of irregular length and ceaseless change of week-day names, would then cease to burden our minds, which would then become free to cast aside that mental crutch poem of "30 Days hath Sept., April, June and Nov., etc." with its tedious exceptions.

Thoughtful persons who reflect upon the number of times per day we thus needlessly waste mental energy upon those efforts now forced upon us by our imperfect almanacs, consider the proposed change to be highly desirable, as it will benefit everybody without injuring anyone.

Statesmen and representatives of the nations called upon to consider the advisability of this reform will realize the developing need for a more convenient almanac suited to modern requirements and unfettered from the defects of the imperfect system of unequal months and changing day names that sufficed in the era of slavery and serfdom 2,000 years ago.—They know that the vast social and industrial changes developed during that long period are becoming more accentuated every year, and they will be quite as ready as the members of the Royal Society of Canada to appreciate not only the conveniences a "Rational Almanac" would give to themselves daily when reading, writing, making appointments, etc., but also give due weight to the fact that the existing almanac anomalies and inconveniences are similarly detrimental to nearly all the 2,000,-000,000 people in the world.

Many of us make numerous almanac references every day in business transactions. It will surprise most people when they individually count the number they make.—But if we take the least possible number of one day, that shows that the colossal number of 730,000,000,000 needless references annually are wasted by our present defective almanacs and could be saved perpetually by this reform, which would work just as easily as February does now each year.

We have practical experience of that, and know how easily we work in even the 29th day for February in Leap years because we record in day-units and it is printed in our almanacs before that date arrives.—Easier still would the "Model Month" always glide along, conferring its perpetual benefits and conveniences upon us all because everybody gladly accepts the day of nature as the inexorable unit of our lives.

Just as surely as Constantine the Great had to lead his people to forsake their quarter-moon periods and accept the fixed seven days week for their common good,—so surely will the leaders of modern nations carry into effect the natural sequence of adopting the fixed four weeks per month now that the month has developed into such vastly greater use than the quarter years.

Your ex-president has reminded you of the effective diplomatic means by which "Standard Time" was so beneficially established amongst all nations, by adherence to the fixed hour unit of change.

But with all due deference it must be pointed out that the beneficial changes proposed by the "Rational Almanac" could be applied with even less trouble than that involved, and without a tithe of the trouble the British Daylight Adjustment Act will cause, as after the Almanac Amendment Act affecting each country is passed, and the printed almanacs circulated, we should only have to press the day-lever on our watches once as the "Dies-non" came round each year, to cause our daily almanac worries to then disappear.

Those nations who are wisely establishing governmental safeguards to Contributory Pension Funds as the best means towards ensuring adequate provision for their workers in old age by encouraging thrifty well-ordered lives by reward and thereby keeping down the cost of living to strengthen their nation's welfare, are finding it highly desirable to save clerical details and yet be just by requiring payments each four weeks as Belgium, etc., are doing.

Friendly, fraternal and other self-help societies, church and similar organizations everywhere would benefit by the change—as well as the dominant business people—in fact the 28 day month would help everybody.

Justice would be meted out to monthly prisoners who would serve 28 days instead of varying 28 to 31. They would come out in a better frame of mind and with clearer ideas as to what "a month" usually was, whilst the nations would permanently save 8 per cent of the cost of maintaining them.

Soldiers, sailors, clerks, domestic servants and the host of people who receive and pay monthly would all be justly dealt with and much tiresome trouble saved.

In almanac reform the supreme need is for a "standard month" to measure with the week. Just as we have fixed and even lengths of seconds, minutes and hours sub-dividing the day, so we need the standard day week and month to measure the year and perfect our system of time.

The longer the unit the more important it is to all concerned. That being so, leads us to wonder why a standard month has not yet been established? Various causes retarded that, but the chief factor was that the rigidly unequal months were fixed by the military rule of the Cæsars, who stereotyped the almanac for Europe long before the seven days week was introduced. Later, exclusive privileges and secret powers to derive easily earned incomes and profits from almanac construction, became vested in certain influential families and dignitaries in the various countries, who jealously conserved and mystified their profession until the year 1828. Then the British monopoly to sell almanacs was taken from the two family representatives who had inherited that privilege from Queen Elizabeth's reign and other people were allowed to print them.

Intercourse between nationalities was rare and united action to establish such a standard was impracticable because every nation was bitterly jealous of its neighbours through almost incessant warfare. The professional almanac makers who had to advise national rulers were financially interested in preventing the introduction of any such simple system as the four-week month.

That would so easily have enabled their customers to make plain wood permanent almanacs for themselves, by using a monthly board with 28 holes bored therein for record by a movable peg, that the costly engraved "Clog Almanacs," in use before printing was invented, and expensive printed almanacs they later had to sell, would not have been required. The bewildering moon wandering of Church Festivals and lingering use of the moon for locating the drifting tides, together with its changing phases and awe-inspiring features prevented men from daring to think that a "standard month" could be used. Nearly all those drawbacks have ceased to operate and changed conditions now prevail. The sub-division of the year is now entirely a matter for governments to decide for public convenience.

We of the 20th century should free ourselves from the irritating fetters of shifting day-name-links in the illogical chain of rugged months which Augustus welded upon his slaves. Shall we not after two thousand years of advance in civilization exercise the true spirit of liberty to decide upon whatever course may prove to be best for our generation?

We need the four-week-month because the 7 days week has become the working and paying unit used by the masses of our vastly increased population. The people under Augustus were mostly fed by rations and seldom bought or sold — indeed, they were largely sold like cattle and slaved ten days per week. They had not the freedom to enjoy the seven days which Constantine the Great conferred on Europeans about four centuries later.

Almanac needs in this busy age of world-wide trade, have grown beyond the scope of the narrow limits and antiquated methods that sufficed for the selfish fancy of Augustus,— now that all countries are opened up for the immense international trade now done, and are penetrated by the ever increasing railways, steamships, and other methods of communication.

That trade involves duplicate entries and troublesome diversity wherever different almanacs are used. The prevailing confusion impressed me whilst wintering near Jerusalem during December, 1900, and January, 1901, when five different Christmases and four New Years were there celebrated by various races and creeds.

Whilst we cannot forthwith remedy all that confusing effect, we can easily take the common-sense course of adopting a "Standard Month" at an early date for our own convenience; then the Eastern races will be quick enough to follow in order to gain the facilities that change will bring.

After twelve years of continuous consideration and investigation in various countries, I submit for your consideration, that the present erratic months fixed by the caprice of Augustus Cæsar are becoming so irksome under the developing needs of our civilization now requiring greater convenience, that the simple month of four weeks (giving equal division into thirteen months and thirteen weeks to the quarters of every year) will prove most advantageous, and that it will ultimately become universal for the reasons given — the chief of them being that it would be easiest when fixed and permanently supplying the greater convenience we should derive from having all the months uniformly containing four weeks, so that Sundays would be the 1st, 8th, 15th and 22nd; Mondays, 2nd, 9th, 16th and 23rd, etc.; whilst the essential weekly wages, etc., would then always accord with the corresponding monthly payments. Then every almanac purpose would be completely served for national and international use by all nations, who might then begin the Universal Era and relieve their peoples from almanac anomalies and inconveniences.

Forethought is necessary as the most useful and widest used "*Nautical* Almanac," based on Greenwich Time, is now internationally adopted for navigation throughout the world, and is worked out and printed about four years in advance. The year 1916 is suggested as the most convenient date to make the change, because it could then most easily,— almost imperceptibly — be effected.

That is within the measurable distance of time which inquiries from the best authorities indicate as a practicable limit within which this earnestly desired reform can be accomplished by the united efforts of friends of progress. It is therefore submitted for your thoughtful consideration, in order that we may be able to participate in the benefits that thus can be won for humanity during our lives.

Although the success of this movement does not depend upon public debate, it is of practical interest to everyone and will prove a fruitful and profitable subject for discussion.

The main question you are asked to consider is, how far it may be made practicable during the next few years, by wise concerted action, to remove existing difficulties now developing from almanac anomalies? not only in Christian countries, but throughout the world, wherein humanity could so largely be benefitted by a simple universal almanac all could most easily adopt for mutual advantages, like "Standard Time," the benefits of which we are daily realizing.

One way by which you can materially help the movement is by the discussion of almanac reform in your Journal, and advocacy of such reform as you collectively consider is the best.

The greatest works of the pyramid building nations of Egypt, Assyria, Mexico, etc., were erected to supply almanac needs. Let us complete their stupendous labours and solve the problem now.

The time is ripe for united action, now whilst peace and good will permeates the nations and the spirit of reform prevails.

Prompt and decisive action is advisable to favourably impress statesmen and the leaders of nations now that the subject has grown beyond the scope of individuals.

Neither the Bill before the British Parliament for Reform in the year 1912, nor the one before the German Parliament, nor the changes proposed by Russia, Greece, Japan, etc., can be wisely made until an International Conference carefully decides what is best for the mutual good-will and development of all nations.

As to whether that conference should be held at the Temple of Peace in Holland, or amidst the cosmopolitan populations now uniting in America, or elsewhere, national diplomacy through our ambassadors will decide. There may be competition between the governments as to which will first invite that assemblage to maturely consider the various plans for reform then proposed, and adopt whatever the combined wisdom of those national representatives finds to be best, from any nation.

Where is that likelier to be developed than in the inventive minds of enlightened Americans, who have attracted the most energetic youthful people from all nations and creeds to this continent, where monthly payments are most frequent and where cosmopolitan people most need the four-week-month and "Rational Almanac" for perpetual use.

Probably no other subject for reform can be so easily accomplished to yield such daily widespread benefits to all nations, because all humanity would thereby personally gain increased convenience and be permanently relieved from almanac uncertainties and inconveniences.

As Mr. Philip very truly writes, "The complications and inconven-
"iences which thus arise are incessant, and nothing but custom and an
"apparently universal ignorance of the extremely simple way in which
"these inconveniences can be obviated could possibly account for the
"apparent contentment with which they have been so long accepted."

It would be very difficult to suggest a more desirable subject for international negotiation, or one more worthily tending to strengthen the bonds of peace and international good-will.

XXI—*Researches in Physical Chemistry carried out in the University of Toronto during the past year.*

Communicated by PROFESSOR W. LASH MILLER.

(Read May 27, 1908.)

1. H. C. COOKE:—*The condensation of oxalic and acetic esters by sodium ethylate.* The study of the effects of conditions on the red colouration given by ferric chloride with the condensation product has been continued, and a number of measurements of the rate of condensation have been made.

2. S. DUSHMAN:—*The behaviour of copper as anode in solutions of chlorides* (read before the American Electrochemical Society). The experiments are in quantitative accord with the hypothesis that at the anode there is chemical equilibrium between metallic copper and the cuprous and cupric salts in solution.

3. R. A. GORTNER:—*The kinetics of the reaction between chromic and hydriodic acids and ferrous salts.* Miss Benson's experiments at high temperatures were extended; while increase of temperature retards the liberation of iodine, it accelerates the oxidation of the ferrous salt. Fluorides, bromides and chlorides retard the rate of liberation of iodine in the order named, they accelerate the oxidation of the ferrous salt. The effect of 'ageing' on the ferric salt is altogether due to hydrolysis. In some of the experiments hydrochloric acid was substituted for sulphuric. (Published in The Journal of Physical Chemistry).

4. H. C. GRAHAM:—*Direct determination of the transport number of acetic acid.* Mr. Dawson's experiments were continued; an attempt was made to eliminate the effect of diffusion by choosing the concentrations of chromic acid and copper acetate, so that the acetic acid generated at the two boundaries might have the same concentration.

5. R. J. MANNING:—*Physico-chemical study of Tannin.* The solutions in water show a well marked rise in boiling point over that of pure water even before hydrolysis into dextrose and gallic acid takes place. They show no Tyndall effect, and give measurable osmotic pressures with gelatine membranes. The distribution of tannin between water and ether, water and ethylacetate, and water and amylalcohol was determined; in the case of ether the ratio is independent of the concentrations. As a result of these measurements tannin can hardly longer be considered to be a colloid.

   The marked effect of traces of water on the solubility of tannin and of other glucosides in organic solvents was also studied.

6. W. LASH MILLER:—*Indirect analysis by means of the dilatometer.* A method of determining the composition of one of the phases at a transition point, without isolating or analysing it. (Published in The Journal of Physical Chemistry.)

XXII.—*Harcourt and Esson's Idea in Chemical Mechanics.*

By W. LASH MILLER.

(Read May 27, 1908.)

I think that I will make the best of the limited time at my disposal by defining at once the fundamental problem of chemical kinetics, for it is with the rates of chemical change that I propose to deal. This problem is, then, to find how the rate of a chemical reaction depends on the circumstances under which that reaction takes place; and in the simple case with which alone we shall be concerned, the simple case that the reaction takes place in a homogeneous solution, the only circumstances that affect the rate are:—the temperature, and the concentrations of the chemicals in the solution.

The kindness of those in charge of this laboratory puts me in the position to illustrate what I say by a concrete case. Here are samples of the very chemicals used by Harcourt and Esson in their experiments forty years ago;[1] a solution of oxalic acid, water, sulphuric acid, and a solution of potassium permanganate. When these are mixed together, the whole solution looks pink from the presence of the permanganate; on standing awhile, however, the colour will gradually fade, owing to the reduction, or destruction, of the red permanganate; and what is meant by the "rate" of the reaction is the number of grammes of permanganate that are reduced, or destroyed, or fade per second.

That this rate depends on the temperature, may easily be seen if I pour a little of the mixture into a test-tube and heat it over the flame. As the solution gets warmer, the colour fades more rapidly, until now it is all gone, while the part left at the temperature of the room is still deep red.

The rate depends also on the concentrations of the chemicals dissolved in the solution; so that

Rate depends on a, b, c, d, ...t

and the fundamental problem of chemical kinetics is to determine quantitatively the relation between the rate, the concentrations and the temperature.

Now for the fundamental difficulty. This lies in the fact that as the reaction proceeds, the temperature changes, owing to the liberation or absorption of heat by the reaction; and the various concentrations on

---

[1] Jour. Chem. Soc., *20* 460 (1866).

mperature, to indicate, not that it was very hot, but that that was kept constant (by the use of a thermostat).

concentration of the permanganate, of course, changed during riment, we saw it fade away; the rate too changed; but as the in the rate was caused only by change in the concentration of the reagents, it was a relatively easy matter for Harcourt and to discover the relation between the rate and the concentration of ne substance; the effect of the concentrations of the others was nined like that of the temperature, by comparing different experis in which these concentrations were different, while remaining tant throughout each.

This method of working is the "idea" of which I spoke. It may, haps, seem a very obvious idea, and hardly worth while making a fuss out; and, indeed, Harcourt and Esson seem to have considered it so. ıt it is true, although to those who are not familiar with this branch, may seem difficult to believe, that even now—forty years after the ublication of Harcourt's experiments—this method is not in general use, and that for thirty-six years it was never used at all and practically all experiments on the rates of chemical reactions were carried out in solutions in which the concentrations of all the chemicals varied greatly during the experiments.

In reply to the question "How is it possible to find the connection between rate and concentrations from experiments so badly planned as these," the answer is "By the method of guess and try." Make some plausible assumption, express it mathematically, and compare the experiments with the methematical deductions from the assumption, or guess. If they agree, well and good. If they don't, guess again. The trouble is, that in case of a bad guess the experiments themselves don't give much help in making a better.

This method, then, I shall call "the Method of Guess and Try," in contradistinction to Harcourt and Esson's method of "Systematic Exploration."

Of course, there are connecting links. Two of the concentrations, for instance, may be small, and the others large; the effect of the former being arrived at by guess and try, and that of the latter by systematic exploration. Hood[1] used such a half-and-half method in 1878.

With regard to the method of guess and try; it is hard to teach people how to guess,—that is "chemical instinct;" but van't Hoff, in his celebrated "Études"[2] or "Studies on Chemical Dynamics,"

[1] Phil. Mag. (5) 6 371 (1878).

[2] Etudes de dynamique chimique, 1884, p. 87.

[illegible] two ways of trying, by testing the [illegible] by experiment. [illegible] in which the initial concentrations of the chemicals were varied, while the other [illegible] altogether on the results of a series of analyses of the same solution at different intervals of time. The first of these methods was used by van't Hoff in his work, the other extensively by his successors, for twenty years.

To resume, then, there are shown in this table four ways of determining the relation between the rate of a chemical reaction and the concentrations: Systematic exploration, Harcourt and Esson, 1866; a hybrid method, 1879; and the method of guess and try, with two ways of trying, of which the former was used by van't Hoff in 1884, and the other was in general use between 1885 and 1895.

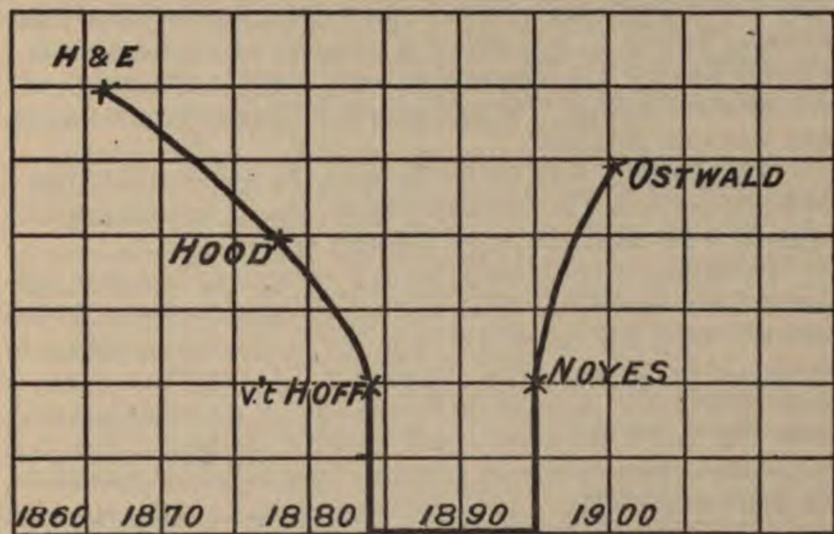
Method.	Definition.	Used by
1. Systematic Exploration—Harcourt & Esson.	[illegible]	H and E. 1866
2. Hybrid	[illegible]	Hood, 1879
Guess and Try	[illegible]	
3. a varying initial conc.		van't Hoff, 1884
4. b varying time only.		General 1885-1895
5. The logical [illegible]	[illegible]	Not employed

I should like to put all this in a diagram; that will make it look more like physical chemistry. The only trouble is what co-ordinates to use. The dates will do for the abscissæ, that's obvious, and I will put Harcourt and Esson high up, because the method they employed was the one best adapted for the purposes of discovery, and Hood a little further down, and then van't Hoff, with the method of varied initial concentrations, and then all the chemists from 1885 to 1895. So that the abscissæ are chronological, and the ordinates psychological.

I would not like to give the impression that van't Hoff, for instance, used a method that was unsuitable for the purpose he had in hand. He had a definite object, and his method enabled him to attain it. In Hood's case, too, there was a special reason—not a very good one, perhaps—that kept him from using method number one; and he too got all he wanted with number two. But the fact is plain, that as time went on, weaker and weaker tools were coming into use, until the very recollection of the method of Harcourt seems to have died out.

If there were time, I should like to go into the reasons for this gradual adoption of the methods of guess and try, but there isn't. It is connected, however, with Guldberg and Waage's application of the kinetic theory to this subject, which made men feel that they were likely to be good guessers. They thought they had a sure tip.

This short line on the board[1] represents ten years of active work, the *Zeitschrift für physikalische Chemie* was founded here, and Arrhenius' theory of electrolytic dissociation was first applied to a kinetic problem here. Dozens of reactions were studied from the kinetic point of view,



all by method number four; and with the result that might be predicted. If the case experimented with happened to be a simple one, the law was guessed; if not, it wasn't. And so, in addition to the reactions for which the relations between rate and concentrations were ascertained, there were gradually being discovered a number of reactions for which these relations could not be formulated.

The first step upward was taken in 1895, by Dr. now Professor A. A. Noyes.[2] He reintroduced van't Hoff's method, method three; quoted van't Hoff's arguments to show that it is superior to number four; and proved its superiority by recalculating Magnanini's measurements (Mag-

[1] Referring to diagram.
[2] Zeit. phys. Chem., *18* 119 (1895).

nanini's work comes here, 1891), and finding quantitative relations where the latter had seen none. Noyes used this method number three in his own work, and discovered the first reactions of the third order studied since the time of Hood.

The next incident is the appearance of the second edition of Ostwald's Lehrbuch, or rather of the second edition of vol. 2, part 2, Heft 2, with the chapter on kinetics. In this, after reviewing the methods of working in common use, viz.: methods three and four of our classification, Ostwald suggests working with all the chemicals but one in excess, and determining the effect of that one on the rate—Harcourt's method, so far. Harcourt's name is not mentioned at all in this connection, however, and reading a little further shows that it is not Harcourt's method after all; because when it comes to determining the effect of the concentration of B on the rate, instead of preparing the experiments with a different excess of B, it is proposed to make b small in turn, and so with all, one after the other. The method used in Harcourt's paper seems to have been quite forgotten.

When planning work for the laboratory for the winter of 1902, I read this new method of Ostwald's with the greatest interest, and fully appreciated the advantages set out so clearly by the author.

On thinking over the case in which I was specially interested, however (the reaction between chloric and hydriodic acids in presence of free iodine) I found that the effect of the iodine concentration could not be ascertained by this new method; to ascertain it, it would be necessary to make up a solution, in which the concentration of the iodide was much lower than that of the others, including that of the iodine. Now, it is impossible to prepare a solution containing much iodine and little iodide, the iodine won't dissolve. And on further thought, I saw that my object could be attained by comparing the rates in two solutions, in both of which the iodide was in excess, but different excesses. The method of Harcourt again, at last.

I didn't know it was Harcourt's at first; in fact, it was only in the winter, when the work was well advanced, that in connection with some work that Mr. Bell[1] was doing, I had occasion to read Harcourt's paper, and found what I had begun to regard as *my* method clearly described.

This tool once in our hands, it is not surprising that we should be able to solve problems that had proved too much for some of the best known chemists working under less favourable circumstances.

The rates of oxidation of hydriodic acid, for instance, by the oxy-

---

[1] Jour. Phys. Chem., 7, 61 (1903).

acids of the halogens, had been studied by Burchard [2] in the laboratory of Lothar Meyer, by Ostwald,[3] by Meyerhoffer,[4] by Dr. Schlundt [5] in Wisconsin, by Warder,[6] of Washington, by Magnanini [7] in Italy, and by Pendlebury and Seward,[8] and Judson and Walker [9] in England. Most light had been thrown on the reaction by Prof. Noyes;[10] but in the opinion of the last chemists to work on this subject, Messrs. Judson and Walker, expressed in 1898 after a review of the earlier papers: "The action of hydriodic acid on the oxyacids of the halogens is of too intricate a nature to give any satisfactory numerical results."

Attacked by the method of systematic exploration, however, this problem proved easy of solution; Messrs. Bray,[11] Dushman [12] and Clark[13] expressed the relations between concentrations and rate in mathematical form, traced out the influence of the iodine liberated during the reaction, and recalculated most of the experimental work of their predecessors. The remarkable catalytic action of chromic acid on one of these reactions, discovered by Ostwald, has also been studied in detail.[14]

In this connection, it became apparent that reactions of the fourth order are plentiful as blackberries in August; and in the oxidation of ferrous salts by chromic acid, Miss Benson[15] found one of the fifth. The opinion held between 1884 and 1895, that reactions of a higher order than the second are curios, must, therefore, be given up. It probably arose from the circumstance that the method of investigation employed was unable to cope with the complicated cases.

Some of these results might conceivably have been attained by a judicious use of method number three. It is otherwise with the reactions to which I will now refer.

Schwicker,[16] who studied the formation of iodate by the action of iodine on caustic potash in 1895, thought that he had discovered a re-

---

[2] Zeit. phys. Chem., 2, 796 (1888).
[3] Zeit. phys. Chem., 2, 127 (1888).
[4] Zeit. phys. Chem., 2, 585 (1888).
[5] Am. Chem. Jour. *17*, 754 (1895).
[6] Am. Chem. Jour. *18*, 23 (1896).
[7] Gazz. Chim. Ital., *21*, 476 (1891).
[8] Proc. Roy. Soc., *45*, 396 (1889).
[9] Jour Chem. Soc., *73*, 411 (1898).
[10] Zeit. phys. Chem., *19*, 599 (1896).
[11] Jour. Phys. Chem., 7, 92 (1903).
[12] Jour. Phys. Chem., 8, 453 (1904).
[13] Jour. Phys. Chem., *10*, 679 (1906).
[14] Jour. Phys. Chem., *11*, 353 (1907).
[15] Jour. Phys. Chem., 7, 1 (1903).
[16] Zeit. phys. Chem., *16*, 303 (1895).

action of the third order; Noyes[17] showed by a recalculation based on method three, that under some circumstances, at least, it is of the first. Mr. Forster,[18] who subjected the reaction to a "systematic exploration," showed it had no "order" at all; that the effect of increasing the concentration of the potash was first to increase and then to decrease the . The relations found by Forster had not been guessed by his pre- ssors, and, consequently, were not revealed by their method of king.

The last reactions of which I shall speak, are the reactions grouped r the common name "induction." Here, two reactions take place once, and the rates of each are affected by the concen- s ur or more chemicals.[19] The experimental study of compli- cases like these is, to put it shortly, absolutely impossible by any od other than that which I have called "systematic exploration." ss and Try is no good; not that one can't guess—some people, I don't know whether any chemists among them, are able to guess the result of a horse race, or of a flurry in stocks—but the "trying" needs the systematic procedure.

Manchot,[20] Schilow, and Luther [21] guessed at the mechanism of the induction by iron of the reaction between chromic acid and hydrogen iodide. Miss Benson's experiments [22] showed that they guessed wrong; and a long series of experiments by Mr. DeLury[23] on the induction of the same reaction by arsenious acid, furnish the first proven case of induction according to the peroxide formula. No other cases of induction have been studied from this point of view; and no others can be, except by this method.

Working with this tool of Harcourt's, we have been able to sharpen it a little, and extend its usefulness. Without going into details, it was obviously only a short step to pass to the "method of constant rates,"[24] in which all the concentrations, and rates as well, are kept constant during the experiments.

---

[17] Zeit. phys. Chem., *18*. 129 (1895).
[18] Jour. Phys. Chem., 7. 640 (1903).
[19] Jour. Phys. Chem., *11*. 9 (1907).
[20] Liebig's Annalen, *325*, 95 (1902).
[21] Zeit. phys. Chem., *46*, 777 (1903).
[22] Jour. Phys. Chem., 7. 356 (1903).
[23] Jour. Phys. Chem., *11*, 54 (1907).
[24] Jour. Phys. Chem., 7, 92 (1903).

Method.	Definition.	Used by
Systematic Exploration:—		
Method of Constant Rates...	A, B, C, D, ...T	Bray 1902
Harcourt & Esson's........	a, B, C, D, ...T	H and E, 1866

This method has proved serviceable in some of the more complicated cases, where even Harcourt's method was none too good.

Then, in some special cases, a way has been found of keeping a concentration constant without using excess of the constituent;[25] and most valuable of all, perhaps, it has been found possible to apply Harcourt's principles to the study of chemical equilibrium. The equilibrium, in solutions containing iodine, iodide, acid, arsenite, and arsenate, is (so far as I know) the most complicated yet studied; Mr. Roebuck [26] cleared the whole matter up in a few weeks by the application of a method analogous to No. 1 of our table.

I am very glad to have been afforded this opportunity, more than forty years after Harcourt and Esson's first publication, to offer this testimony to the value of the indispensable "idea" with which they have endowed the study of chemical mechanics. No stronger testimony could be offered of the power of the tool which they have placed in our hands, than the fact that young chemists, most of them just completing their college course, have attacked and solved problems which had been left unsolved by some of the most able workers of the present day.

And when I think of a review [27] of Harcourt and Esson's paper published in 1895, in which—after expressing pleasure that these pioneers had again returned to work in the old fields—the reviewer regretted that they had taken so little notice of the progress made since their last visit, I feel that these fathers of the science would have been justified in replying, if they had had an opportunity of replying—you can't reply to a reviewer—that so far as the method of working went, a great deal of the progress since 1866 had been made down hill.

[25] Jour. Phys. Chem., *8*, 454 (1904).
[26] Jour. Phys. Chem., *6*, 365 (1902).
[27] Zeit. phys. Chem., *19*, 177 (1906).

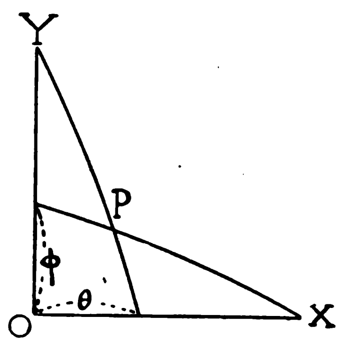
XXIII.—An Outline of Analytical Spherical Geometry.

By S. BEATTY, B.A.,

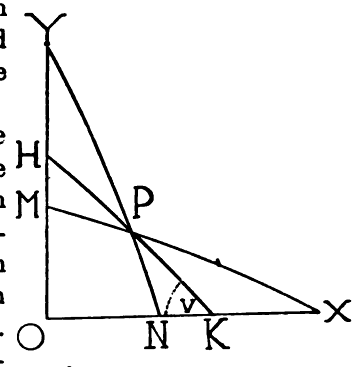
Fellow in Mathematics, University of Toronto.

(Presented by Professor Alfred Baker, and read May 26th, 1908.)

I. In analytical spherical geometry several systems of axes present themselves. The first to be considered is that analogous to the Cartesian in plane geometry. It will be subsequently noted

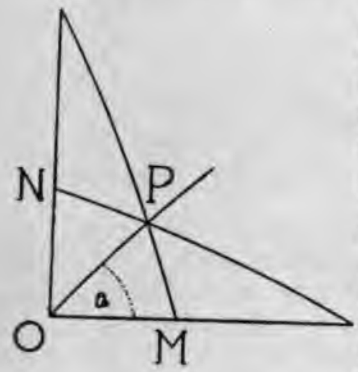


that the great circle plays the same role in spherical geometry as the straight line in analytical plane geometry. Consequently, we choose as axes any two great circles passing through a fixed point O called the origin; much labour will be avoided if the axes are taken as making an angle of 90° at the origin. Furthermore, the lines OX and OY are each taken a quadrant in angular distance. The co-ordinates θ and ϕ of a point P are defined to be the angular intercepts on OX and OY made by the great circles YP and XP respectively. The following diagram makes clear the meaning intended. As in plane geometry the directions OK and OY are by convention positive. The reverse are negative.



II. As has been intimated, the simplest curve on the surface of the sphere is the great circle. The equation in the case where the angular intercepts are α and β is readily found. From triangles NPK and NPX we have $\sin(\alpha - \theta) \tan V = \tan PN = \cos\theta \tan\phi$. But $\sin\alpha \tan V = \tan\beta$. On eliminating V the equation of the great circle, $\frac{\tan\theta}{\tan\alpha} + \frac{\tan\phi}{\tan\beta} = 1$, results.

III. This may become the equation of any great circle on the surface of the sphere by giving to α and β particular values, as long as $O < | \alpha | < \pi$, with a similar relation for β. In the particular case where $\alpha = \beta = o$ the equation is readily obtained.



$\cos \theta \tan \phi = \tan PM = \sin \theta \tan a$ or $\tan \phi - \tan \theta \tan d = o$. This becomes $\tan \phi = m \tan \theta$ where $m = \tan a$. This has included the case where $\alpha = \beta = \pi$. Suppose, further, that $\alpha = O$ and $O < | \beta | < \pi$. This is readily seen to have as equation $\tan \theta = o$. When $\alpha \neq O$, and $\beta = \frac{\pi}{2}$ the equation is $\tan \theta = c$, which for different values of c may become any great circle passing through the poles of OX. We conclude, therefore, that in all cases the equation

$$A \tan \theta + B \tan \phi + C = o$$

represents a great circle; furthermore, all great circles are represented by this equation.

IV. It is interesting to note that if $a = \alpha R$, $b = \beta R$, $x = \theta R$, and $y = \phi R$ the equation

$$\frac{\tan \theta}{\tan \alpha} + \frac{\tan \phi}{\tan \beta} = 1,$$

as R becomes infinite, becomes the familiar equation in plane geometry,

$$\frac{x}{a} + \frac{y}{b} = 1.$$

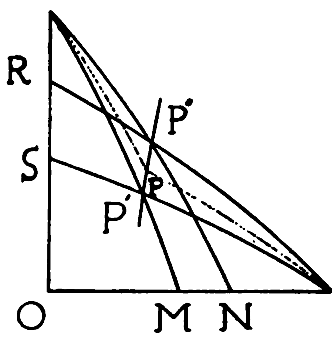
Similar remarks apply to the two type forms,

$$\begin{aligned} \tan \phi - m \tan \theta &= o \\ \tan \theta - c &= o. \end{aligned}$$

V. The fundamental equation of all great circles could be taken as

$$\begin{vmatrix} \tan \phi & \tan \theta & 1 \\ \tan \phi' & \tan \theta' & 1 \\ \tan \phi'' & \tan \theta'' & 1 \end{vmatrix} = o,$$

the circle being defined through the property that two points on it are given. The following analytic method would seem to give us this equation, from first principles. Suppose the equation of the circle through the points P' and P'' is required; let P be any point on this circle; suppose the co-ordinates of these points are in order $(\theta'\ \phi')$, $(\theta''\ \phi'')$, and $(\theta\ \phi)$.



Then
$$\frac{\sin P'P}{\sin(\theta-\theta')}=\frac{\sin AP'}{\sin LP}$$

$$\frac{\sin(\theta''-\theta)}{\sin P''P}=\frac{\sin LP}{\sin AP''}$$

That is

$$\frac{\sin P'P}{\sin P''P}\ \frac{\sin(\theta''-\theta)}{\sin(\theta-\theta')}=\frac{\sin AP'}{\sin AP''}=\frac{\cos P'M}{\cos P''N}$$

So too

$$\frac{\sin P''P}{\sin P'P}\ \frac{\sin(\phi-\phi')}{\sin(\phi''-\phi)}=\frac{\cos P''R}{\cos P'S}$$

Therefore

$$\frac{\sin(\theta''-\theta)\sin(\phi-\phi')}{\sin(\theta-\theta')\sin(\phi''-\phi)}=\frac{\cos P'M\cos P''R}{\cos P''N\cos P'S}=\frac{\cos\phi'\cos\theta''}{\cos\theta'\cos\phi''}\cdot\frac{\cos\theta\cos\phi}{\cos\theta\cos\phi}$$

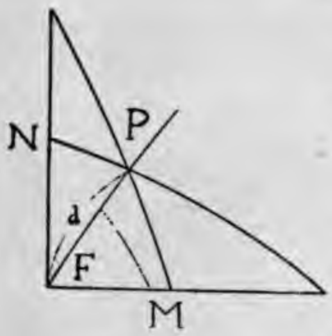
Therefore

$$\frac{(\tan\theta''-\tan\theta)}{(\tan\theta-\tan\theta')}=\frac{(\tan\phi''-\tan\theta)}{(\tan\phi-\tan\phi')}$$

Or

$$\frac{(\tan\theta-\tan\theta')}{(\tan\theta'-\tan\theta'')}=\frac{(\tan\phi-\tan\phi')}{(\tan\phi'-\tan\phi'')}$$

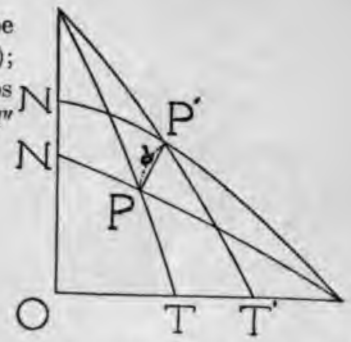
VII. Let us now proceed to find the angular distance between any two points. The simple case where one of these points is the origin will be first dealt with.



Let $OP = d$, $\sin\theta \tan F = \tan PM = \cos\theta \tan\phi$. That is, $\tan\theta \tan F = \tan\phi$. But $\cos F \tan d = \tan\theta$. The elimination of F gives $\tan^2 d = \tan^2\theta + \tan^2\phi$, an equation of the second degree in $\tan\theta$ and $\tan\phi$ and readily seen from the hypothesis to be the equation of a small circle with the origin as centre and angular radius of d. Making the supposition that R becomes infinite, we arrive at the well-known form,

$$x^2 + y^2 = r^2.$$

VIII. The more general case will now be attempted. Let P be $(\theta\,\phi)$ and P', (θ', ϕ'); $\cos d = \sin PT \sin P'T' + \cos PT \cos P'T' \cos(\theta - \theta') = \cos PT \cos P'T' \left\{\tan PT \tan P'T' + \cos(\theta - \theta').\right\}$



But

$$\cos\theta \tan\phi = \tan PT;$$

and

$$\cos\theta' \tan\phi' = \tan P'T',$$

whence $\cos d = (\cos PT \cos P'T' \cos\theta \cos\theta')\,(1 + \tan\theta \tan\theta' + \tan\phi \tan\phi')$.

That is

$$\frac{1}{1 + \tan^2 d} = \frac{\cos^2\theta}{1 + \tan^2 PT} \cdot \frac{\cos^2\theta'}{1 + \tan^2 P'T'}$$

$$(1 + \tan\theta \tan\theta' + \tan\phi \tan\phi').$$

But

$$\frac{(1 + \tan^2 PT)}{\cos^2\theta} = \frac{1 + \tan^2\theta + \tan^2\phi}{1}$$

It therefore follows that

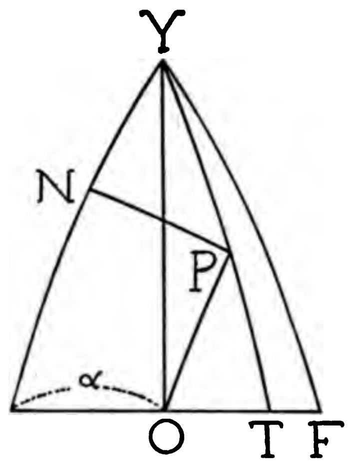
$$(1 + \tan^2 d) = \frac{(1 + \tan^2\theta + \tan^2\phi)\ (1 + \tan^2\theta' + \tan^2\phi')}{(1 + \tan\theta \tan\theta' + \tan\phi \tan\phi')^2},$$

which is an equation of the second degree in $\tan\theta$, and $\tan\phi$, and as the hypothesis indicates the equation of a small circle with centre at P' and with d as angular radius.

IX. If we attempt to see what this becomes, when we make the customary substitutions with R tending to infinity, we shall first get rid of the unity appearing on the left side; the form then assumed is

$$r^2 = (x - x')^2 + (y - y')^2.$$

X. We can get equations for curves—not plane curves in this case—which are analogous to the conic sections of analytical plane geometry. We define the curve to be the locus of a point which moves so that its distance from a given point bears always a fixed ratio to its distance from a given great circle.



XI. The case where this ratio is unity will first be treated. Let the fixed point be F, whose co-ordinates are (α, O). Let the great circle be $\tan\theta + \tan\alpha = o$. By a previous theorem we have the relation

$$(1 + \tan^2 PF) = \frac{(1 + \tan^2\theta + \tan^2\phi)\ (1 + \tan^2\alpha)}{(1 + \tan\theta\tan\alpha)^2}.$$

To get the value of PN we have that

$$\sin^2 PN = \sin^2(\alpha + \theta)\ \cos^2 PT \quad \frac{\sin^2(\alpha + \theta)}{1 + \tan^2 PT}$$

But $$\tan PT = \cos\theta\tan\phi.$$

Therefore

$$\sin^2 PN = \frac{(\sin\alpha\cos\theta + \cos\alpha\sin\theta)^2\sec^2\theta}{(\sec^2\theta\tan^2\phi)} = \frac{\sin^2\alpha\ (1 + \tan\theta\cot\alpha)^2}{(1 + \tan^2\theta + \tan^2\phi)}$$

Since here $PF = PN$ the equation is

$$\frac{\sin^2\alpha\ (1 + \tan\theta\cot\alpha)^2}{(1 + \tan^2\theta + \tan^2\phi)} =$$

$$\frac{\sec^2\alpha\ (1 + \tan^2\theta + \tan^2\phi) - (1 + \tan\theta\tan\alpha)^2}{(1 + \tan^2\theta + \tan^2\phi)\sec^2\alpha}$$

We derive from these two, since $PF = e \,.\, PM$, the relation

$$e \sin^{-1} H = \sin^{-1} K$$

That is $$K = \sin\,(e \sin^{-1} H).$$

XIII. The roots of H^2 and K^2 and also the $\sin^{-1}$ operations are here free from ambiguity. This form $K = \sin\,(e \sin^{-1} H)$ is not so interesting as the previous one; however, if we make the substitutions before mentioned and let a finite portion of the sphere become a plane surface, we get first $\frac{K^2}{H^2} = e^2$, since the limit of $H = o$. Later get rid of the *one* appearing in K^2 and the form assumed by the equation is:—

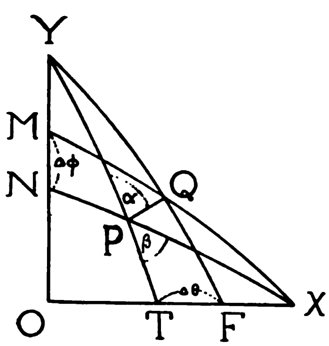
$$x^2\,(1 - e^2) + y^2 = a^2\,(1 - e^2),$$

or $$\frac{x^2}{a^2} + \frac{y^2}{a^2\,(1 - e^2)} = 1,$$

or $$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,$$

where $$a^2 e^2 = (a^2 - b^2).$$

XIV. The curve that corresponds to the hyperbola would present no new features and so the loxodrome will be next considered. This curve is defined to be one which makes a constant angle with each meridian it encounters. The meridians in the system adopted are all represented by $\tan\,\theta = c$, for various values of c, ranging from $-\infty$ to $+\infty$. Let the constant angle be α. Let P and Q be two points on the curve, the coordinates of P being and $(\theta,\,\phi)$ and those of Q as shewn. Let $\varsigma = PQ$.



Then $$\frac{\varsigma}{\Delta\,\theta} = \frac{\cos QF}{\sin \alpha}.$$

and $$\frac{\Delta\,\phi}{\varsigma} = \frac{\sin\,(\beta + \alpha)}{\cos QM}.$$

Therefore

Limit $\Delta\,\theta = O$ $$\frac{\Delta\,\phi}{\Delta\,\theta} = \frac{d\,\phi}{d\,\theta} = \frac{\cos PT}{\cos PN} \cos\beta\,(1 + \tan\beta\cot\alpha),$$

$$\cos\beta = \sin\theta\sin\phi,$$

$$\frac{\Delta\,\phi}{\Delta\,\theta} = \frac{\cos QF}{\cos QM} \cdot \frac{\sin\,(\beta + \alpha)}{\sin\alpha}$$

and $$\cos PN \cos\phi = \cos PT \cos\theta.$$

That is $$\frac{d\,\phi}{d\,\theta} = \sin\theta\sin\phi\cos\phi\sec\theta\,(1 + \tan\beta\cot\alpha).$$

XV. We shall first take the special case where $\alpha = \frac{\pi}{2}$. The differential equation then reduces to the form

$$\frac{d\,\phi}{\sin\phi\,\cos\phi} = \frac{\sin\theta\,d\,\theta}{\cos\theta}$$

The solution is here arrived at readily.

$$\int_{\phi'}^{\phi} \frac{d\,2\,\phi}{\sin 2\,\phi} = \int_{\theta'}^{\theta} \frac{d\,\mathrm{os}\ \theta}{\cos\theta}$$

That is

$$\log\frac{\tan\phi}{\tan\phi'} = \log\frac{\cos\theta'}{\cos\theta}.$$

That is $\tan\phi\cos\theta = \tan\phi'\cos\theta'$, where (θ', ϕ') were the co-ordinates of the initial position. This we see is the equation of what corresponds to a parallel of latitude, since $\tan\phi\cos\theta = \tan$ (latitude).

XVI. The general case yet contains the angle β which is to be eliminated.

$$\sin PT\tan\beta = \cot\theta,$$
$$\tan PT = \cos\theta\tan\phi.$$

Therefore

$$\tan\beta = \frac{\cot\theta\sqrt{1+\cos^2\theta\tan^2\phi}}{\cos\theta\tan\phi} = \frac{\sqrt{1+\cos^2\theta\tan^2\phi}}{\sin\theta\tan\phi}$$

$$\frac{d\phi}{d\theta} = \sin\theta\sin\phi\frac{\cos\phi}{\cos\theta} + \cot\alpha\sin\phi\sin\theta\frac{\cos\phi}{\cos\theta}\cdot\frac{\sqrt{1+\cos^2\theta\tan^2\phi}}{\sin\theta\tan\phi}$$

$$= \sin\theta\sin\phi\frac{\cos\phi}{\cos\theta} + \cot\alpha\cos^2\phi\sqrt{1+\tan^2\theta+\tan\phi^2}$$

$$= \frac{\tan\theta\tan\phi + \cot\alpha\sqrt{1+\tan^2\theta+\tan^2\phi}}{1+\tan^2\phi}$$

Therefore

$$\frac{d\tan\phi}{d\tan\theta} = \frac{\tan\theta\tan\phi + \cot\alpha\sqrt{1+\tan^2\theta+\tan^2\phi}}{1+\tan^2\theta}$$

The differential equation

$$\frac{d\,u}{d\,v} = \frac{u\,v + \cot\alpha\sqrt{1+u^2+v^2}}{1+v^2}$$

will be quite difficult to solve, where we have made the substitution

$$u = \tan\phi$$
$$v = \tan\theta$$

XVII. The solution may be had, however, in the case where R becomes infinite, and we see it is then a straight line

$$\frac{dy}{dx} = \cot \alpha$$

or integrating $(y - y') = \cot \alpha \,.\, (x - x')$.

XVIII. The next question we shall consider is to derive a general formula applicable for finding the general equation of the tangent to the curve of $f(\theta, \phi) = o$. The tangent at a point P is the limiting great circle of all great circles, which pass through P and Q, as Q moves up to P along the curve. Let (θ, ϕ) be the co-ordinates of the point P. Suppose we choose the running co-ordinates, to avoid confusion, to be (x, y). The equation of the great circle through (θ, ϕ) and $(\theta + \triangle \theta, \phi + \triangle \phi)$ is $\tan x \left\{ \tan(\phi + \triangle \phi) - \tan \phi \right\} + \tan y \left\{ \tan(\theta + \triangle \theta) - \tan \theta \right\} + \left\{ \tan(\theta + \triangle \theta) \,.\, \tan \phi - \tan(\phi + \triangle \phi) \tan \theta \right\} = o.$

That is

$$\tan x \left\{ \triangle \phi \frac{d}{d\phi} \tan \phi + ((\triangle \phi^2)) \right\} - \tan y \left\{ \triangle \theta \frac{d}{d\theta} \tan \theta + ((\triangle \theta^2)) \right\} + \left\{ \triangle \theta \tan \phi \frac{d}{d\theta} \tan \theta - \triangle \phi \tan \theta \frac{d}{d\phi} \tan \phi \right\} = o.$$

Therefore

$$(\tan x - \tan \theta) \triangle \phi \frac{d}{d\phi} \tan \phi - (\tan y - \tan \phi) \triangle \theta \frac{d}{d\theta} \tan \theta + ((\triangle \theta^2)) + ((\triangle \theta \triangle \phi)) + ((\triangle \phi^2)) = o.$$

Therefore

$$\frac{\triangle \phi \sec^2 \phi}{\triangle \theta \sec^2 \theta} = \frac{(\tan y - \tan \phi) + ((\triangle \theta)) + ((\triangle \phi))}{(\tan x - \tan \theta) + ((\triangle \theta)) + ((\triangle \phi))}$$

But the limit of $\frac{\triangle \phi}{\triangle \theta}$ as each term of the ratio approaches zero is by definition $\frac{d\phi}{d\theta}$. The limit of the left side is given by the circumstance that the right side approaches the definite limit, $\frac{(\tan y - \tan \phi)}{(\tan x - \tan \theta)}$, which, therefore, gives us the equation

$$\frac{d \tan \phi}{d \tan \theta} = \frac{(\tan y - \tan \phi)}{(\tan x - \tan \theta)}$$

The value of $\frac{d \tan \phi}{d \tan \theta}$ can be found from the curve $f(\theta \phi) = o$, which, as a rule, appears in the form $F(\tan\theta, \tan\phi) = o$.

That is
$$\frac{dF}{d\tan\theta} + \frac{dF}{d\tan\phi}\cdot\frac{d\tan\phi}{d\tan\theta} = o.$$

XIX. This could readily be applied to finding the tangent to the circle at a point (θ, ϕ) on it.

$$\tan^2 r = \tan^2\theta + \tan^2\phi$$

$$\frac{d\tan\phi}{d\tan\theta} = -\frac{\tan\theta}{\tan\phi} = \frac{(\tan y - \tan\phi)}{(\tan x - \tan\theta)}$$

Therefore

$$\tan\theta\tan x + \tan\phi\tan y = \tan^2\theta + \tan^2\phi = \tan^2 r.$$

The analogy is plainly discernible between this and the equation to the tangent to a circle in plane geometry. Furthermore, the tangent at $(\theta\ \phi)$ whose equation we see is

$$\tan\theta\tan x + \tan\phi\tan y = \tan^2 r$$

can be proven to be perpendicular to the spherical radius of the small circle. The equation of the radius to the point $(\theta\ \phi)$ is

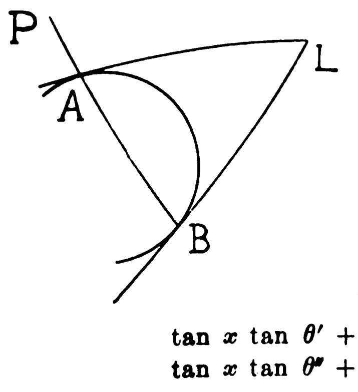
$$\tan y\tan\theta - \tan x\tan\phi = o.$$

The perpendicularity follows since

$$\tan\theta\,(-\tan\phi) + \tan\phi\tan\theta = o.$$

The general theorem dealing with the question of perpendicularity of great circles will be given later, now that its use has been rendered necessary.

XX. Moreover, all the theorems dealing with poles and polars in plane geometry may be here demonstrated. The polar of a point (θ, ϕ) is defined to be the locus of the intersection of tangents drawn from the two points, where a great circle through (θ, ϕ) cuts the small circle whose equation has been found. The locus of L is arrived at thus — Let P be the point (θ, ϕ). Let a great circle through P cut the small circle in two points (θ', ϕ') and $(\theta''\ \phi'')$. The point L, where the tangents at $(\theta'\ \phi')$ and $(\theta''\ \phi'')$ intersect satisfies both of the equations



$$\tan x\tan\theta' + \tan y\tan\phi' = \tan^2 r.$$
$$\tan x\tan\theta'' + \tan y\tan\phi'' = \tan^2 r.$$

That is $$\frac{\tan\phi' - \tan\phi''}{\tan\theta' - \tan\theta''} + \frac{\tan x}{\tan y} = o.$$

But $$\frac{\tan\phi' - \tan\phi''}{\tan\theta' - \tan\theta''} = \frac{\tan\phi - \tan\phi'}{\tan\theta - \tan\theta'}$$

since the three points are on a great circle.

Therefore $$\tan x\,(\tan\theta - \tan\theta') + \tan y\,(\tan\phi - \tan\phi') = o.$$

Or $$\tan x \tan\theta + \tan y \tan\phi = \tan^2 r.$$

XXI. The following theorems could be proven from this general equation in precisely the same manner as the corresponding ones are in plane analytical geometry:

(a) If P lies on the polar of Q, then Q lies on the polar of P.

(b) If a point P moves along a great circle, its polar turns about a point.

(c) This is a special case of the previous one. The pole of PQ is the intersection of the polars of P and Q.

XXII. In like manner the theorem for finding the tangent to any curve could be used to find the tangent to a small circle with centre (α, β) and radius r. The equation of such a circle is

$$(1 + \tan^2 r) = \frac{(1 + \tan^2\theta + \tan^2\phi)\ (1 + \tan^2\alpha + \tan^2\beta}{(1 + \tan\theta\tan\alpha + \tan\phi\tan\beta)^2}$$

Let (θ, ϕ) be the point where the tangent is required, to this circle.

For convenience in manipulation write for $\tan\theta$, the symbol θ. This gives us

$$(1 + r^2)\,(1 + \theta\alpha + \phi\beta)\,(\alpha + \beta\frac{d\phi}{d\theta}) = (1 + \alpha^2 + \beta^2)\,(\theta + \phi\frac{d\phi}{d\theta})$$

or $$\frac{d\phi}{d\theta} = \frac{\theta\,(1 + \alpha_2 + \beta^2) - (1 + r^2)\,\alpha\,(1 + \theta\alpha + \phi\beta)}{(1 + r^2)\,\beta\,(1 + \theta\alpha + \phi\beta) - \phi\,(1 + \alpha^2 + \beta^2)}$$

That is

$$(1 + r^2)\,(x\alpha + y\beta)\,(1 + \theta\alpha + \phi\beta) + (\theta^2 + \phi^2)\,(1 + \alpha^2 + \beta^2) =$$
$$(1 + r^2)\,(\theta\alpha + \phi\beta)\,(1 + \theta\alpha + \phi\beta) + (x\theta + y\phi)\,(1 + \alpha^2 + \beta^2).$$

But this becomes

$$(1 + r^2)\,(1 + x\alpha + y\beta)\,(1 + \theta\alpha + \phi\beta) - (1 + x\theta + y\phi)\,(1 + \alpha^2 + \beta^2) =$$
$$(1 + r^2)\,(1 + \theta\alpha + \phi\beta)^2 - (1 + \theta^2 + \phi^2)\,(1 + \alpha^2 + \beta^2) = o,$$

which is therefore the equation of the tangent. Writing it out in full the equation is

$$(1 + \tan^2 r)\,\frac{(1 + \tan\theta\tan\alpha + \tan\phi\tan\beta}{(1 + \tan^2\alpha + \tan^2\beta)} = \frac{(1 + \tan\theta\tan x + \tan\phi\tan y)}{(1 + \tan\alpha\tan x + \tan\beta\tan y)}$$

It also could be used to establish the theorem on polars, but though perfectly symmetrical the formula is somewhat cumbersome.

XXIII. Time will not be taken up with the application of this formula to determine the tangents, poles and polars of the spherical parabola, spherical ellipse or spherical hyperbola, though it will be readily seen that in the case of the spherical parabola, at least, these would be easily found.

XXIV. The differential equation of the loxodrome gives the equation of its tangent at once since

$$\frac{d \tan \phi}{d \tan \theta} = \frac{\tan \theta \operatorname{ton} \phi + \cot \alpha \sqrt{1 + \tan^2 \theta + \tan^2 \phi}}{1 + \tan^2 \theta} = \frac{\tan y - \tan \phi}{\tan x - \tan \theta}$$

XXV. At this stage we shall insert the proof for the condition of perpendicularity of two great circles,

$$A \tan \theta + B \tan \phi + C = o.$$
$$A' \tan \theta + B' \tan \phi + C' = o.$$

Where α is an angle employed in the loxodrome, and making the convenient substitution, to save writing, we have

$$-\cot \alpha = \frac{\frac{A}{B}(1 + \theta^2) + \theta \phi}{\sqrt{1 + \theta^2 + \phi^2}}$$

$$-\cot \left(\frac{\pi}{2} + \alpha\right) = \frac{\frac{A'}{B'}(1 + \theta^2) + \theta \phi}{\sqrt{1 + \theta^2) + \phi^2}}$$

That is

$$(1 + \theta^2 + \phi^2) + \left(\frac{A}{B}(1 + \theta^2) + \theta \phi\right) \left(\frac{A'}{B'}(1 + \theta^2) + \theta \phi\right) = o$$

The elimination of θ and ϕ from this equation and the initial two above gives the required condition for perpendicularity.

$$\frac{A}{B} + \theta \left(\frac{A}{B} \theta + \phi\right) = \frac{A}{B} - \frac{C \theta}{B} = \frac{A - C \theta}{B}$$

$$\phi^2 = \frac{A \theta + C}{B} \cdot \frac{A' \theta + C'}{B'}$$

This gives then

$$BB' (1 + \theta^2) + (A \theta + C)(A' \theta + C') + (A - C \theta)(A' - C' \theta) = o,$$

or

$$(1 + \theta^2)(AA' + BB' + CC') = o.$$

This requires then that

$$AA' + BB' + CC' = o,$$

which is, therefore, the condition for perpendicularity of two great circles.

XXVI. The equation of the great circle through the point $(\theta' \ \phi')$ and perpendicular to the great circle

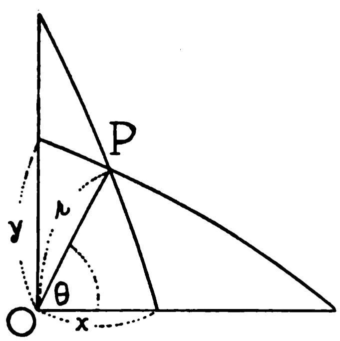
$$A \tan \theta + B \tan \phi + C = o,$$

is at once seen to be

$$\begin{vmatrix} \tan \theta & \tan \phi & 1 \\ \tan \theta' & \tan \phi' & 1 \\ A & B & C \end{vmatrix} = o.$$

An application of this would be to find the equation of the normal to a curve at any point when the equation of the tangent is known.

XXVII. It might seem at first glance that there is here no analogue of the parallelism of plane geometry. However, we should apparently be justified [in] taking any two great circles through a point as parallel. It would be interesting to find the locus of the points of bisection of parallel chords of a sphero-conic. Analogy suggests that this locus would in every case be a great circle.



XXVIII. The connection between the two systems of co-ordinates is similar to that in plane geometry. To express x and y in terms of θ and r we have at once

$$\cos \theta \tan r = \tan x$$
$$\sin \theta \tan r = \tan y$$

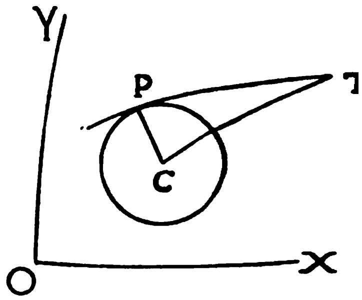
That is,

$$\tan \theta = \frac{\tan y}{\tan x}$$

Therefore

$$\theta = \tan^{-1}\left(\frac{\tan y}{\tan x}\right)$$

Besides $\qquad \tan^2 r = \tan^2 x + \tan^2 y.$



XXIX. The equation of the circle, $(1 + \tan^2 r)(1 + \tan\theta\tan\alpha + \tan\phi\tan\beta)^2 = (1 + \tan^2\alpha + \tan^2\beta)(1 + \tan^2\theta + \tan^2\phi)$ lends itself to proving the properties of the radical axis. Suppose C is a small circle and let a tangent from P pass through T. We have proven that the angles at P are each right angles. Then

$$\cos C\,T = \cos C\,P \cos P\,T.$$

Therefore

$$\frac{(1 + \tan^2 C\,T)}{(1 + \tan^2 r)} = (1 + \tan^2 P\,T)$$

But if T is the point (θ, ϕ)

$$1 + \tan^2 P\,T = \frac{1 + \tan^2 C\,T}{1 + \tan^2 r} =$$

$$\frac{(1 + \tan^2\theta + \tan^2\phi)(1 + \tan^2\alpha + \tan^2\beta)}{(1 + \tan^2 r)(1 + \tan\theta\tan\alpha + \tan\phi\tan\beta)^2}$$

which is the same form as though (θ, ϕ) were a point on the circumference. That is if (θ, ϕ) is a point on the circumference

$$\frac{(1 + \tan^2\theta + \tan^2\phi)(1 + \tan^2\alpha + \tan^2\beta)}{(1 + \tan\theta\tan\alpha + \tan\phi\tan\beta)^2(1 + \tan^2 r)} - 1 = o.$$

Here when T is a point without, it equals

$$\tan^2 PT.$$

XXX. The radical axis of two circles is the great circle passing through their points of intersection. Where the circles have as characteristic elements (α', β', r') and $(\alpha''; \beta,'' r'')$ the radical axis will readily be seen to be

$$\frac{1 + \tan\theta\tan\alpha' + \tan\phi\tan\beta'}{1 + \tan\theta\tan\alpha'' + \tan\phi\tan\beta''} =$$

$$\sqrt{\frac{(1 + \tan^2 r'')(1 + \tan^2\alpha' + \tan^2\beta')}{(1 \quad \tan^2 r')(1 + \tan^2\alpha'' + \tan^2\beta'')}}$$

which is seen to be a great circle. Moreover, with this definition of the radical axis it may be proven to be the locus of a point T, which moves so that $T\,P' = T\,P''$, the lines being tangents to the two small circles. For

$$\operatorname{Tan}^2 P'\,T = \frac{(1 + \tan^2\theta + \tan^2\phi)(1 + \tan^2\alpha' + \tan^2\beta')}{(1 + \tan\theta\tan\alpha' + \tan\phi\tan\beta')^2(1 + \tan^2 r')} - 1.$$

And

$$\text{Tan}^2 P'' T = \frac{(1 + \tan^2\theta + \tan^2\phi)\,(1 + \tan^2\alpha'' + \tan^2\beta'')}{(1 + \tan\theta\tan\alpha'' + \tan\phi\tan\beta'')\,(^2(1 + \tan^2 r'')} - 1.$$

The equating of these two, since $(1 + \tan^2\theta + \tan^2\phi)$ is never zero, gives the same equation as before. Either definition would, therefore, suffice for the radical axis.

XXXI. We shall now direct our attention to the consideration of a treatment of the r and θ system of co-ordinates. As before, a fixed point O is taken as origin, and a fixed great circle, usually OX, is taken as the line of reference. By r we mean the angular interval separating any point on the sphere from the origin, measured along the arc of the great circle. The angle between the great circle so used and the great circle of reference goes by the name of θ. Let our first problem be to find the equation of the great circle cutting OX at the point $(a, 0)$ and making an angle of α.

$\tan\theta\sin(a + M) = \tan\alpha\sin M = \tan PV$.

That is

$\sin a(\cot M + \cot a) = \tan\alpha\cot\theta$.

But

$$\cos\theta\tan r = \tan(a + M).$$

Or

$$\sec\theta\cot r = \frac{\cot a\cot M - 1}{\cot a + \cot M}$$

This becomes on reduction by eliminating M

1. $\sec\theta\cot r + \cot\alpha\,\text{cosec}\,a\tan\theta = \cot a$,

or further, $\tan r(\cos\theta\tan\alpha - \sin\theta\sec a) = \tan\alpha\tan a$.

2. $\tan r(\cos\theta - \sin\theta\sec a\cot\alpha) = \tan a$.

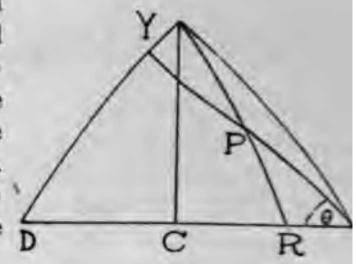
XXXII. This can readily be seen to be correct, for if the radius of the sphere becomes infinite the equation is

$$r\cos\theta = a + r\sin\theta\cot\alpha.$$

Equations 1 and 2 are identical; the second seems to be a more compact form, however. The above equation would scarcely indicate that if $\alpha = o$, the equation becomes $\theta = o$. The equation is applicable to any other case, and so is the general equation of a great circle in polar co-ordinates. We get at once in this system that the equation of a small circle with centre at the origin is $\tan r = c$.

XXXIII. To extend this to the case of a small circle of radius ρ about the point (r', θ') is our next problem. The equation here is evidently

$$\cos\rho = \cos r\cos r' + \sin r\sin r'\cos(\theta - \theta').$$



Next let us consider how the equation of the spherical parabola is deduced according to this method. Let $C D = C O = \alpha$. Take O as origin and the line $\cos\theta \tan r = \tan 2\alpha$ as directrix. Take any point P such that $O P = P M = r$. Let θ be as represented. Then $\sin r = \cos P R \sin (2\alpha - O R)$ from triangle $M P Y$.

Therefore

$$\sin r = (\sin 2\alpha \cos O R - \cos 2\alpha \sin O R) \cos P R.$$
$$= \sin 2\alpha \cos r - \cos 2\alpha \sin O R \cos P R.$$

But

$$\sin O R \cos P R = \frac{\sin P R}{\sin \theta} \cos\theta = \sin r \cos\theta.$$

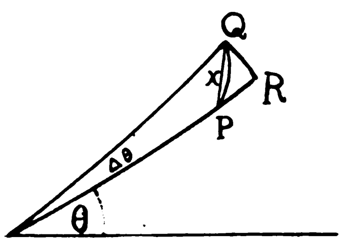
Therefore

$$\frac{\sin 2\alpha}{\tan r} = (1 + \cos\theta \cos 2\alpha),$$

which is the equation of the spherical parabola. It, of course, break down into the form $\frac{2a}{r} = (1 + \cos\theta)$ when R becomes infinite.

The work on Cartesian co-ordinates in connection with th ellipse will lead us to expect that the equation cannot be found i any convenient form. That is, the inverse trigonometrical function appear.

XXXIV. **Let us now find a formula for giving the inclination o the tangent to a radius rector, in connection with any continuou curve, $f(r, \theta) = o$, on the surface of the sphere. Let the co-ordinates of P be (r, θ), of Q $(r + \triangle r, \theta + \triangle\theta)$, and of R $(r + \triangle r, \theta)$. $P Q$ is a finite portion of a curve, $f(r, \theta) = o$. The angle ψ is defined to be the limit of the angle $R P X Q$ as Q moves up to P, the point X lying on the great circle joining P and Q. $Q R$ is also an arc of a great circle. We shall first prove that the angle R becomes ultimately 90°**



$$\cos R = -\cos R \cos \triangle\theta + \sin R \sin \triangle\theta \cos (r + \triangle r).$$

Therefore

$$\cos R (1 + \cos\triangle\theta) = \sin R \sin \triangle\theta \cos (r + \triangle r)$$
$$\cot R = \frac{\sin\triangle\theta \,.\, \cos (r + \triangle r)}{1 + \cos\triangle\theta}$$

The limit of the right side being zero indicates that ultimately the angle at R is 90°. Therefore the limit of $\frac{\sin QR}{\sin \triangle \theta}$ = the limit of sin $(r + \triangle r)$ = sin r = the limit of $\frac{QR}{\triangle \theta}$. Besides tan ψ = limit $\frac{\tan QR}{\sin PR}$ since R has 90° for its limit.

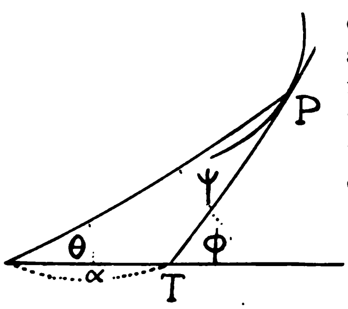
Therefore

$$\tan \psi = \text{limit } \frac{QR}{PR}$$

$$= \text{limit } \frac{QR}{\triangle \theta} \cdot \frac{\triangle \theta}{PR}$$

$$= \sin r \, . \, \frac{d\theta}{dr}.$$

XXXV. To apply this to any curve, $f(r, \theta) = o$ we need only equate tan ψ cosec r to the value of $\frac{d\theta}{dr}$ found from the relation $\frac{df}{d\theta} \cdot \frac{d\theta}{dr} \; \frac{df}{dr} = o$. This serves to give tan ψ. The angle ϕ can be obtained from the relation cos ϕ = cos θ cos ψ − sin θ sin ψ cos r. The angular length α can be found from the relation sin α sin ϕ = sin ψ sin r. That is, the equation of the tangent PT can now be found since the two necessary elements to fix the great circle, which is the tangent, have been determined. The inverse problem in which we are asked to construct a curve where tan ψ = $f(r, \theta)$ can also be solved in all cases where the differential equation



$$\sin r \; \frac{d\theta}{dr} = f(r, \theta)$$

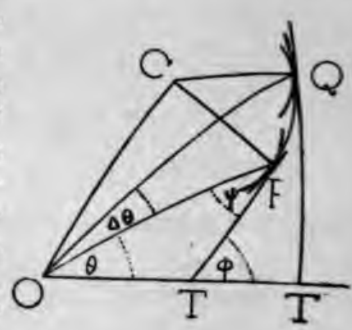
is solveable.

XXXVI. A case discussed before in connection with the Cartesian system is better handled here. In the loxodrome where the North Pole is taken at O we have the simple relation

$$\tan \psi = c = \sin r \; \frac{d\theta}{dr}$$

Therefore $\int_{r'}^{r} \frac{dr}{\sin r} = \int_{\theta'}^{\theta} \frac{d\theta}{c}$ where $(\theta' \; r')$ are the co-ordinates of the initial position. This gives us $\tan \frac{r}{2} = Ke^{\theta}$, where K is written in place of a function of θ' r' and e, which is readily calculated. This curve, then, is the analogue in spherical analytical geometry of the equiangular spiral in plane. In fact if the radius of the sphere were infinite we should have an equiangular spiral about the origin.

XXXVII. The centre of curvature for any point P on a curve is defined to be the limiting position of the intersection of normals at P and Q where Q is another point on the curve, as Q moves up to P along the curve. The radius of curvature will be the spherical radius of the small circle passing through P with the centre of curvature as centre. It will be seen that there will be two centres of curvature and two radii of curvature; the sum of the radii will be π. Furthermore, the maximum radius of curvature is $\frac{\pi}{2}$. Suppose PQ a secant of the curve and let the normals of length $\bar{\rho}$ meet at C. Then



$$\cos OC = \cos r \cos \bar{\rho} + \sin r \,.\, \sin \bar{\rho} \sin \psi$$
$$= \cos (r + \triangle r) \cos \bar{\rho} + \sin (r + \triangle r) \sin \bar{\rho} \sin (\psi + \triangle \psi)$$

That is on simplification

$$\tan \bar{\rho} = \frac{\triangle r \sin r + ((\triangle r^2))}{\triangle r \cos r \sin \psi + \triangle \psi \sin r \cos \psi + ((\triangle r^2)) + ((\triangle \psi^2))}$$

Now the limit of the left side exists through the circumstance that the right side has a definite limit. Calling ρ the radius of curvature, then

$$\tan \rho = \frac{\sin r}{\cos r \sin \psi + \frac{d\psi}{dr} \sin r \cos \psi}$$

$$= \frac{1}{\cot r \sin \psi + \frac{d\psi}{dr} \cos \psi}$$

$$\cot \rho = \cos r \frac{d\theta}{ds} + \frac{d\psi}{ds}$$

Or

$$\tan \rho \left(\cos r \frac{d\theta}{ds} + \frac{d\psi}{ds}\right) = 1.$$

The result shews that $(\rho - \pi)$ answers as well as ρ, which we predicted. The result also gives the customary formula in plane geometry that

$$\rho \frac{d\phi}{ds} = 1.$$

XXIV.—*Some New Symmetric Function Tables.*

By PROFESSOR W. H. METZLER.

(Read May 26, 1908).

1. If Δ represents the determinant of the nth order $| a_{1n} |$, then let $\Delta_2, \Delta_3, \ldots \Delta_{n-1}$ denote the 2d, 3d, ... $(n-1)$th compounds of Δ respectively; and let $| \Delta - x |, | \Delta_2 - x |, \ldots$ $| \Delta_{n-1} - x |$ denote the polynomials in x obtained by subtracting x from each constituent along the principal diagonals of $\Delta, \Delta_2, \ldots \Delta_{n-1}$ respectively.

It is known[1] that if $\alpha_1, \alpha_2, \ldots \alpha_n$ are the roots of $| \Delta - x | = 0$, then the roots of the equation $| \Delta_k \; x | = 0$ are the products of the α's k at a time $(k = 2, 3, \ldots n-1)$. Let the roots of $| \Delta_k - x | = 0$ be denoted by $a_1, a_2, a_3, \ldots$; $b_1, b_2, b_3, \ldots$; $c_1, c_2, c_3, \ldots$ etc. according as k has the values 2, 3, 4, etc., respectively.

2. It follows from the foregoing that to every symmetric function of the roots of $| \Delta_k - x | = 0$, which we have expressed in terms of the p's,[2] there is a corresponding relation between the sums of the principal minors of Δ. For instance, we see from the tables (B, I) that

$$\Sigma \, b_1^2 = p_3^2 - 2\, p_2\, p_4 + 2\, p_1\, p_5 - 2\, p_6,$$

which may at once be translated into determinant language by observing that $\Sigma \, b_1^2$ denotes the sum of the squares of the principal minors of order three, and that p_i denotes the sum of the principal minors of order i $(i = 1, 2, 3, \ldots 6)$.

3. In the accompanying tables the symmetric functions of the roots of $| \Delta_k - x | = 0$ $(k = 1, 2, 3, \ldots 7)$ are given in terms of the p's. All the functions of the form $\Sigma \, k_1 k_2 k_3 k_4 \ldots k_v$ were obtained by first expressing them in terms of symmetric functions of the α's, the numerical coefficients of each term being actually calculated, and then by means of the ordinary symmetric function tables in terms of the coefficients (p's). These were then used in connection with the ordinary tables to calculate the other symmetric functions.

---

[1] Metzler—Compound Determinants, Am. Jour. Math. Vol. XVI. No. 2, 1894. Rados—Zur Theorie der adjugirten Substitutionen, Math. Annalen Band 48, 1897.

[2] $p_1, p_2, \ldots p_n$ represent the coefficients in $| \Delta - x | = 0$.

But to differentiate with respect to this is equivalent to differentiating with respect to s_1 and dividing by

$$\frac{1}{(k-1)!}\begin{vmatrix} s_1 & 1 & 0 & 0 & \dots & \dots \\ s_2 & s_1 & 2 & 0 & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \\ s_{k-1} & \dots & \dots & \dots & \dots & s_1 \end{vmatrix}$$

or p_{k-1}.

It follows therefore that :

$$P\,\Sigma\, a_1\, a_2\, a_3 \dots a_h = p_1\,\Sigma\, a_1\, a_2 \dots a_{h-1},$$
$$P\,\Sigma\, b_1\, b_2\, b_3 \dots b_h = p_2\,\Sigma\, b_1\, b_2 \dots b_{h-1},$$
$$\dots\dots\dots\dots\dots\dots\dots$$
$$P\,\Sigma\, k_1\, k_2 \dots k_h = p_k\,\Sigma\, k_1\, k_2 \dots k_{h-1}$$
$$\dots\dots\dots\dots\dots\dots\dots$$
$$P\,\Sigma\, k_1^{n_1}\, k_2^{n_2} \dots k_h^{n_h} = o$$
$$P\,\Sigma\, k_1^{n_1}\, k_2^{n_2} \dots k_{h-1}^{n_{h-1}}\, k_h = p_k\,\Sigma\, k_1^{n_1}\, k_2^{n_2} \dots k_{h-1}^{n_{h-1}}$$

etc., etc.

6. Since the labor of finding the symmetric functions of the type $\Sigma\, k_1\, k_2 \dots k_h$ by first expressing them in terms of symmetric functions of the α's, and then by the ordinary tables in terms of the p's, is very great, some short cut or direct method of obtaining them would be very desirable. Such a method I shall illustrate in the case of finding $\Sigma\, a_1\, a_2\, a_3 \dots a_8$.

7. If $n = 6$ there are ${}_6C_2 = 15$ products of the roots two at a time, and having $\Sigma\, a_1\, a_2 \dots a_7$ we can, by one of the laws referred to in art. 4, write down all these terms in $\Sigma\, a_1\, a_2 \dots a_8$ containing no p with a subscript greater than six by taking the terms $+ p_6\,(p_1^2\, p_2\, p_4 - p_1^3\, p_5 + p_1\, p_2\, p_5 + 3\, p_3\, p_5 - 2\, p_2^2\, p_4 - p_1\, p_3\, p_4 + p_1^2\, p_6 + p_4^3) + p_5\,(p_2^2\, p_5 + p_1\, p_4^2 - 2\, p_1\, p_3\, p_5 - p_4\, p_5)$ from $\Sigma\, a_1\, a_2 \dots a_7$, changing each p into its complementary (p_1 and p_5, p_2 and p_4, p_3 and p_3 are complementary) and multiplying, where necessary, any term by a proper power of p_6 to raise its weight to sixteen. Thus we get $+ p_6\,(p_1\, p_4\, p_5 + 3\, p_1\, p_3\, p_5 - 2\, p_2\, p_4^2 - p_2\, p_3\, p_5 + p_5^2 + p_3^2\, p_6 + p_1^2\, p_4^2 + p_1\, p_2^2\, p_5 - 2\, p_1^2\, p_3\, p_5 - p_1^2\, p_2\, p_6) + p_5^2\,(p_3\, p_4 - p_1\, p_5)$.

Again if we observe $\Sigma\, a_1\, a_2$, $\Sigma\, a_1, a_2\, a_3, \dots \Sigma\, a_1\, a_2 \dots a_7$ it will be seen that they may be written

$$-\begin{vmatrix} p_4 & p_1 \\ p_3 & 1 \end{vmatrix},$$

$+ 3\, p_4\, p_5 + 12 p_2\, p_7 + 3\, p_1\, p_2^2\, p_4 + 3\, p_1\, p_2\, p_6) + p_6\, (p_1\, p_4\, p_5 + 3\, p_1$
$p_3\, p_6 - 2\, p_2\, p_4^2 - p_2\, p_3\, p_5 + p_5^2 + p_2^2\, p_6 + p_1^2\, p_4^2 + p_1\, p_2^2\, p_5 - 2\, p_1^2\, p_3\, p_5$
$- p_1^2\, p_2\, p_6) + p_5^2\, (p_2\, p_4 - p_1\, p_5).$

9. That the law for the determinants in art. 7 is general may be shown by means of the operator P. For since

$$P\, \Sigma\, a_1\, a_2 \, . \, . \, . \, a_k = p_1\, \Sigma\, a_1\, a_2 \, . \, . \, . \, a_{k-1}$$

the coefficient of p_i in $P\, D_k$ is evidently the coefficient of p_{i+1} in D_k plus the result of operating on the coefficient of p_i by P, that is

$$(-1)^{2k-i-1} \begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & & \\ 0 & 1 & p_1 & p_2 & \cdots & & \\ \cdot & \cdot & \cdot & \cdot & \cdots & & \\ 0 & 0 & 0 & 0 & \cdots & 1\, p_1 & p_2 \\ 0 & 0 & 0 & 0 & \cdots 0 & 1 & p_1 \end{vmatrix} + (-1)^{2k-i} P \begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & & \\ 0 & 1 & p_1 & p_2 & \cdots & & \\ \cdot & \cdot & \cdot & \cdot & \cdots & & \\ 0 & 0 & 0 & 0 & \cdots & 1\, p_1 & p_2 \\ 0 & 0 & 0 & 0 & \cdots & 1 & p_1 \end{vmatrix}$$

where the first determinant is of order $2k-i-1$ and the second of order $2k-i$. If we operate by P in the second term by rows we get the sum of $2k-i$ determinants which are as follows:

$$\begin{vmatrix} 1 & 2p_1 & p_2 & 2p_3 & \cdots & & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & & \\ 0 & 1 & p_1 & p_2 & \cdots & & \\ \cdot & \cdot & \cdot & \cdot & \cdots & & \\ 0 & 0 & 0 & 0 & \cdots & 1 & p_1 \end{vmatrix} + \begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & & \\ 0 & 1 & p_1 & 2p_2 & \cdots & & \\ 0 & 1 & p_1 & p_2 & \cdots & & \\ \cdot & \cdot & \cdot & \cdot & \cdots & & \\ 0 & 0 & 0 & 0 & \cdots & 1 & p_1 \end{vmatrix}$$

$$+ \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; .$$

$$+ \begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & & & & & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & & & & & \\ \cdot & \cdot & \cdot & \cdot & \cdots & & & & & \\ 0 & 0 & 0 & 0 & \cdots & 1 & p_1 & p_2 & p_3 & \cdots \\ 0 & 0 & 0 & 0 & \cdots & 1 & p_1 & p_2 & p_3 & \cdots \\ \cdot & \cdot & \cdot & \cdot & \cdots & & & & & \\ 0 & 0 & 0 & 0 & \cdots & & & & 1 & p_1 \end{vmatrix}$$

$$+\begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & & \\ \cdots & & & & & & \\ 0 & 0 & 0 & 0 & \cdots 1 & p_1 & p_2 \\ 0 & 0 & 0 & 0 & \cdots 0 & 0 & 1 \end{vmatrix}.$$

Certain of these determinants obviously vanish since they have two rows identical. The others all reduce to the next lower orders, and when added together give the determinant

$$\begin{vmatrix} p_1 & 2p_2 & p_3 & \cdots & & \\ 1 & p_1 & p_2 & \cdots & & \\ \cdots & & & & & \\ 0 & 0 & 0 & \cdots 1 & p_1 & p_2 \\ 0 & 0 & 0 & \cdots 0 & 1 & 0 \end{vmatrix} \text{ of order } 2k-i-1.$$

We have therefore for the coefficient of p_i in $P\ D_k$

$$(-1)^{2k-i-1}\begin{vmatrix} p_1 & 2p_2 & p_3 & 2p_4 & \cdots & \\ 1 & p_1 & p_2 & 2p_3 & \cdots & \\ \cdots & & & & & \\ 0 & 0 & 0 & 0 & \cdots 1 & p_1 \end{vmatrix} + (-1)^{2k-i}\begin{vmatrix} p_1 & 2p_2 & p_3 & \cdots & & \\ 1 & p_1 & p_2 & \cdots & & \\ \cdots & & & & & \\ 0 & 0 & 0 & \cdots 1 & p_1 & p_2 \\ 0 & 0 & 0 & \cdots 0 & 1 & 0 \end{vmatrix}$$

or

$$(-1)^{2k-i-1}\begin{vmatrix} p_1 & 2p_2 & p_3 & \cdots & & \\ 1 & p_1 & p_2 & \cdots & & \\ \cdots & & & & & \\ 0 & 0 & 0 & \cdots 1 & p_1 & p_2 \\ 0 & 0 & 0 & \cdots 0 & 0 & p_1 \end{vmatrix}$$

or

$$(-1)^{2k-i-1}p_1\begin{vmatrix} p_1 & 2p_2 & p_3 & \cdots & \\ 1 & p_1 & p_2 & \cdots & \\ \cdots & & & & \\ 0 & 0 & 0 & \cdots 1 & p_1 \end{vmatrix}$$

that is p_1 times the coefficient of p_i in D_{k-1}.

For $i = 2k$, or $2k-1$, p_i evidently vanishes, and for $i = k$ only part of the coefficient of p_i is found in D_k.

10. It may be observed that the sum of the numerical coefficients of the p's in $\Sigma a_1 a_2 a_3 \ldots$, $\Sigma c_1 c_2 c_3 \ldots$ etc., is zero, and the sum of these coefficients in $\Sigma b_1 b_2 \ldots$, $\Sigma d_1 d_2 \ldots$ etc., is one. That is, the sum of the coefficients in the case of the symmetric functions of those roots, which are the products of the α's taken an even number at a time, is zero; and the sum in the case of those roots, which are the products of the α's taken an odd number at a time, is one.

ROYAL SOCIETY OF CANADA

TRANSACTIONS

SECTION IV

GEOLOGICAL AND BIOLOGICAL SCIENCES

PAPERS FOR 1908

I.—*The Nepheline and Associated Alkali Syenites of Eastern Ontario,*

By FRANK D. ADAMS, D.Sc., F.R.S. and ALFRED E. BARLOW, M.A., D.Sc.

(Published by permission of the Director of the Geological Survey.)

(Read May 26, 1908.)

1. Introduction.
2. Distribution.
3. Geological Relations.
4. General Petrographical Character.
5. Mineralogical Composition.
6. Description of the several occurrences:
    (a) The Alkali Syenites of the Township of Lutterworth.
    (b) The Nepheline and Alkali Syenites of the Township of Monmouth.
    (c) The Nepheline and Alkali Syenites of the Township of Glamorgan.
    (d) The Nepheline and Alkali Syenites of the Townships of Harcourt, Cardiff and Wollaston.
    (e) The Nepheline and Alkali Syenites of the Township of Methuen.
    (f) The Nepheline and Alkali Syenites of the Townships of Faraday, Dungannon, Carlow and Monteagle.
7. Summary.

INTRODUCTION.

By far the most extensive development of nepheline syenite which has up to the present time been discovered in North America, or in fact, so far as can be ascertained, anywhere in the world, is that which occurs in the eastern part of the Province of Ontario, in the counties of Haliburton, Peterborough, Hastings and Renfrew, in the tract of country whose position is indicated on the accompanying sketch map.

The occurrence of nepheline syenite in this district was first recognized in 1893, attention having been directed to its probable existence by a specimen of sodalite which was sent in to the Museum of the Geological Survey at Ottawa from the township of Dungannon in the spring of this year, just as Dr. Adams was about to leave for that district to undertake a geological reconnaissance of this part of Eastern Ontario for the Geological Survey of Canada.

On visiting the locality from which this sodalite came, the mineral was found to occur in the form of veins traversing a large area of nepheline syenite in the ancient crystalline rocks of the Laurentian Protaxis.

course, as shown on the accompanying map. The most westerly occurrence discovered is that in the township of Lutterworth, where a corundum-bearing syenite has been found on lot 12, concession IV. of this township. The next occurrences are those which are situated in the townships of Glamorgan and Monmouth, in which townships some twenty separate areas of the rock have been mapped and studied. The largest and in many respects the most noteworthy of these is a wide belt of nepheline syenite which surrounds an occurrence of granite intervening between this rock and the limestone which forms the country rock of the central portion of the township of Monmouth. Here the nepheline syenite and the granite are clearly seen to be differentiation products of a common magma. The other occurrences in these townships are smaller and lie for the most part in the limestone.

Going to the east from the township of Monmouth a narrow band of nepheline syenite can be traced across the corner of the township of Cardiff into the second range of Harcourt, beyond which, in the north-east corner of Cardiff, occurrences of the closely related white alkali syenite have been noted by Dr. Miller at Leafield.

Beyond this, in the north-west corner of the township of Faraday, what appears to be a continuous belt of nepheline syenite, accompanied sometimes by the closely related red alkali syenite, extends in a south-easterly direction for a distance of about three and a half miles, crossing the Monck road on lot 26 between concessions A and B. Near this place there is a gradual change in the strike of the rock, the band curving around and running in a direction a little north of east, as far as lot 16 of concession A. It is impossible to trace its further extension eastward, as occasional outcrops only were found protruded through the deep covering of drift. It seems, however, entirely reasonable to assume that the several exposures found, belong to one continuous belt, for as the village of Bancroft is approached there is a very marked increase in the area over which these syenite rocks are distributed. At its intersection with the Hastings road at the village of Bancroft, between the townships of Dungannon and Faraday, the nepheline syenite measures over half a mile across its strike, which is here nearly east and west. East of Bancroft these syenite rocks increase very rapidly in volume, attaining their maximum development in the vicinity of Bronson, where extended and often nearly continuous outcrops may be found for a distance of over two and a half miles in a north and south direction, underlying most of the area between the eleventh and fourteenth concessions as far as the York river.

Along the valley of the York river and extending in a general direction a little east of north from the bridge over the York river in ı. This represents a distance of about 103 miles. Within this om the township of Glamorgan north-east to the Ottawa river, over ance of about eighty-three miles, the nepheline syenites and their ated rocks are represented by very frequent exposures, constituting most continuous development.

Geological Relations.

The area in which the nepheline syenites occur is underlain by the ırentian System of Logan. According to Logan, this system was ɪposed of the Fundamental Gneiss, with an overlying series of very cient sediments consisting chiefly of limestones, and which subse-ently came to be known as the Grenville Series. Logan considered ɔth series to be of sedimentary origin, the well defined bedding of the pper series being in the Fundamental Gneiss, represented by a gneissic tructure which he regarded as representing an almost obliterated bed-ding. The contact of these two series in the single area which he worked out in detail, namely, the district lying north of Grenville, which is situated about half-way between the cities of Montreal and Ottawa oı. the north shore of the St. Lawrence, is of such a character as to lend some colour to this old Wernerian view.

A careful examination of the very large areas in which the relations of these two series has since been closely studied, shows, however, that in all cases the so-called Fundamental Gneiss breaks up through the over-lying Grenville Series, the contact being an intrusive one, so that over wide stretches of country in the Province of Quebec and in Eastern Ontario the "Laurentian System" is composed of a great series of sedimentary rocks chiefly limestone, invaded and intensely altered by enormous intrusions of the Fundamental Gneiss. In Western Ontario a similar relation is always seen where the oldest stratified series in that part of the Dominion, namely, the Keewatin Series, comes in contact with the Fundamental Gneiss. In fact, the same remarkable relation has been found in all parts of the world where the oldest sediments have been studied. There is no floor to the sedimentary series, no basement of granitic or other rocks on which the oldest sediments of the geological column repose and from which they have been derived, but, instead, the oldest sedimentary series float on enormous intrusions of granite, which break up through them in every direction.

It is in such an area that the rocks described in the present paper occur. The limestones with their associated sedimentary gneisses and amphibolites (Grenville Series) are excellently developed, being of great areal extent and of great thickness. Through this Grenville Series the granite batholiths of the Fundamental Gneiss are well up, being often plutonic activity. They belong to one petrographical province; nevertheless for purposes of convenience of description, they may be considered as divisible into four groups, although it must be understood that no arbitrary lines exist in nature between these respective subdivisions.

1. The Nepheline Syenite.
2. Rocks of the Urtite and allied groups.
3. The White Alkali Syenite.
4. The Red Alkali Syenite.

1. *The Nepheline Syenite.*—This is made up essentially of an acid plagioclase, usually albite, with nepheline and biotite (lepidomelane), hornblende or pyroxene. Orthoclase, microcline and microperthite are occasionally found, but when present rank merely as accessory constituents.

2. *Rocks of the Urtite and Allied groups.*—The nepheline syenite exhibits extreme variations in the relative proportion of its constituent minerals, passing by a decrease in the amount of plagioclase present into rocks composed exclusively of nepheline and ferro-magnesian minerals, and of these into varieties composed on the one hand, almost exclusively of nepheline (Monmouthite) or, on the other hand, into very basic varieties composed almost exclusively of iron magnesian constituents and approaching Jacupirangite in composition.

The rocks of groups 1 and 2, in addition to their essential constituents almost invariably contain a certain amount of calcite. Scapolite is also a frequent constituent. Some of the less common accessory constituents are, garnet, sodalite, cancrinite, fluorite, muscovite, corundum, magnetite, pyrite, sphene, zircon, apatite, spinel (automolite), graphite and eudialite.

3. *White Alkali Syenite.*—This differs from the nepheline syenite in that the nepheline occurs merely as an accessory constituent, or may be entirely lacking. The rock is thus composed of an acid plagioclase and the ferro-magnesian constituents, the latter, however, being present usually in very subordinate amount.

4. *Red Alkali Syenite.*—This rock is distinguished at once from the preceding syenite by its pinkish or reddish colour. Like the white syenite it contains plagioclase, usually albite, as the predominant feldspar, but orthoclase and microcline are usually present and are relatively more abundant. Occasionally a little nepheline occurs, but when found is generally decomposed to a reddish or pinkish gieseckite. Magnetite in small irregular crystals and grains is usually present. Biotite is the iron magnesian constituent and is, as a general rule, present in very subordinate amount. When specimens are examined by the unaided eye,

quartz seems to be entirely lacking, but an examination of thin sect under the microscope often reveals this mineral, sometimes in no in siderable amount.

The rocks of these several groups pass into one another by im ceptible graduations. The magmas of all four types were in pl supersaturated with alumina, this excess crystallizing out as free alun in the form of corundum. In those varieties of nepheline syenite wl are unusually rich in nepheline and in the rocks of the Urtite gr the corundum is only developed when the iron magnesia minerals do occur in any appreciable amount.

Intimately associated with the rocks of these several types and fo ing part of the same igneous complex are certain abnormally co phases which are their pegmatitic equivalents. These may occur parallel or intercalated bands or they may cut across the foliation the rock in the form of dyke-like masses. The contact of these p matites with the parent or normal plutonic rock is sometimes quite sha especially in the case of those which intersect the foliation. Tl usually, however, present a rather abrupt, though quite perceptil transition into the ordinary medium grain type. The nepheline syen pegmatite is usually composed altogether of nepheline and albite. Son times very large individuals of biotite and occasionally of hornblen apatite and magnetite are present. The pegmatitic form of the r syenite is made up almost exclusively of microperthite, consisting of irregular intergrowth of orthoclase and albite.

The term syenite as applied to the nepheline syenite, in the nort eastern portions of the syenitic band, is in some cases somewhat of misnomer, for plagioclase varying from albite through oligoclase andesine is the prevalent and often the only feldspathic constituer Dr. Adams[1] in his paper announcing the discovery of these occurrenc in the townships of Dungannon and Faraday, made reference to this follows.—"If the distinctive character of the nepheline syenite nam Litchfieldite by Bayley be the replacement of the orthoclase by albit this rock is a more typical Litchfieldite than that from the original loca ity. The propriety of defining nepheline syenite as a rock compos essentially of nepheline and an alkali feldspar, instead of one compos of nepheline and orthoclase is rendered evident, as otherwise it would necessary to classify this rock as a theralite from typical specimens which it would differ greatly in composition."

These various rocks, while sometimes quite massive, possessing true hypidiomorphic granular structure, usually have a more or less pe

[1] American Journal of Science, vol. XLVIII, 1894, p. 15.

fect foliated structure which in many places presents an actual schistose development, the strike of which conforms to that of the adjacent country rock. The foliation has all the characters of an original structure. They vary in texture from medium to coarse grained, while the pegmatitic phases sometimes present nepheline and plagioclase individuals as much as a yard in diameter.

The rock is, as a rule, remarkably fresh and unaltered. Evidences of pressure even in the most pronouncedly foliated or schistose varieties are extremely rare. In occasional instances, however, some of the feldspars show strain shadows and curved or slightly dislocated twinning lamellae. Sections of the rock comprising the narrow part of the band, crossing the Monck road in Faraday township, show quite pronounced granulation and cataclastic structure.

The relations of the constituent minerals, especially the feldspathoid species, do not indicate the same regular and definite order of succession which is seen in most of the rocks which have crystallized from a molten magma. In general, however, it may be stated that after the crystallization of such minerals as apatite, zircon, sphene, corundum and magnetite, individuals of which usually possess rather good crystal outlines, the hornblende and biotite were formed. Both of these last mentioned minerals, and especially the hornblende, exhibit many sharp and distinct crystallographic boundaries. Plagioclase came next in order, while the remaining interspaces were filled either with potash feldspars when present, or with nepheline. So far as the texture of the rock is concerned, in the great majority of instances nepheline apparently plays the same part as quartz in an ordinary granite. Garnet, which is a very frequent and often abundant accessory constituent, is distinctly later than all of these constituents. Sodalite and cancrinite are also distinctly later, filling cracks and fissures.

On the other hand many grave exceptions to this general order of crystallization have been noticed, such as the inclusion of rounded individuals of nepheline and microcline in the plagioclase, and of plagioclase and nepheline in the hornblende. Again albite is frequently found forming poikilitic intergrowths with hornblende, such included individuals of albite often having direct connection and more or less distinct optical continuity with certain mantles or borders which sometimes surround the hornblende, separating individuals of this mineral from the other constituents of the rock. There is moreover undoubted evidence of very pronounced magmatic corrosion, due apparently to progressive changes in the physical constitution and composition of the magma.

The shells or mantles of muscovite which often enclose the dividuals of corundum are distinctly and clearly attributable to the creased acidity and hydration of the magma in its later stages.

The nepheline syenites and the associated alkali syenites occur most invariably on the borders of the granite bathyliths where these through crystalline limestone.

When the actual contact of the two rocks is well exposed, large dividuals of nepheline, biotite and other constituents of the syenite be seen to have developed in the limestone all along the margin of nepheline syenite body, while masses of the limestone, great and sm can be found scattered through the nepheline syenite along the conta These masses, furthermore, were evidently in process of replacement the magma, the various constituents of the nepheline syenite growi into them. They thus become gradually reduced in size, and now survi merely as separate, irregularly rounded grains of calcite often enclos in single individuals of perfectly fresh nepheline, hornblende or oth minerals of the nepheline syenite, or lying between these, with the for of the latter impressed upon them on every side. (See Plates and 10).

Every stage of the passage from the solid limestone to the separa calcite grains enclosed in the constituent minerals of the nepheli syenite can be distinctly traced, while the latter is at the same time fres and free from decomposition products. The phenomenon is well seen i the railway cutting on the outskirts of the village of Bancroft. In som cases an additional proof of the derivation of the calcite from the ad jacent limestone is afforded by the fact that the calcite grains enclose in the nepheline syenite show the twisting and the strain shadows to b observed in the constituent individuals of the invaded limestone, whil the minerals of the nepheline syenite which enclose them, are absolutel free from all signs of pressure. The calcite in the syenites is therefor undoubtedly foreign to the magma and represents inclusions of the sur rounding limestones. In the case of the only important body of nephelin syenites which does not have limestone as a wall rock, namely the occur rence in the township of Methuen, calcite is very rarely found in the rock and when it does occur, it is in very small amount, while the mode of it occurrence is entirely different from that above described and is such a to indicate that the mineral is probably secondary or a later infiltration

The presence of calcite has been noted in other occurrences o nepheline syenite. These are like those of the area at present under dis cussion, associated with ancient metamorphic rocks, but the calcite i them is believed to be primary by the investigators who have studied them. The occurrences in question are the nepheline syenites of the Sivamalai series of India [1] and that of the Island of Alnö [2] in Sweden. A similar association has been noted in the occurrences at Kussa in the Ural Mountains[3] and in the nepheline rocks of the Kaiserstuhl in Baden.[4]

Concerning the calcite in the Indian occurrences, Holland says:—"The calcite occurs in granular crystals with apparently as much right as any of the others to be considered a primary constituent. The crystals form isolated granules, and there are no signs of secondary decomposition ...... the low silica percentage in this group of rock removes the chief theoretical difficulty to its crystallization from a molten magma as a normal constituent of an igneous rock." The Alnö rock contains large masses of crystalline limestone as well as scattered granules of calcite and micropegmatitic intergrowths of calcite with nepheline, ægerine or feldspar, and Höghom believes that the limestone has been fused in the magma without decomposition and was, during the process of solidification, crystallized out of the magma in precisely the same way as the other minerals. In neither of these cases does limestone now occur in the immediate vicinity of the syenite, but it may, especially in the latter case, have sunk down into it from overlying beds, since removed by erosion.

This is also considered by Graeff to be the true explanation of the origin of the limestone inclusions in the Kaiserstuhl occurrence. Of the crystalline limestone associated with the Kussa nepheline syenite, Arzruni says that its "austreten unaufgeklart geblieben ist."

---

[1] Holland, T. H.—The Sivamalai Series of Elæolite Syenite and Corundum Syenites in the Coimbatore District, Madras Presidency—Mem. Geol. Survey of India, Vol. XXX—part 3, 1901, p. 197.

[2] Högbom, A. G.—Ueber das Nephelinsyenitgebiet auf der Insel Alnö—Geol. Fören i. Stockholm Förh. Bd, 17. Heft 2. 1895, s. 118. Also Abstract in Min. Mag. Vol. XI. (1897), p. 250, and Rosenbusch Mikr. Phys. (1896), pp. 169 and 171.

[3] Arzruni, A.—Die Mineralgruben bei Kussa and Miass—(In the Livret—Guide for the Ural Excursion of the International Congress of Geologists, St. Petersburg Meeting, 1900.)

[4] Graeff.—Zur Geologie des Kaiserstuhlgebriges—Mitt. der Bad. Geol. Landesanst. Bd. II, 1892.

Knop,—Der Kaiserstuhl im Breisgau—Leipzig. 1892; also Högbom, A. G. (loc. cit.)

MINERALS WHICH OCCUR IN THE SYENITES.

The following minerals have been found in the nepheline syeni its associated alkali syenites.

Nepheline	Corundum	Eucolite
Sodalite	Calcite	Molybdenite
Cancrinite	Garnet	Apatite
Feldspar	Zircon	Magnetite
Scapolite	Sphene	Pyrite
Biotite	Tourmaline	Pyrrhotite
Hornblende	Spinel	Chalcopyrite
Muscovite	Chrysoberyl	Graphite

Nepheline.—As a rule the mineral is quite fresh and glassy, bre ing with a sub-conchoidal or uneven fracture. The freshly brol fragments are often distinguishable with difficulty from the plagiocl It varies from almost colourless to white or very pale grey. Often possesses a beautiful pale salmon pink colour, which, on inspection is s to accompany an incipient decomposition of the mineral. A progress increase in this alteration is characterized by a gradual deepening of t tint until a bright brick red colour is assumed, representing the extrei stages in the decomposition and hydration of this mineral. The resu tant products in the primary stage are chiefly minute scales of mu covite, with very brilliant double refraction, the process extending fro certain cracks, and from the margin of the individual or formir "halos" around certain inclusions. Some of the individuals are mo or less turbid and opaque as a result of decomposition. In the mo highly coloured phases of the mineral an aggregate resembling giesecki in composition and appearance is produced, giving rise to very brillian aggregate polarization.

It is usually comparatively free from inclusions, although sometime hornblende, biotite, calcite and even feldspars occur enclosed. Th hardness of the nepheline occurring at York river according to Di Harrington[1] is nearly 6. The specific gravity at 17°C.=2.625 as deter mined with the bottle and 2.618 by suspension with a hair. Before th blowpipe it fused quietly at about 3.5 to a colourless slightly vesicula glass. An analysis of this nepheline by Dr. Harrington gave the follow ing results (under I). For comparison an analysis of the yellow variet of nepheline of Coimbatore, Madras, India, is given under II.[2]

---

[1] Amer. Jour. Sc. Vol. XLVIII. (1894), p. 17.

[2] Mem. Geol. Surv. Ind., Vol. XXX, Part III, 1901, p. 187.

	I.	II.
SiO_2	43.51	43.35
Al_2O_3	33.78	34.32
Fe_2O_3	0.15	1.02
CaO	0.16	0.82
MgO	tr.	.....
K_2O	5.40	5.52
Na_2O	16.94	14.62
Loss on ignition	.40	0.75
	100.34	100.40

The appearance of the nepheline on the weathered outcrops of the nepheline syenite is remarkable. When surfaces of the rock, which have been exposed to the action of the atmosphere are examined, each grain or individual of nepheline will be found to be represented by a depression. At the bottom of this the nepheline grain can be seen with a smooth rounded surface, as if it had been partially dissolved away, the feldspar and iron magnesia constituents standing up above it on all sides. The surface of the nepheline is coated with a mere film of decomposition products and is of a faint bluish grey colour, the feldspar weathering chalk white, and on breaking the rock open the nepheline appears to be perfectly fresh. Evidently the nepheline is destroyed much more readily by the weather than the other constituents of the rock, and the alteration products are of such a character that they are at once removed, leaving the surface of the mineral fresh and hard. This peculiar method of weathering makes it possible to determine the presence or absence of nepheline in any specimen of the syenite from a careful inspection of the weathered surface of the rock alone. In fact its presence can be quite as certainly determined in this way as by means of chemical tests or a microscopical examination. This simple method has furthermore the advantage that it can be applied to large areas of rock surface. (See Plates 3 and 4.)

Sodalite.—This mineral was observed at a large number of widely separated localities along the great belt of these syenite rocks in the townships of Glamorgan, Faraday, Dungannon, Monteagle, Raglan, Brudenell, and as far as Clear Lake near the north-east end of the belt.

It usually occurs in ill-defined irregular masses and patches, of comparatively small size, in the nepheline syenite, especially in those portions which are unusually rich in nepheline. It is also developed along and in the immediate vicinity of certain cracks and fissures in the nepheline, with no sharp line of division between the two minerals, the bluish colour gradually fading in passing outward to the white or greyish nepheline. In thin sections under the microscope it is seen occur in irregular strings or vein-like forms cutting across and am the other constituents. In certain portions of the area it occurs in large masses, notably on lot 25, concession XIV of Dungannon. presence of the sodalite at this locality has been proved over a lengtl some 250 feet with a width of from forty to fifty feet, and it is state be even more extensive than the present developments have shown. S cient quarrying has, however, been done to prove this occurrence to b distinct economic importance, as it is quite possible to secure blocks sodalite weighing several tons. In 1906 a shipment was made of tons of what was considered suitable material, to be used in the deco tion of the residence of Sir Ernest Cassell in Park Lane, Hyde Pa London, England. This property has been known as the "Princ Quarries," although a company has not yet been incorporated. It stated to be the intention of the owners to instal a complete plant only for quarrying the sodalite with channelling machines but sawing into slabs of suitable thickness. Other exposures showing large mas of beautifully coloured sodalite also occur on lots 25 and 29, con. XI of Dungannon. At the first mentioned locality, preliminary developm work consisting of stripping and some blasting has shown the preser of several large patches of the sodalite. At Craigmont in Raglan tow ship and on lot 34, concession V. of the township of Brudenell, patch of deep blue sodalite occur in a nepheline syenite made up in additi to this sodalite of a beautiful pale salmon nepheline and grey plagiocla the association producing a rock which has a very pleasing effect. T colour in this mineral varies from a very dark cobalt blue to very pa bluish, the colour fading rapidly when exposed to the action of t weather. It is susceptible of a high polish and is eminently suitable f inside decorative work. It is often associated with more or less magneti and biotite, and displays veinlets of reddish and whitish feldspar whi was shown on analysis by Dr. Harrington to be orthoclase. A samp in the museum of the Geological Survey shows a crystal of hastingsi several inches in length and perfectly terminated, completely enclosed the sodalite. Most of the material is compact with a multitude of ve fine cracks which may be due to the shocks of blasting. The specim selected by Dr. Harrington for analysis showed distinct dodecahedr cleavage and vitreous lustre. It was translucent and often sub-tran parent in ordinarily thin fragments, and its hardness was about 5. Heated in a closed tube the sodalite became perfectly white, while b fore the blowpipe it fused easily with intumescence to a colourless gla

Under I is given an analysis of the sodalite from lot 25, concession XIV of Dungannon, by Dr. B. J. Harrington.[1] Under II an analysis of sodalite from Dungannon by L. McI. Leigher and G. J. Volckenning.[2]

	I.	II.
SiO_2..	36.58	37.34
Al_2O_3..	31.05	31.25
FeO..	.20	......
Na_2O..	24.81	25.01
K_2O..	.79	.74
CaO..	......	.38
Cl..	6.88	6.79
SO_3..	.12	......
H_2O..	.27	......
Insoluble..	.80	......
	101.50	101.51
Deducting O = Cl	1.55	
Specific gravity =	2.295	2.303

Cancrinite.—This mineral was first detected in Canada by Dr. Harrington in the nepheline syenites of Mount Royal and Belœil, in the Province of Quebec.[3] In the nepheline syenites of Ontario, it usually can only be distinguished by the assistance of the microscope. It occurs in irregular grains or rude radial aggregates, whose outlines are dependent on the surrounding minerals. It is usually at least in immediate association with the nepheline and sometimes forms a narrow border more or less completely surrounding the individuals of this mineral. It also occurs in cracks or fissures traversing the nepheline. Under the microscope it is transparent, colourless, and altogether free from inclusions or alteration products. Cancrinite was noticed in considerable amount in the nepheline syenite where it crosses the Monck road in Faraday township, and is also found in the nepheline syenite about two miles east of Bancroft. On lots 25, concessions XIII and XIV of Dungannon, the cancrinite was found in small irregular masses with rather ill-defined boundaries, and so intimately associated with the nepheline as to be separable only with extreme difficulty. The cancrinite is translucent, of a pale citron-yellow colour, gradually fading on exposure to the

[1] Am. Jour. Sc. Vol. XLVIII. 1894. pp. 17 and 18.
[2] Am. Jour. Sc. Vol. XLIX. 1895. pp. 465-466.
[3] Trans. Roy. Soc. Can. Vol. I., Sect., III., 1882-83., p. 81.

weather. It has a subvitreous and somewhat greasy lustre. It is doubtedly an alteration product of the nepheline, the cleavage pla in contiguous masses or areas, being common to both minerals wl boundaries between the two are rarely, if ever, sharp or distinct.[1]

Feldspar.—Plagioclase varying in composition from albite thro oligoclase to andesine, is the prevailing feldspar in all of these syeni Albite, with a small percentage of lime, seems to be the most comn variety. The specfic gravity of the rock near York river is 2.6207 a 2.625, while in a separation of the rock from lot 25, con. XIV of Du gannon, it was found to be not greater than 2.623. The specific grav of the fresh oligoclase from the syenite was about 2.64, although some it which had undergone partial alteration was considerably lighter. T andesine which is the feldspathic constituent of the nepheline syen from lot 12, concession XV of Dungannon, was determined by hea solution on fine fragments to be 2.668. An analysis of this feldspar given on page 67.

A noteworthy feature in connection with the development of t feldspar is the frequent occurrence of a thin mantle of plagioclase (a bite) more or less completely surrounding individuals and even aggr gates of hornblende and separating these from the surrounding and mo abundant nepheline. It has also been noticed as a border surroundin calcite and between this mineral and the nepheline. This bordering zo of plagioclase is rather variable in width, but shows very marke optical continuity over long distances, in this respect also being in clos agreement with similar feldspathic material which occurs filling up th various inequalities in the hornblende individuals formed as a result o this mineral's imperfect crystallographic development—and also with in clusions of feldspar in the midst of the hornblende. In some respect this phenomenon resembles certain "reaction rims," and it is thus ex plained by Holland;[2] but what seems a more reasonable explanation o the Ontario occurrences is that as the plagioclase succeeded and to certain extent overlapped the crystallization of the hornblende, it woul have been attracted to such centres of crystallization as had already bee formed by the solidification of the earlier and more basic mineral. Thi curious occurrence is well illustrated in certain of the hornblendi varieties of the syenite exposed at the dam at Bancroft and at Ega Chute on the York river. The larger crystals of corundum occurring i the nepheline rich variety of the syenite at Craigmont are also frequentl surrounded by a zone of plagioclase, separating the former mineral fron the nepheline.

[1] Can. Rec. Sc. Vol. VII, No. 4, 1896-97.

[2] Mem. Geol. Surv. Ind. Vol. XXX, Part 3, 1901, pp. 190-191.

Microcline in rather unusual in the nepheline syenite and much of it presents a somewhat indefinite and distorted mesh which is not distinctive. Much of the microperthite has the very fine and interrupted twinning lamellæ characteristic of anorthoclase with which it is probably identical. Most of what has been considered to be orthoclase also shows quite a perceptible intergrowth of other feldspars, the potash feldspar being, however, predominant. A white and reddish mineral, which was proved on analysis by Dr. Harrington to be orthoclase, fills certain little cracks traversing the sodalite on lot 25, concession XIV of Dungannon. It is mostly dull, but in places shows cleavage surfaces with a pearly lustre. The reddish portions probably owe their colour to the decomposition of pyrite, occasional grains of which still remain. The mineral is regarded as secondary. The specific gravity at 18°C. was fcund to be 2.555, and analysis gave the following percentage composition:—

SiO_2	63.00
Al_2O_3	18.93
Fe_2O_3	.59
CaO	.08
MgO	.09
K_2O	12.08
Na_2O	3.67
Loss on ignition	1.00
	99.44

An analysis of the microperthite of the corundum-bearing syenite pegmatite of Craigmont in the township of Raglan is given on page 71.

Scapolite.—This mineral is a frequent and often abundant constituent of the nepheline syenite, occurring in clear colourless grains which meet the accompanying nepheline and feldspar grains with a perfectly sharp outline, there beirg no evidence that the mineral is the result of alteration or weathering. The double refraction is much stronger than in the nepheline and feldspars, the interference colours seen in the thin sections being red, blue, and yellow. In this it resembles cancrinite, from which it can generally be distinguished by its habit, the cancrinite usually filling in cracks and the small interspaces left after the crystallization of the other constituents.

Biotite. This is the chief iron-magnesia constituent of these rocks, but it is usually present in subordinate amount. It occurs in the usual small scales and plates, some of which exhibit good crystal boundaries. The hand specimens show an almost black mica which has usually a disamined between crossed nicols in convergent light, a black cross is seen, thickened towards the intersection of the arms. This cross, on revolving the stage, divides into two hyperbolas, but these separate from one another but very little and appear to separate less than they really do, on account of the fact that the low double refraction and deep colour of these sections cause the hyperbolas to be ill-defined, while the whole field is very dark. The dispersion, however, makes itself evident in the varying colours on the sides of the hyperbolas. When, however, a gypsum plate giving a red of the first order, is inserted above the objective, the hyperbolas become a little better defined, although still not sufficiently definite to allow the axial angle to be accurately measured. The axial angle is found to be over 30°, possibly as much as 45°, which, however, is still very small for hornblende, being about one-half the usual value.[1] This hornblende resembles a variety intergrown with the augite in the nepheline syenite from the Corporation Quarry at Montreal. It also resembles in some respects the variety described by Hackman under the name " arfvedsonite " occurring intergrown with ægirine in the nepheline syenite from Umptek in the Kola Peninsula.[2] The Kola hornblende is much lighter in colour than that from either of the Canadian localities.

This hornblende was analyzed by Dr. Harrington with the following results:—

SiO_2	34.184
TiO_2	1.527
Al_2O_3	11.517
Fe_2O_3	12.621
FeO	21.979
MnO	.629
CaO	9.867
MgO	1.353
K_2O	2.286
Na_2O	3.290
H_2O	.348
	99.601
Specific gravity	3.433

[1] Am. Jour. Sc. Vol. XLVIII, 3rd Series, 1894, p. 13, and Am. Jour. Sc. Vol. 1. 4th Series, 1896, p. 210-218.

[2] Can. Rec. Sc. Vol. VII. 1896-97, pp. 77-87.

The name "Hastingsite" was suggested by Dr. Harrington as varietal name for this hornblende, thus connecting it with the regi where it occurs.

Muscovite.—This mineral seems to occur in two definite and di tinct forms. First, in comparatively small individuals, somewhat simil in dimensions and habit to the biotite, which is the usual and more abu dant mica. In this mode of development it is often intergrown wi the biotite.

In the second place, the muscovite occurs in much larger plates ar aggregates, in more or less intimate association with corundum, in tho types of the syenite which have consolidated from a magma supersatu rated with alumina. It is, therefore, present in greater abundance an is more characteristic of these somewhat unusual types of the nephelin syenite, which mainly by the almost complete failure of the ferromag nesian minerals, favoured the separation of the excess of alumina in th form of corundum. The mineral, under these conditions of association has always been described and regarded as secondary, resulting from th alteration of the corundum. The supporters of such a view, argued that every gradation in the process of this alteration may be seen, from those occurrences, in which a comparatively pure crystal has been replaced by muscovite. On the other hand, the peculiar conditions which attended and contributed to the replacement have never been satisfactorily explained. Both minerals are developed side by side in perfectly fresh and unaltered rocks, the surrounding constituent minerals having undergone little or no perceptible change. Moreover, it is well known that corundum is one of the most unalterable of substances when subjected to ordinary processes of atmospheric decay, this fact receiving the strongest support from the Ontario occurrences. The critical and extended study of these Ontario deposits of corundum, both in the field and in thin sections under the microscope, shows that this apparent alteration is closely connected with some phases of pneumatolytic or vein action, which immediately preceded the complete solidification of the rock. The extreme phases of this alteration are best seen in the pegmatitic or coarser varieties of the syenite, although examples are not lacking in the more normal grained portions of these rocks. Indeed it seems to belong to the same class of phenomena as the "corona" or "reaction rims" which so frequently surround some of the earlier formed minerals in many plutonic rocks. (See Plate 10.)

The alteration in the case of the Ontario corundum is always to muscovite and this mineral may be considered chemically as made up of orthoclase, corundum and water. Morozewicz has shown experimentally that a magma such as that which on cooling gives rise to a soda syenite has the power to dissolve alumina and on cooling to separate out any excess completely. The conditions laid down by what is known as Morozewicz's law (see page 65) are completely fulfilled by the corundum-bearing nepheline syenites of Ontario. In all magmas, those of acidic composition especially, water is believed to be present in considerable amount. As the corundum separated out, the magma would tend to approach more nearly to the composition of a mass of fused feldspar together with a certain amount of water. At this stage, and on account of some condition or change of conditions, this residual magma attacked the corundum, the hydrous feldspathetic magma together with the alumina from the dissolved corundum making muscovite, which crystallized around or replaced the corundum, according to the following formula:—

$$K_2O, Al_2O_3, 6SiO_2 \ (= \text{orthoclase}) + 2Al_2O_3 \ (= \text{corundum}) + 2H_2O = K_2O, 2H_2O, 3Al_2O_3, 6SiO_2 = \text{muscovite}.$$

This likewise explains the marked prevalence of this alteration in the pegmatitic *facies* of the syenite, for it is in these residual differentiated portions of the magma that water plays such an important part in the process of crystallization.

Corundum.—The crystals when normally developed are usually six-sided prisms which are sometimes terminated by a six-sided pyramid and not frequently by the basal plane. Many of the crystals especially those occurring in the nepheline syenite have a tolerably sharp and perfect outline, frequently tapering to either extremity, thus producing the very characteristic barrel-shaped form. The pyramidal and prismatic faces are very often more or less deeply striated or grooved horizontally. The basal planes or truncated ends of the crystals are frequently striated in three directions, forming equilateral triangles, corresponding with the less perfect rhombohedral partings or pseudo-cleavages. The crystals vary greatly in size, the largest noticed in the nepheline syenite being about eight inches in length by two inches in diameter. Such crystals are comparatively rare, the usual size being about two to three inches and from that sinking to those of microscopic dimensions. The larger crystals as well as the very small ones are usually inclined to have an irregular or imperfect outline. The corundum is in many instances somewhat brittle, breaking with an uneven or conchoidal fracture, but when in large masses it is exceedingly tough. The lustre is in general vitreous, but in the translucent light green variety noticed in Brudenell township the lustre is somewhat pearly. The colour of the corundum in the nepheline syenite is in general of varying shades of blue to white. It is sometimes of a distinct rose-red colour. Many of the crystals, especially those present in the nepheline syenite exposures in the vicinity of York river, show an irregular or cloud-like arrangement

of the colour material, shading off from deep azure blue through pale b
to colourless. Occasionally crystals exhibit a very decided and be
tiful zonal arrangement. The hardness of the mineral is 9 = 9. T
specific gravity of the blue corundum from the nepheline syenite
Dungannon ranges from 3.93 to 4.01, with an average of 3.95.

A microscopical examination of the thin sections of the rock sh
that in addition to the larger and more perfect crystals which are visi
to the naked eye, there are often innumerable small, usually exceedin
irregular individuals distributed through the rock.

Corundum under the microscope has a high index of refract
but a low double refraction, and in good thin sections the interfere
colours do not exceed a red of the first order. Such sections are, ho
ever, difficult to obtain on account of the relatively much greater ha
ness of corundum as compared with the surrounding minerals. Wh
these latter have been ground sufficiently thin the corundum grains,
may be seen in sections from which the cover glass has be
removed, stand out in relief, the result of their resistan
to the grinding operations. As a consequence, therefo
the corundum seems to have a higher double refraction than it actual
possesses, and the mineral in most thin sections shows very brillia
polarization colours between crossed nicols. The pronounced reli
the dark borders of total reflection, the rough surface and the partin
planes or pseudo-cleavages are very strongly marked, as is also the neg
tive character of the double refraction. The following localities sho
corundum in the nepheline syenite, most of which are of economic im
portance:—Lot 12, cons. XI and XII; lot 18, con. XI; lot 12, con. XI
and XV; lots 6 and 7, con. XV; lots 6 and 7, con. XVI, Dunganno
township. Lot 4, con. I, Monteagle; lots 2 and 3, con. II, Monteagl
Lot 34, con. V., lot 25, con. VI, and lot 32, con. VII of Brudenell town
ship. (See Plates 10 and 12.)

An analysis of the corundum from lot 12, con. XV, of Dunganno
is given on page 68, and an analysis of the corundum from Craigmont
in the township of Raglan, on page 72.

Calcite.—This mineral is very frequently present and is especiall
abundant in those exposures which are in immediate contact with crys
talline limestone. Its unexpected presence in the rock has already bee
explained elsewhere (see page 12). That the mineral is foreign to th
magma and represents included fragments of the neighbouring crystallin
limestones is in direct agreement with all the phenomena so far observed
Its mode of occurrence is essentially that of an original constituent, be
ing found in comparatively large, well defined, unusually rounded grains
sometimes completely enclosed by the other constituents, or in othe
cases lying between them. The line of separation is quite sharp an

distinct, with no hint of decomposition in any of the surrounding minerals. The individual grains show the usual perfect rhombohedral cleavages often with well marked twinning lamellæ. Comparatively large individuals occur in the pegmatitic phases as noticed in the exposures west of the bridge over the York river in Dungannon township.

Garnet.—This mineral is of common occurrence and is occasionally so abundant, especially at certain exposures near the York river in the northern part of Dungannon, as to characterize the rock. In the hand specimen it exhibits a dark reddish brown colour. In thin sections it is, of course, much paler in tint, assuming a deep brownish tint, fading to a yellowish towards the interior of the larger grains. It shows the usual high index of refraction and consequent very pronounced relief. It is quite isotropic. The individuals and especially the larger grains usually possess a very irregular outline, with irregular arms and intricate indentations and hold abundant inclusions of most, if not of all, of the other constituent minerals of the rock. In some instances it exhibits well developed crystallographic boundaries. It is especially abundant in those varieties of the syenite which contain hornblende, and is for the most part developed in immediate association with this mineral. It resembles a garnet found in small amount in the nepheline syenite of the Corporation Quarry at Montreal, and also the melanite in the nepheline syenite of Alnö.[1]

A chemical analysis by Dr. B. J. Harrington[2] of the variety associated with Hastingsite about two miles east of the town of Bancroft in the township of Dungannon afforded the following results, showing the garnet to be a titaniferous andradite:—

SiO_2	36.604
TiO_2	1.078
Al_2O_3	9.771
Fe_2O_3	15.996
FeO	3.852
MnO	1.301
CaO	29.306
MgO	1.384
Loss on ignition	.285
	99.577
Specific gravity at 16° C.	3.739

[1] Geol. Fören. i. Stockholm, Förh. 1895. p. 144.

[2] Can. Rec. Sc., Vol. VI., 1894-95, pp. 480-481; also Vol. VII., 1896-97, pp. 87-88.

Zircon.—This mineral is quite commonly seen in thin sections the microscope. The microscopic individuals have a rather shor matic form and are as a rule somewhat rounded. In some of the phases of the rock, noticeably at the York river in Dungannon Craigmont in Raglan, crystals are not uncommon which would m from a quarter to half an inch in length. On lot 32 of con. Glamorgan, crystals of zircon over an inch in diameter are fou dykes of nepheline syenite, each of these crystals displaying a tetragonal pyramid. One short stout crystal at present in the M of the Geological Survey measures an inch in length by three-quar in inch across. These crystals "show two quite different habit in which by the development of two opposite pairs of the pyra faces, together with a pair of the prisms of the second order, the becomes columnar in this direction and mimics a hexagonal pri the second order terminated by rhombohedral faces. In the s habit the pyramidal faces are strongly developed, while the prism are short or lacking altogether."[1]

Sphene (Titanite).—This mineral is sometimes present alth by no means abundant, and so far as observed it occurs in micros crystals only. It is often in characteristic wedge-shaped though what rounded forms, but also occurs in irregular grains. It is abundant in the hornblendic varieties, where it is often quite an portant accessory constituent.

Tourmaline.—This mineral is seen occasionally and in only s amount. It occurs in characteristic crystals, which are black in co

Spinel (Automolite).—A dark green spinel evidently closely a if not identical with automolite is occasionally found in the neph syenite, although it is more abundant in the red alkali syenite.

Chrysoberyl. This mineral is occasionally met with in the al syenite at Craigmont, associated with the corundum.

Eucolite.—A mineral with the characters of eucolite occurs ra abundantly in the hornblendic variety of the nepheline syenite at F chute on the York river as well as at another locality a little lower d on the same stream. It has a yellow colour and usually displays an perfect crystallographic form. It is intimately associated with h blende and garnet, frequently enclosed in the former and resembling latter closely in appearance. It has, however, when examined in sections, a distinct, though low double refraction with negative sign. a high index of refraction with decided relief, a rough surface and pa lel extinction. It is further distinguished from the garnet by a deci

[1]Amer. Jour, Sc. Vol. XLVIII., 1894, p. 215.

difference in colour, the garnet being brownish or reddish brown in thin sections, while the eucolite is pale yellowish. In a heavy solution, eucolite falls with the hornblende and garnet and can only be separated with the greatest difficulty from these minerals. By magnetic separation several times repeated, fairly pure material is obtained, but hardly pure enough for purposes of chemical analysis. It is likely that further and more careful search in this region will show a larger and more abundant supply of this mineral.

Molybdenite.—This mineral is occasionally found and occurs usually in small plates and scales and less frequently in crystals.

Apatite.—This mineral is a very common constituent of the nepheline syenite, but it is usually present as a very subordinate accessory constituent and in very small, often microscopic, crystals. In some localities, especially in association with the magnetite on lot 30, con. XIII of Dungannon, comparatively large crystals of apatite may be obtained, while in the north-west corner of Faraday, similarly large and well defined hexagonal prisms, terminated by planes of two pyramids, have been collected. Occasionally these crystals were noticed growing together in parallel position, the resulting individual simulating a twin crystal.

Magnetite.—This mineral has a very general distribution throughout the whole mass of the nepheline syenite, although its complete and unexpected absence from occasional outcrops representing even the more basic phases of the rock is noteworthy. It is usually present, however, and is certainly one of the more important of the accessory constituents. Individuals in thin sections under the microscope often show fairly good crystalline form, but the grains are usually somewhat rounded and irregular in outline. The mineral is most conspicuous and abundant in the more feldspathic variety, especially the red syenite. In many places the magnetite has differentiated out from the rest of the rock and forms large and important masses of this mineral, much of which is free from any other admixture. Attempts have sometimes been made to work some of these masses in the hope that they would ultimately become producing mines. At one locality on lot 30, con. XIII of Dungannon, considerable development work, consisting chiefly of stripping and blasting, has revealed the presence of considerable bodies of very pure magnetite which, however, judging from analogous occurrences accompanying the red syenite and which have been analyzed, would in all probability contain titanium. The mineral here has a very perfect octahedral cleavage. In certain localities in Dungannon, and especially in the north-west corner of Faraday, perfect octahedrons of magnetite can be occasionally secured weighing several pounds. (See

Plate 8.) An analysis of the magnetite occurring in the syenite matite at Craigmont, in the township of Raglan, is given on page

Pyrite, Pyrrhotite and Chalcopyrite.—All three of these mi have been found as constituents of the nepheline syenite. Pyrite i most common. Under the microscope it is occasionally present in well defined cubes, but usually it occurs in rounded or irregular g

Graphite.—This mineral is not, so far as observed, a freque an abundant constituent, but it has been noticed in the coarse ph the nepheline syenite exposed to the east of the York river in Dung township. It occurs very pure, in small rounded shot-like forms sisting of minute scales of the mineral arranged in a radiatin plumose manner. In certain portions of the rock at this locality, phite in this form is quite abundantly distributed. It has been n as an important and characteristic mineral in a certain variety o nepheline syenite of Sivamalai in India, described by Holland, wh constitutes 0.58 per cent of considerable masses of the rock.[1]

Holland explains its presence in this rock as due to its crysta tion from fusion, and regards it as a primary constituent and than the feldspar. This conclusion may be taken as applying al the graphite in the York river nepheline syenite.

Description of the Several Occurrences.

For purposes of description it will be most convenient to grou several occurrences by townships, as follows:—

I. The alkali syenites of the township of Lutterworth.

II. The nepheline and associated alkali syenites of the townshi Monmouth.

III. The nepheline and associated alkali syenites of the townshi Glamorgan.

IV. The nepheline and associated alkali syenites of the township Harcourt, Cardiff and Wollaston.

V. The nepheline and associated alkali syenites of the townshi Methuen.

VI. The nepheline and associated alkali syenites of the township Faraday, Dungannon, Carlow and Monteagle.

I. *The Alkali Syenites of the township of Lutterworth.*— corundum-bearing syenite was discovered on lot 12, con. IV, in township, by Mr. Tett, when acting as assistant to W. A. Johnson, E of the Geological Survey of Canada, in the summer of 1905. This r is said to occupy an area from thirty to forty acres in extent and to

[1] Mem. Geol. Surv. Ind., Vol. XXX, part 3, pp. 174 and 17.

the gneissic granite of the district. Much of the rock contains over ten per cent of corundum.[1]

II. *The Nepheline and associated Alkali syenites of the township of Monmouth.*—The largest and most important occurrence of nepheline syenite in this township, is that which is found as a border around the body of pegmatitic granite which runs through the centre of the township stretching in a direction about N.30°E. from con. VII to con. XIV, a distance of about six miles. This granite mass has a maximum width of a little over a mile. The border of nepheline syenite varies from one-eighth to half a mile in width. Fine transverse sections from the limestones on either side through the nepheline border to the central mass of granite can be obtained on the several roads which cross this occurrence.

The rock which has been referred to as granite, is pink or red in colour and is usually of medium grain. It shows in many places that irregular and often rapid variation in size of grain which is seen in pegmatite. At the north-eastern end of the mass on lot 29, con. XIII, it has a distinctly foliated structure. Farther south the foliation becomes less distinct, although the rock still retains a streaked appearance.

This granite is never rich in quartz, although in the north-eastern part of the mass and as far south as con. XI, this mineral is present in considerable amount. Farther to the south-east the quartz decreases in quantity and the rock passes into a syenitic phase. The rock as exposed on lot 26, con. XII of Monmouth, in the middle of the granite mass, is a medium grained granite, red in colour and with a rude foliation. The quartz is light gray and glassy. The feldspar is red on the fresh surface of fracture and shows a good cleavage and high lustre, but weathers to a pale red or pink colour. The iron-magnesian constituent is present only in small amount. Under the microscope the rock is seen to be composed of the following minerals:—albite, microcline, orthoclase, microperthite, quartz, hornblende, biotite, sphene, apatite and magnetite. It was found by making a separation with Thoulet's solution that the amount of albite and microperthite taken together was about double the sum of the amounts of orthoclase and microcline present in the rock. Quartz is about equal in amount to the potash feldspars. The ferro-magnesian constituents occur in aggregates of individuals which have a rather frayed or irregular outline. Very few of these approach an idiomorphic development. Two varieties of hornblende are present: one green and the other blue in colour. The former is evidently ordinary hornblende, showing a pleochroism in yellow and green tints with an extinction of 20°. The blue variety of hornblende

[1] Geological Survey of Canada, Summary Report, 1905, p. 93.

intergrown with that just mentioned, and presents absorption co
anging from deep lavender blue to light green. Biotite is prese
insignificant amount.

The syenite phase of this rock is red in colour and composed al
exclusively of feldspar, which is for the most part microperthite
iron-magnesian constituent occurring in occasional dashes with a r
parallel arrangement. It differs from the granite, not only in the
that no quartz is visible in the sections, but also in the absence of h
blende. The rock contains a small amount of biotite, while a little
covite and calcite are also present. The latter may be secondary.
soda feldspar preponderates over the potash feldspar, as shown by
analysis given below.

An analysis of this rock was made by Prof. Norton-Evans,
the following result:—

SiO_2	64.15	per cent.
Al_2O_3	19.04	"
Fe_2O_3	1.02	"
FeO	.93	"
MnO	.16	"
CaO	1.37	"
MgO	.37	"
K_2O	7.10	"
Na_2O	5.37	"
P_2O_5	.10	"
CO_2	.70	"
H_2O	.27	"
	100.58	

If the norm of this rock be calculated, it will be found to be
follows. The calcite is considered to be secondary and is theref
omitted.

Quartz	1.86	per cent
Orthoclase	42.26	"
Albite	45.59	"
Anorthite	5.84	"
Corundum	.30	"
Hypersthene	2.09	"
Magnetite	1.39	"
Apatite	.34	"
	99.67	

The position of the rock in the Quantitative Classification is accordingly as follows:—

Class 1..	Persalane.
Order 5..	Canadare.
Rang 1..	Normarkose.
Sub-rang 3..	Phlegrose.

It is a question whether the calcite should be considered as an alteration product or as representing little inclusions of the surrounding limestone, as in the case of the nepheline syenites described below. If, as above, all the lime be considered as belonging to the magma, the rock lies near the line between phlegrose and pulaskose.

The mode of the rock, that is to say, its actual mineralogical composition, is found on calculation to be as follows:—

Quartz....................		4.20	per cent.
Orthoclase.................		37.25	"
Albite............	45.59	47.26	"
Anorthite	1.67		
Muscovite..................		4.78	"
Biotite....................		3.93	"
Magnetite..................		1.39	"
Apatite....................		.27	"
Calcite....................		1.60	"
		100.68	

This syenitic phase of the granite passes imperceptibly into the nepheline syenite on either side by the disappearance of the quartz with the concomitant increase of soda feldspar at the expense of the potash feldspars, together with the increase in the proportion of iron-magnesia constituents and the appearance of some nepheline. An albitic phase of the nepheline syenite thus results. This transition is excellently seen on lot 26, con. XII of Monmouth, the transitional rock being rather coarse in grain and dark in colour, having a faint red tinge and showing on the weathered surface a little nepheline and in one or two places small crystals of corundum. Rather large grains of magnetite are also scattered through the rock. It has a distinct foliation, due chiefly to the approximately parallel arrangement of the biotite, of which a large amount is present.

Under the microscope this rock is seen to consist of albite, orthoclase, microcline and a little microperthite with nepheline, biotite and calcite. As accessory constituents magnetite and apatite are present in the thin sections. A separation by means of Thoulet's solution shows that there is about eighteen times as much albite as potash feldspar present in the rock.

The transition between the syenitic phase of the granite and t nepheline syenite is also well seen at the southern end of lot 15, c VIII of Monmouth. The nepheline syenite here, has a schlieren str ture, caused by a variation in the relative amount of the constitue minerals in the different streaks. Some of these schlieren consist of r syenite and others are intermediate in composition between the r syenite and the nepheline syenite. There is thus represented in th schlieren a complete transition from the red syenite to the normal whi or gray nepheline syenite.

The nepheline syenite which forms the border of the mass, has distinctly foliated structure and is coarse in grain. It is white to da gray in colour, according to the proportion of the iron-magnesia co stituents which it contains. In a few places, as, for instance, on lot 2 con. XI, it is pale pinkish, owing to the presence of a pink geisecki like alteration product of the nepheline. The rock is by no means ur form in composition, but usually possesses a rudely banded or schlier structure which conforms to the direction of the foliation, the differe schlieren being marked by a variation of the relative percentage of tl several minerals present. Thus, in some schlieren, the rock will be ric in nepheline, while, in the adjacent ones, the nepheline will almost entirely disappear; again, there may be a variation in the relative pr portion of the iron-magnesia constituents, which will give rise to change in character. As a place where the rock is locally very rich i nepheline, lot 24, con. XII, may be cited, the nepheline rock here i some places containing much magnetite in large grains scattered throug it. These respective schlieren or bands are usually of considerabl dimensions, being several feet to many yards in width, and, of course are not sharply defined, but fade away into one another, although rathe abruptly. Occasionally the grain of the rock will suddenly become much coarser, the rock passing into a pegmatitic facies, this being most common in those places where nepheline is abundant.

A detailed study was made of a variety of the nepheline syenite rich in albite and poor in nepheline, which occurs on lot 16, con. IX of Monmouth, and forms part of this belt of nepheline syenite surrounding the granite. It was collected on the east side of the road between McCue lake and Hotspur, about one third of the way south of the northern limit of the band. The rock is coarse in grain and possesses a distinct foliation.

Under the microscope it is seen to possess a hypidomorphic structure and to consist of the following minerals:—Albite, microcline, microperthite, nepheline, lepidomelane, magnetite and calcite. In some few schlieren a dark green hornblende (probably hastingsite) replaces a portion of the biotite. Albite and lepidomelane are the chief constituents. The albite is well twinned and must be a variety approaching the pure soda molecule, as it has a specific gravity of 2.618 and shows a maximum extinction against the line of the twinning lamellæ of 15°. In a single slide a few grains having an extinction as high as 20° were observed, showing that a plagioclase somewhat more basic than albite is also occasionally present in very small amount. The microcline presents its usual characters and is frequently intergrown with albite, forming microperthite. The nepheline is in the form of large individuals similar in shape and dimensions to those of the albite. Smaller individuals of it are sometimes seen to be included in the albite, while, in other cases, it includes individuals of albite. It is very fresh and free from alteration products. The lepidomelane is the same dark brown highly pleochroic variety of biotite which occurs in the transitional rock lying between the granite and the nepheline syenite (p. 32) and has the form of short laths. A lighter coloured mica is also present in smaller amount. The calcite occurs in large single individuals, often of a rounded form, sometimes enclosed in the feldspars, nepheline or lepidomelane, but usually lying between the other constituents. The enclosing minerals show no signs of alteration and the calcite shows no signs of secondary origin. The magnetite is in large sub-angular or more or less rounded grains. There seems to be no definite order of succession in the crystallization, seeing that the various minerals enclose and penetrate one another. The lepidomelane, however, has a much better form than the other constituents and would thus seem to have crystallized earlier.

An analysis of the biotite-bearing variety of this nepheline syenite was made by M. F. Connor, B.Sc., and gave the following results:—

SiO_2..	51.58	per cent.
TiO_2..	.35	"
Al_2O_3..	19.40	"
Fe_2O_3..	4.26	"
FeO..	5.25	"
MnO..	.20	"
CaO..	3.64	"
MgO..	.49	"
K_2O..	4.23	"
Na_2O..	7.49	"
P_2O_5..	.15	"
CO_2..	1.53	"
H_2O..	1.02	"
	99.59	

The norm of the rock is as follows:—

Orthoclase..	25.02	per cent.
Albite..	34.84	"
Anorthite..	6.67	"
Nepheline..	15.50	"
Diopside..	.90	"
Olivine..	5.05	"
Ilmenite..	.73	"
Magnetite..	6.15	"
Apatite..	.34	"
Calcite..	3.45	"
	98.65	
Water..	1.02	
	99.67	

The rock has thus the following position in the Quantitative C sification:—

Class II	Dosalane.
Order 6	Norgare.
Rang 2	Essexase.
Sub-rang 4	Essexose.

If the calcite be regarded as representing inclusions (and reasc will be given for thus considering it later on), the rock will lie just the line between Essexose and Laurdaiose.

The calculation of the mode of the rock, that is to say the perce tage proportion of the minerals actually present in it, cannot be ma with absolute accuracy, since the precise composition of both micas pr sent is not known. If, however, the micas be taken to have the san average composition as the lepidomelane from the nepheline syenite Litchfield, Me., (see Bull. 168, U.S. Geol. Survey, p. 21), except th one per cent of alumina replaces an equivalent amount of ferric oxid as is frequently the case in these minerals, the mode will be as follows:-

Orthoclase		4.45	per cent.
Albite	50.83 }	52.08	"
Anorthite	1.24 }		
Nepheline		8.05	"
Biotite		29.61	"
Iron Ore		.73	"
Apatite		.34	"
Calcite		3.45	"
Water		1.02	"
		99.73	

This gives a plagioclase of the albite series having a composition $Ab_{10 \cdot 8}$ An., which is the proper composition as shown by the Thoulet separation. The composition assumed for the nepheline is that of the nepheline of the Dungannon nepheline syenite, the analysis of which is given on page 15. This arrangement of results leaves an excess of 1.25 per cent of lime and a deficit of 1.40 per cent of ferric oxide.

The dark brown or black lepidomelane present in the rock was isolated by means of a Wetheral Electric Separator, followed by the use of Thoulet's solution, and was analysed by J. C. Egleson, M.Sc., of McGill University. It was found to have the following composition:—[1]

SiO_2	31.48
TiO_2	2.50
Al_2O_3	17.23
Fe_2O_3	5.85
FeO	27.96
MnO	1.61
CaO	1.33
MgO	2.99
K_2O	4.17
Na_2O	1.68
Li_2O	.00
Water (combined)	3.94
Fl.	.00
	100.74

The specific gravity of this mica is 3.25.

Another very interesting occurrence in this township is that presented by the lenticular shaped mass of nepheline rocks, occupying portions of lots 9, 10, 11 and 12, cons. VI and VIII. This consists of nepheline syenite associated with rocks of the urtite group. The intrusion breaks through the crystalline limestone of the Grenville Series, by which it is entirely surrounded, and of which it holds many inclusions. These included masses of the limestone are coarsely crystalline and have a variety of silicates developed in them. The nepheline syenite presents the appearance of eating into these masses. It might be supposed that the limestone was in course of solution by the magma, but there is no sign of an increase of lime-bearing silicates near the contact, for while in some places the nepheline syenite near the contact is rich in hastingsite, elsewhere about the border of the mass this and other lime-bearing minerals are absent. Scapolite in this occurrence is comparatively rare. It is probable that the mass of the limestone was carried

[1] An Examination of some Canadian Micas—Trans. Roy. Soc. of Canada, 2nd Ser., Vol. X, Sec. 3, p. 57 (1904).

off in solution by the magmatic waters contained in the invading mag and given off by it as it solidified.

On the weathered surface of the syenite, the limestone fragme which in many places are thickly scattered through the rock, are dissol away, leaving little pits and cavities into which the individuals of t nephelìne and other constituents of the rock project, often with n crystallographic forms.

The intrusion has a marked foliation or gneissic structure, and irregular in composition, consisting of a series of thick bands or schlie running parallel to one another and to the strike of the surrounding lin stones. Some of these schlieren are very highly feldspathic and hold l little nepheline. Much of the rock, however, is rich in nepheline, wh in some of it, nepheline replaces the feldspar almost entirely. Bands much as six feet in width can be found, which consist almost exclusiv of nepheline. Usually those streaks which are rich in nepheline a also rich in hornblende, often with red garnet as an accessory constitue Elsewhere the rock consists of nepheline and albite. In the latter varie small individuals of white mica sometimes occur which exactly resemb the crystals of this mineral which in other parts of the area are form by the alteration of corundum.

The highly feldspathic type which resembles those already describe does not require further mention, but three tpyical varieties of the ro in which nepheline is more abundant were selected for study.

Nepheline Syenite—Township of Monmouth—Lot 11, *Con. VII*
(*First variety*).

This is a variety rich in hornblende. It is coarse in grain, dark i colour, and possesses a distinct gneissic structure.

Under the microscope it is seen to consist of nepheline, albite, horn blende and calcite, with a small amount of apatite as an accessory con stituent. These minerals, with the exception of the apatite, are all i large individuals, and like most of the nepheline syenites of this area have a peculiar structure which approaches an allotrimorphic struc ture in character. None of the minerals have good crystallin forms, but all have a tendency to occur with more or les rounded outlines and to come against one another in curved lines. In clusions of one mineral in another are common, no definite order o succession can be observed in the crystallization, and the structure i some respects approaches the "mosaic" structure seen in the metamor phic rocks when a complete recrystallization has taken place.

The nepheline is considerably altered to a very fine grained turbi aggregate resembling kaolin, but in places it is quite fresh and show its usual optical properties. It frequently holds rounded inclusions of albite and of calcite. The albite is well twinned and possesses the usual characters. The hornblende is the most abundant constituent, and, if not hastingsite, is a variety closely resembling it. It is deep green in colour, looks black on the fractured surface of the rock. Although the rock is so basic, it contains no iron ore, which is elsewhere common as an accessory constituent in such rocks. The calcite, as usual occurs as rounded inclusions in the albite, nepheline or hornblende, or filling spaces between the grains of these minerals. No microcline nor microperthite is present in the sections.

Analysis of the rock by Prof. Norton-Evans shows it to have the following composition:—

SiO_2..	43.67	per cent.
TiO_2..	.78	"
Al_2O_3..	20.91	"
Fe_2O_3..	3.54	"
FeO..	8.01	"
MnO..	.05	"
CaO..	7.37	"
MgO..	1.46	"
K_2O..	2.25	"
Na_2O..	6.73	"
P_2O_5..	.11	"
CO_2..	2.37	"
H_2O..	2.52	"
	99.77	

The norm of the rock will then be as follows:—

Orthoclase..	12.79	per cent.
Albite..	22.01	"
Anorthite..	20.29	"
Nepheline..	19.03	"
Olivine..	10.58	"
Ilmenite..	1.52	"
Magnetite..	5.10	"
Apatite..	.34	"
Calcite..	5.41	"
	97.07	
Water..	2.52	"
	99.59	

Its position in the Quantitative Classification is as follows:—

Class III..............Dosalane.
Order 6..............Norgare.
Rang 2..............Essexase (very near Salemase).
Sub-rang 4............Essexose.

Its mode or actual mineralogical composition is as follows:—

Orthoclase		2.78	per cent.
Albite	22.27	23.94	"
Anorthite	1.67		
Nepheline	15.91	26.23	"
Kaolin	10.32		
Hornblende		39.75	"
Apatite		.34	"
Calcite		5.50	"
		98.54	
Water		1.10	"
		99.64	

Nepheline syenite—Township of Monmouth—Lot 11, *Con. VII*
(Second Variety).

This is rich in nepheline and contains a large percentage of pyroxene. It is much lighter in colour, but otherwise bears a general resemblance to the variety just described. Under the microscope all the constituents are seen to be fresh, but they frequently show signs of having been submitted to pressure, as shown by the presence of a more or less uneven extinction. This is especially marked in the case of the calcite, and the albite can in some few instances be seen to have been not only bent but actually fractured. The nepheline also occasionally shows strain shadows. As before, no microcline nor microperthite is present in the sections and a Thoulet separation shows that the rock contains no potash feldspar. The albite has a specific gravity of very nearly 2.61.

The pyroxene is very deep green in colour and somewhat pleochroic Around the individuals of this mineral and occasionally about the calcite grains, there is sometimes a narrow border of garnet. The pyroxene is evidently very rich in iron and holds rounded inclusions of calcite and nepheline.

An analysis of the rock by Prof. Norton-Evans shows it to have the following chemical composition:—

SiO_2..	42.72	per cent.
TiO_2..	.38	"
Al_2O_3..	25.08	"
Fe_2O_3..	2.00	"
FeO..	4.36	"
MnO..	.16	"
CaO..	6.92	"
MgO..	.97	"
K_2O..	2.69	"
Na_2O..	11.02	"
P_2O_5..	.19	"
CO_2..	2.99	"
H_2O..	.88	"
	100.36	

Its norm is as follows:—

Orthoclase..	15.57	per cent.
Albite..	7.34	"
Anorthite..	10.80	"
Nepheline..	46.58	"
Diopside..	3.08	"
Olivine..	5.10	"
Ilmenite..	.76	"
Magnetite..	2.78	"
Apatite..	.34	"
Calcite..	6.80	"
	99.15	
Water..	.88	"
	100.03	

Its position in the Quantitative Classification is:—

Class II.. .. ..Dosalane (very near Persalane).
Order 7.. .. ..Italare.
Rang 2.. .. ..Vulturase.
Sub-rang 4.. .. ..Vulturose.

If this rock possessed about one-half of one per cent less iron-magnesia constituents, it would fall into the class of persalanes and would constitute the first dosodic domalkalic tasmanare known.

The mode or actual mineralogical composition of the rock is as follows:—

Albite..	19.39	per cent.
Nepheline..	50.57	"
Pyroxene..	18.35	"
Garnet..	1.45	"
Iron Ore	1.86	"
Apatite..	.34	"
Calcite..	6.80	"
	98.76	
Water..	.88	"
	99.64	

Nepheline Rock (Monmouthite)—Township of Monmouth—Lot 1, *Con. VIII. (Third Variety).*

This consists essentially of nepheline and hornblende, the rock being practically free from feldspar. It is found in bands six feet or more in width, which bands may be traced for long distances on the strike. The rock is coarse in grain, the white nepheline and black hornblende being strongly contrasted on the surface of fracture. The hornblende in the case of the nepheline syenite has a tendency to run in streaks parallel to the course of the bands. On the weathered surface the rock is pale grey in colour and presents the smooth surface assumed by nepheline when exposed to the weather, the black hornblende standing out from it.

Under the microscope the rock is seen to consist essentially of nepheline and hornblende, with plagioclase, cancrinite, and calcite as accessory constituents, as well as sodalite, apatite, sphene, biotite, pyrite and iron ores, these latter minerals being present in extremely small amounts.[1]

The nepheline occurs in large well-defined grains, presenting the usual characters displayed by the species. It is clear and fresh.

[1] F. D. Adams.—On a New Nepheline Rock from the Province of Ontario, Canada. Am. Jour. of Sci., April, 1904.

The hornblende is green in colour, the pleochroism and absorption being as follows:—$\mathfrak{a}$ = pale greenish yellow. $\mathfrak{b}$ and $\mathfrak{c}$ = very deep green. The absorption is $\mathfrak{c} = \mathfrak{b} > \mathfrak{a}$. The maximum extinction observed in the sections of the rock was 19°. It is an alkali hornblende, containing less iron than hastingsite, but like it, as shown by the calculation of the analysis of the rock, belonging to the division of the syntagmatites.

The plagioclase is present only in very small amount and is in some cases untwinned, while in other cases it shows a faint, polysynthetic twinning. In thin sections it bears a very close resemblance to the nepheline, and when untwinned it is difficult in all cases to distinguish the two minerals. When a section is treated with acid and etched, however, the plagioclase is seen to occur in individuals of a more or less rounded form, or with curving outlines, lying between the nepheline grains or enclosed in the latter. The feldspar isolated from another variety of the rock in the same occurrence was found to be albite, and this feldspar has, therefore, been taken as albite in calculating the mode of the rock.

The amount of cancrinite present varies very considerably in different specimens of the rock. In the specimen analyzed about 5 per cent was found. In other specimens more is found, although in no case is it very abundant. It is clear and colourless, but is at once distinguished from the nepheline when examined between crossed nicols by its much higher polarization colours, which in thin sections frequently rise to a blue of the second order. It is free from interpositions, and in convergent light is seen to be uniaxial and negative. It also shows a slight but distinct dispersion of the bisectrices, giving a brownish and a bluish tint on either side of the position of maximum extinction. When separated by Thoulet's solution, the mineral was found to have a specific gravity between 2.44 and 2.48, and to be readily decomposed when heated with dilute hydrochloric acid, with the evolution of carbonic dioxide, and with subsequent gelatinization. The cancrinite occurs in the nepheline in the form of narrow strings or more rarely in little bunches of grains. These usually follow the course of minute cracks or cleavage lines, but also are frequently seen to follow the boundaries of individual grains of nepheline on their contact with grains or other minerals. Thus between crossed nicols they appear as a brilliant edging about hornblende individuals or about calcite inclusions in the nepheline, the small prismatic individuals of cancrinite being arranged with their longer axes at right angles to the contact or to the course of the crack, as the case may be. The cancrinite has the appearance of being an alteration p duct of the nepheline.

Calcite occurs in large single individuals, which are found as clusions in both the hornblende and the nepheline. The single dividuals are often perfectly circular in outline, and the enclosing mine is perfectly fresh and unaltered and is sharply defined against them. other cases the same large calcite individuals lie between the other co stituents of the rock, in all cases having the character of inclusio They generally show very marked strain shadows, while the other co stituents show but little or no evidence of pressure phenomena.

The apatite is found as occasional more or less rounded individu enclosed in the nepheline or hornblende, but, like the other access constituents, merits no special description.

An analysis of the rock made Mr. M. F. Connor, B.Sc., gave t following results:—

SiO_2	39.74
TiO_2	.13
Al_2O_3	30.59
Fe_2O_3	.44
FeO	2.19
MnO	.03
CaO	5.75
MgO	.60
K_2O	3.88
Na_2O	13.25
CO_2	2.17
SO_3	trace
Cl	.02
S	.07
H_2O	1.00
	99.86

If following the methods of the Quantitative Classification, the norn of the rock be calculated, that is to say the proportion of standar minerals which would give a magma of this composition, or in the forn of which the rock under other conditions of cooling might have solidified this is found to be as follows:—

Anorthite	12.51
Nepheline	67.72
Leucite	8.28
Olivine	3.70
Akermanite	.40
Magnetite	.70
Ilmenite	.30
Pyrite	.14
Calcite	4.92
	98.67
Water	1.00
	99.67

This gives the rock the following position in the Quantitative Classification:—

Class I	Persalane.
Order 8	Ontarare.
Rang 2	(Domalkalic).
Sub-rang 4	(Dosodic).

As this is the first Ontarare which has been described, the rangs and sub-rangs have received no names as yet. It is proposed, therefore, to call rang 2 Monmouthase, and sub-rang 4 Monmouthose, from the township of Monmouth in which this rock is found, while, as an ordinary designation, the name **Monmouthite** may be applied.

The mode, or actual mineralogical composition of the rock, is quite different from the norm, as given above, no leucite, anorthite, olivine, or akermanite being actually present. The mode is abnormative to a striking degree.

The mode is as follows:—

Albite	1.83
Nepheline	72.20
Sodalite	.28
Cancrinite	5.14
Hornblende	15.09
Hematite	.50
Calcite	3.12
Pyrite	.14
	98.30
Water	.50
Excess of Al_2O_3	1.20
	100.00

[1] See Quantitative Classification (loc. cit.), p. 150.

e this coarse pegmatitic development and consist of albite, nd black mica. Their exact mode of occurrence cannot in : seen on account of the drift which surrounds them, but on half of lot 32, con. III, this same development of the rock is ng the limestone in the form of great dykes; while on lot 32, ; is seen in dykes of the same character, penetrating the gabbro ng abruptly across the course of its foliation. These dykes on on. III, hold included masses of limestone, very coarse in grain, of zircon, dark reddish brown in colour, over an inch in dia- ind each consisting of a double tetragonal pyramid, were also in these dykes, as well as crystals of apatite.

he dykes on lot 32, con. II, in some cases become extremely coarse ain. A specimen obtained from one of them consisted of a pyra- l mass of nearly pure nepheline, which measured 14 inches on the and was composed of individuals of this mineral from three to five es in diameter. The nepheline is in places slightly streaked with alite, and on the weathered surface shows in places irregular-shaped ities which represent spaces from which masses of calcite have been solved.

An important area of nepheline syenite is that which runs across on IV, from lot 27 to lot 32. It is very well exposed on lot 30, con. IV, n the property of Mr. Archibald McColl. The greater part of this mass consists of a light grey, well foliated nepheline syenite, containing a hornblende resembling hastingsite. A specimen of this rock, which was examined microscopically, was found to be composed of microcline, albite, nepheline and hastingsite, with a little microperthite. Both microcline and albite are present in large amount. Inclusions of the former were observed in the nepheline. The rock is quite fresh and has the almost allotriomorphic structure usually seen in these foliated nepheline syenites. In addition to this, which may be called the normal development of the rock, there are on the same lot other varieties. One of these is a very coarse pegmatitic phase of the rock like that forming dykes on lot 32, con. II, but even coarser in grain. One exposure of this is seen not far from Mr. McColl's house and has been opened up by blasting. Here the rock consists essentially of nepheline and albite, with occasional individuals or small masses of coarsely crystalline cal- cite. The iron-magnesia constituents are present in very small amount, and are over large surfaces entirely absent. They are represented chiefly by a black mica. A black hornblende, probably hastingsite, as well as a white mica and a little pyrrhotite were also observed. The rock con- tains masses of pure nepheline as much as a yard in diameter.

In fact, so far as can be ascertained no nepheline rock so coa grain has hitherto been discovered anywhere. Sodalite is also p in the rock in places, occurring in irregular shaped masses som as much as two inches in diameter, included in the large mas nepheline and having apparently been derived from them by som cess of alteration. The relation of this pegmatitic developme the normal variety of the rock cannot be ascertained with certain the contact is covered by drift. A true quartz orthoclase pegmatite, ever, occurs protruding through the drift in the immediate vicini the occurrence just described and in such a position as to suggest it is a differentiation product of the same magma. A reddish sy containing some biotite, and similar to that found in so many pa the area in association with the nepheline syenites is also exposed i immediate vicinity.

Another important and interesting occurrence is that which i form of a comparatively narrow band is exposed at intervals alon Monck road to the east of the village of Gooderham on cons. V. an from lot 29 to lot 35, and then curving north with the strike o country rock extends to the front of con. VIII. Just to the nort the road, on lot 29, con. V, the rock is seen as a pale gray granular s ite containing in places a little nepheline and also holding a small am of black mica. So closely does it resemble the crystalline limes through which it cuts and to whose strike it conforms, that the rocks are with difficulty distinguished from one another by their pearance. On lot 31, con. VI, it is seen intimately associated with, occurring as schlieren in, the great quartz pegmatite masses which border and probably cut the granite gneiss. In places on this lot holds nepheline, although never in large amount.

IV. *The Nepheline and Alkali Syenites of the Townships of Harco Cardiff and Wollaston.*

The occurrences in these townships are of comparatively small tent.

In the township of Harcourt, on lot 15, of concession I, there i fine exposure of the nepheline rock in a cutting on the Irondale, B croft and Ottawa railway. It is bounded on the north by the heavy ba of crystalline limestone which sweeps around the northern end of Cardiff bathylith, the limestone being seen just north of the railw track in large exposures consisting of nearly horizontal beds. The lin stone here is nearly pure and free from admixture of silicates, but some bands is dolomitic. The nepheline rock appears to form a narr selvage along the southern side of the limestone and can be traced to the west across the neighbouring lots. To the south the relations of the syenite to the granite of the bathyliths are obscured by drift. The nepheline syenite has a banded structure, some bands consisting of almost pure nepheline, while in others the iron-magnesia constituents preponderate; there is also in many cases a variation in size of grain in different bands. Masses of coarsely crystalline calcite, evidently fragments from the adjacent limestones, are occasionally found as inclusions in the nepheline syenite, the nepheline and other constituent minerals of the syenite growing into these inclusions, as if the limestone was being replaced by them. Under the microscope the rock is seen to be composed essentially of nepheline and a deep green hornblende allied to hastingsite. The relative proportions of these two minerals vary in different slides. A considerable amount of calcite is present in large individuals with irregular and usually curved outlines, which lie between the other constituents of the rock. A plagioclase feldspar and microperthite are present in very subordinate amount, together with a few rounded grains of sphene. The structure of the rock is allotrimorphic. None of the constituents possess any approach to good crystalline form, but come together along curved or straight lines and are quite irregular in shape.

About four miles to the east of this occurrence and associated with the same band of limestone, Dr. Miller ([1]) has observed a mass of white syenite carrying brown corundum. The rock is stated to form a hill about half a mile east of Leafield Post Office in the north-east corner of the township of Cardiff, and was also found at the roadside about half a mile south-east of the same point. Some of the syenite in the hill has a quite strongly marked porphyritic structure. No description of this rock is given, but it is apparently free from nepheline and allied to the alkali syenites associated with the nepheline syenites in the township of Methuen and elsewhere in the area. This occurrence was not visited, but its position, as indicated by Dr. Miller, has been shown on the Bancroft sheet.

In the township of Wollaston, only a single occurrence of nepheline syenite is known, and this is a small one. It is found on the road which runs on the line between the townships of Wollaston and Faraday, on lot 9. On account of the fact that the country here is rough, the road does not follow the exact line on which it is supposed to be laid out, but winds to and fro across the boundary. On lot 9, at the point where the nepheline syenite occurs, it bends to the south and is almost exactly on

---

[1] Report of the Ontario Bureau of Mines, Vol. VIII, page 216.

the boundary. The occurrence, therefore, probably lies partly in] day and partly in Wollaston. Its position, however, is here tak lot 9 of con. XVI of Wollaston. The mass is peculiarly situated, i ing as it does a solitary exposure only twenty feet across, surround gabbro diorite. (1) The nepheline syenite has a more or less well m banded character and is usually coarse in grain. The relative abun of the constituents varies more or less in different parts of the ma

Under the microscope the rock is seen to consist essentially of n line, plagioclase and biotite, while microcline, calcite, magnetite, p apatite and zircon(?) occur as accessory constituents. The b usually occurs in rather large irregular-shaped individuals which strongly pleochroic in colours, ranging from a pale yellow to a very brown, basal sections being nearly black. It is sometimes found joining or partially surrounded by magnetite or chlorite, this l mineral clearly showing its derivation from the biotite. The plat biotite are frequently twisted. The prevailing feldspar is an a which, with the nepheline, in some places makes up the entire rock. a rule it is fresh, occurring as large individuals and smaller grains, c showing fine polysynthetic twinning, the lamellæ being distinctly ben some cases and the mineral often showing strain shadows. Micro is present in small amount and microperthite intergrowths are comm The nepheline forms large irregular individuals, frequently cracked very turbid, this turbidity being due to incipient decomposition. clusions of small rounded grains of plagioclase and untwinned felds as well as of calcite and biotite, are frequently found in the nephel Calcite is always present and is often abundant, occurring in large dividuals. The shape of the grains indicates that it is derived f limestone inclusions. The twinning lines of the calcite are often cur in a striking manner. Both magnetite and pyrite occur in sn amounts, the former being much more abundant. The pyrite in one two cases is found partially altered to hematite, while magnetite fo a border around it. Little zircons (?) and a few grains of apatite p sessing good crystallographic outlines are present in the sections. T curved individuals of biotite, plagioclase and calcite, and strain shado suggest that the rock has been subjected to great pressure.

A separation of the constituents of the rock was made by means Thoulet's solution, which showed that the feldspar present was alm exclusively albite, the potash feldspar present being quite subordin in amount but white in colour like the albite, and thus not

[1] A somewhat similar occurrence has been described by Ransome in case of a nepheline syenite at Brockville, N.J., Am. Jour. of Sci., 1899, p.

be distinguished from it in hand specimens of the rock. One curious fact in connection with this rock is that, while the nepheline syenite contains numerous large grains of calcite, which from analogy with other occurrences would naturally be regarded as derived from the disintegration of included masses of limestone, no limestone was found within a mile of the exposure. So that, while there may be inclusions of limestone hidden by the forest which mantles much of the surrounding district, the small body of nepheline syenite seems to occur as an isolated mass within the great body of diorite which underlies the north-eastern corner of Wollaston.

V. *The Nepheline and Alkali Syenites of the Township of Methuen.*

These rocks in Methuen are confined to a single occurrence which, however, is large, and forms the most striking topographical feature in the township. This is what is known as the Blue Mountain, a ridge which, rising abruptly from the level country about the middle of the township, stretches away to the south-west nearly to the Burleigh line, where it gradually sinks again to the level of the plain. It has an average height of somewhat over 200 feet above the waters of the Kashabog Lake which lies immediately to the south of it, but at its northern end becomes considerably bolder, reaching a height of 300 feet above the waters of the lake.

The ridge is formed of nepheline syenite associated with both the white and the reddish varieties of alkali syenite, while the surrounding country, as shown in the accompanying map, is underlain by amphibolites containing thin interstratified bands of crystalline limestone, both of which are cut by the granite-gneiss of the Methuen batholith.

The intrusive mass of the Blue mountain thus possesses a slender pear-shaped outline, being eight miles long and one and a half wide at its widest part, near the north-east end, while the narrow south-western part of the mass, where it runs through the township of Burleigh, has a width of only about 200 yards.

The Nepheline Syenite.— The normal nepheline syenite of this occurrence is best exposed on the north-east half of the Blue Mountain. It is light grey or white in colour and of medium grain, being characterized like all the syenites of this occurrence by a very low content of iron-magnesia constituents. In the central and highest portion of this north-eastern part, the rock is massive in character, but on either side the rock develops a more or less well marked foliation or parallelism of constituent minerals, which, however, is not very striking on account of the small proportion o magnesia constituents which the rock contains. The foliated appe is accompanied by a streaked or schlieren structure in the rock, coincides with the strike of the foliation, that is with the direction longer axis of the ridge. The streaks consist of portions of th which are coarser in grain than the normal rock or which contai constituents more abundantly developed.

Under the microscope the rock is seen to be very fresh and t sist of albite, microcline and nepheline, with which are associated i subordinate amount magnetite, biotite, hornblende, or very pyroxene. In some cases, but not usually, these two latter miner cur together. Occasionally muscovite occurs associated with an tially replacing the biotite. As accessory constituents garnet, lite(?) and zircon (?) were observed in very small amounts and in but a single specimen. The nepheline syenite in this townshi sents a variety which is highly feldspathic and rather poor in neph The feldspar is chiefly albite. This mineral is always well tw according to the albite law, and occasionally this mode of twinni combined with that according to the Carlsbad law. A series of mea ments of the extinction of this feldspar in sections in the zone o macropinacoid were made in slides of the rock from the highest poi the Blue mountain, and it was found that the maximum extincti either side of the twinning line was 16°. A separation of the c tuents by Thoulet's solution showed the feldspar to have a specific gr of very nearly 2.60. The feldspar is therefore albite. Similar se tions carried out on specimens collected on lot 18, con. VI an specimens of the various varietal differentiation products of the ro be mentioned below, show that the plagioclase present in the rock ways albite and that no feldspar more basic than this specimen (th having a specific gravity greater than 2.60) occurs in the rock.

The microcline is much less abundant than the albite, althou always occurs in considerable amount. There is, as a rule, from t four times as much albite as microcline present. The nepheli usually quite fresh, but occasionally shows traces of alteration. I curs in large, irregular shaped grains. It is on the whole about to the microcline in amount, but locally becomes the preponder constituent in the rock. The biotite is a very strongly pleochroic va $\mathfrak{a}$ = dark greenish brown, nearly black. $\mathfrak{c}$ = pale yellow. sorption $\mathfrak{a} > \mathfrak{c}$. The axial angle is very small. The hornbler hastingsite. The small individuals possess a fairly good cryst form, but the larger are irregular in shape, sometimes lying betwee feldspathic elements of the rock and sometimes enclosing them. It has an intense colour and a very strong pleochroism, as follows:—

$\mathfrak{a}$ = green with yellowish tinge. $\mathfrak{b}$ = deep green with bluish tinge. $\mathfrak{c}$ = deep green. The absorption is $\mathfrak{c} \gtrless \mathfrak{b} > \mathfrak{a}$. The dispersion is very strong and sections at right angles to the optic axes are nearly opaque. The extinction is high, probably about 30°. The magnetite occurs chiefly in large individuals scattered sparingly through the rock and usually possessing a rude crystalline form. The garnet, which was found in small amount in one specimen of the rock holding hornblende, is pale yellowish brown in colour and identical in all its characters with that occurring associated with the hastingsite in the Dungannon nepheline syenite from which the latter mineral was originally described.(1)

As has been mentioned, the rock often possesses a streaked or schlieren structure. The more coarsely crystalline streaks are usually composed of albite and nepheline—individuals of the latter mineral seven inches in diameter having been observed in one case. Sodalite was observed in association with this coarsely crystalline nepheline in a few places.

The rock has a granular texture with which the faint gneissic and the schlieren structures are combined—blocks of the rock thus resembling a somewhat impure crystalline limestone or marble. Under the microscope the structure is seen to be essentially allotriomorphic. In one case a minutely miarolitic structure was observed.

A fine development of the nepheline syenite is seen forming high white cliffs at the western end of Mountain Lake, on the north side of the lake, on lots 13 and 14, con. X of Methuen. The rock consists of about one-third nepheline and two-thirds feldspar and is almost free from iron-magnesia constituents.

In a rather more micaceous specimen of the nepheline syenite from the Blue Mountain, a short distance further east, on lot 15, con. IX of Methuen, a small quantity of spinel in little rounded individuals was observed in the thin sections. The occurrence of this mineral is of interest in showing that the magma here contained a slight excess of alumina, which separated in combination with magnesia as spinel, while, as mentioned below, the much larger excess of alumina in other parts of the mass separates out as corundum.

The White Alkali Syenite.—The nepheline syenite in places becomes rather fine in grain and poorer in nepheline, passing into a white syenite.

---

1 Adams, F. D. and Harrington, B. J.—On a new alkali Hornblende and a titaniferous Andradite from the Nepheline Syenite of Dungannon, Hastings County, Ontario.—Am. Jr. of Science, March, 1896.

One of the best developments of this white syenite is to be [f]
the summit of the ridge of the Blue Mountain, about the m[iddle of]
lots 13 and 14, con. X of Methuen, where it is seen in large ex[posures.]
Under the microscope it is seen to be composed chiefly of albite [with a]
considerable admixture of microcline and a very small amount o[f nephe-]
line. Muscovite and magnetite, both very subordinate in amo[unt, are]
the only other constituents. Its structure and the character of [the con-]
stituent minerals is identical with that of the nepheline syenite [already]
described.

A chemical analysis of a specimen of this rock which, howe[ver,]
contains a considerable amount of accessory nepheline, by P[rof.]
Norton-Evans of McGill University, gave the following result[s:]

SiO_2	59.68
TiO_2	none
Al_2O_3	23.48
Fe_2O_3	.59
FeO	.37
MnO	none
CaO	.26
MgO	.21
K_2O	4.68
Na_2O	9.52
P_2O_5	none
CO_2	.04
H_2O	.66
	99.49

The norm of the rock when calculated is found to be as follo[ws:]

Orthoclase	27.80	per cent.
Albite	49.25	"
Anorthite	1.25	"
Nepheline	16.76	"
Olivine	.45	"
Corundum	2.24	"
Magnetite	.93	"
	98.68	
Water	.66	"
	99.34	

The rock thus has the following position in the Quantitative Classification:—

Class I	Persalane.
Order 6	Russare.
Rang 1	Miaskase.
Sub-rang 4	Miaskose.

The mode of the rock, that is to say, its *actual* quantitative mineralogical composition when calculated out is found to be as follows:—

Orthoclase		16.12	per cent.
Albite	53.45	54.70	"
Anorthite	1.25		
Nepheline		18.18	"
Biotite		1.27	"
Muscovite		7.95	"
Magnetite		.93	"
		99.15	
Water		.28	"
		99.43	

The Reddish Alkali Syenite.—The reddish syenite is typically developed about a quarter of a mile to the west of the locality from which the white syenite, whose analysis has been given above, was obtained. The syenite is here traversed by the veins which are being worked for corundum. It is first seen to occur as streaks or schlieren in the white syenite, and then on going west it replaces the latter. The syenite here has a pale reddish or pinkish colour and is rather fine and even in grain. The iron-magnesia constituents, which are very subordinate in amount, occur in the form of little elongated dashes, giving a species of foliation to the rock. It is chiefly confined to the sides of the Blue Mountain mass, although not continuously developed about it.

Under the microscope the rock is seen to be composed essentially of albite and microcline. The twinning of the microcline is very narrow, and there is some untwinned feldspar which is apparently orthoclase. The only other minerals present are biotite, magnetite, pyrite, calcite and quartz. These occur intimately associated and form the little dark coloured dashes seen on the surface of fracture. They are all present in small amount, the magnetite often having a rude crystalline form. The calcite occurs in irregular-shaped individuals and is occasionally seen away from the dashes, lying between the feldspar grains. The quartz, like the calcite, does not occur in all sections, and when present, is found with the calcite in the form of rather large irregular-shaped grains. These two constituents may be secondary, although not ordinary decomposition products, for the rock is very fresh.

The rock has an allotriomorphic structure, approaching n character to the "mosaic" or "pavement" structure seen i morphic rocks.

The reddish colour is apparently due to very minute red clusions which occur in both feldspars indiscriminately, and wh sence in the other occurrences of the rock seems to be accomp the alteration of any nepheline which may be present to a pecul seckite-like aggregate. The reddish colour, in fact, seems to be d incipient alteration of the rock, which is chiefly seen about t of the mass.

A chemical analysis of the rock by Professor Norton-Eva the following results:—

SiO_2	65.89
TiO_2	none
Al_2O_3	19.73
Fe_2O_3	2.03
FeO	.75
MnO	trace.
CaO	.46
MgO	.27
K_2O	3.95
Na^2O	6.59
P_2O_5	none
S.	undet.
CO_2	.44
CO_2	.44
H_2O	.34
	100.45

The norm of the rock is as follows:—

Orthoclase	23.35	per cent.
Albite	55.54	"
Anorthite	2.22	"
Quartz	11.22	"
Corundum	3.77	"
Hypersthene	.70	"
Magnetite	2.32	"
Pyrite	.48	"
	99.60	
Carbonic acid and water	.78	"
	100.38	

The amount of pyrite is calculated by assuming that the excess of ferric iron over the amount required to form magnetite with the ferrous oxide, is united with sulphur.

The position of this rock in the Quantitative Classification is as follows:—

Class I..	Persalane.
Order 4..	Britannare.
Sub-rang 4..	Kallerudose.
Sub-rang 4..	Kallerudose. (near Nordmarkase).

If, however, the calcite be regarded as secondary and its lime be calculated as anorthite, on the supposition that it was really present in the original magma while the carbonate acid was not, this increase of salic lime will be just sufficient to carry the rock over into Order 5, and thus make it a Cànadare with the sub-rang Nordmarkose. Mineralogically it differs from the white syenite just described in containing no nepheline or muscovite, but in holding a little quartz. The *mode* of this rock is nearly normative—that is, the actual mineral composition is nearly that set forth in the norm. The hypersthene of the norm belongs to the biotite of the rock, the former mineral not being actually present. The calculation shows that there is really relatively more albite present in proportion to the orthoclase than would be supposed from a study of the thin sections. It also shows that there is rather more quartz present than would be expected from an examination of the hand specimens or the slides, and also that the rock must contain some free alumina in the form of corundum, although this mineral does not happen to occur in any of the thin sections of the rock from this particular locality, which have been prepared. As has been mentioned, however, corundum is found abundantly in the veins or dykes of syenite pegmatite which cut the rock at this locality. The occurrence of free quartz and corundum in the same igneous rock appears to be an anomaly. If, however, the quartz be secondary, the anomaly disappears.

Where this reddish syenite, a mile and a quarter to the south-west of the locality just described, crosses the road running from Lake Kashabog to Jack's Lake, on lot 6, con. XII of the township of Burleigh, it in places holds corundum in large amount. Under the microscope the rock is seen to consist of albite, microcline, orthoclase, biotite, muscovite and corundum. The albite preponderates largely in amount over the potash feldspars. Biotite is present only in very small amount, but there is a considerable percentage of muscovite in irregular-shaped individuals which have a tendency to a lath-shaped development and which, if they occur in groups, frequently penetrate one another and also penetrate the feldspars. The corundum occurs as individuals about inch long which are especially abundant in streaks following th of the rock. In the thin sections it is invariably seen to lie en in the muscovite, in the form of very irregular-shaped grains, or corroded in appearance. Each corundum grain has a single l dividual or muscovite enclosing it, or occasionally there are two smaller grains of corundum within the single muscovite individua look as if they had originally formed part of a larger individual muscovite outline often in a general way conforms to that of the dum core which it contains, as shown in figure.

The corundum has the usual high index of refraction and a refraction, which usually gives yellows and reds of the first order, some cases, even in good sections, gives a blue of the second orde has been mentioned elsewhere, the colours which the mineral gi thin sections are usually higher than would be expected, on acco the fact that, owing to its hardness, it always remains thicker finished section, than the minerals with which it is associated an be seen distinctly standing up from the surface, if the slide is exa before the cover glass is placed upon it. It often contains minute o black inclusions, which, in the basal sections, appear as irregularly r ed plates, but in sections parallel to the vertical axis of the crystal as In the last mentioned sections the extinction of the corundum is pa to the direction of the rods, so that the latter are inlaid parallel t base. It is impossible to determine from the thin sections wh there is a constant orientation in the case of the corundum and covite. In one case, however, the basal plane of the corundum, m by the inclusions, lay in the direction of the vertical axis of the en ing muscovite individual. In addition to the inclusions just menti the corundum occasionally encloses minute grains of a deep green tropic mineral which have the characters of spinel. And in one o cases, larger grains of this mineral are seen associated with the corun

Along the south-eastern side of the Blue Mountain, the re syenite crosses an arm of Kashabog Lake, and in most places holds a amount of a mineral which is now completely changed to a gieseckite alteration product. This is yellow on the weathered surface, b fresh surfaces of the rock it has a pale green or a pink colour. I a hardness of four and is quite dull and lustreless. A rough qua tive analysis of a specimen by Prof. O. E. Leroy, M.Sc., showed it to sess the following chemical composition:—

SiO_2, 45 p.c.; Al_2O_3 (with a little Fe_3O_2), 38 p.c.; MgO, 3.6 CaO, 2.2 p.c.; H_2O, 7.8 p.c; K_2O, not determined.

This represents the chemical composition of the aggregate known as gieseckite, which is an alteration product of nepheline commonly found in other parts of the world. Here also it evidently represents altered nepheline, for although in the pink syenite the change is always complete, no unaltered nepheline remaining in the rock, in the white variety of the syenite in a few places the nepheline can be seen in process of alteration into such an aggregate. A similar material is also produced by the alteration of the nepheline in a nepheline syenite in the township of Monmouth (see page 36).

As has been mentioned, both the nepheline syenite and the reddish alkali syenite frequently contain coarser-grained streaks or schlieren. In this respect they resemble many of the granites of other parts of this area. These coarser streaks usually coincide in direction with the foliation of the rock, but in some cases they are seen to cross the foliation of the syenite and even to penetrate the rock of the surrounding country. They are, in fact, the pegmatite phases of this nepheline syenite magma.

These pegmatites are composed of the same constituents as the normal rock, and in several places on and about the Blue Mountain they have been opened up by mining operations, in order to obtain the muscovite or corundum which they contain. The muscovite, which is a common constituent of the syenite, in some of these pegmatite dykes occurs in plates several inches in diameter; while the corundum which is often as has been mentioned, an accessory constituent in the syenite, in several of these dykes occurs in considerable amount. In these cases there must have been a concentration of alumina in the residual magma represented by the pegmatites in question. Those pegmatites, which are worked for muscovite and corundum, however, do not as a general rule here contain nepheline, or if this mineral be present, it is only a small amount and is often represented by gieseckite, and they are thus for the most part the pegmatitic developments of the alkali syenite, and usually have syenite for the wall rock.

The coarse corundum-bearing pegmatitic segregations worked for this mineral on the Blue Mountain vary in width from one to four or more feet. A striking feature presented by them is the form in which the corundum occurs, being usually found in rounded individuals, each having an irregular, though smooth, surface resembling that which might have been produced by solution. Each of these rounded individuals is found in the middle of a large individual of muscovite, both minerals being perfectly fresh and unaltered. Reference has already been made to this mode of occurrence on page 22.

The corundum is of a greenish-grey colour, often changing in the centre of the crystal. The colour suggests sapphire, l mineral is opaque or at best only translucent.

VI. *The Nepheline and associated Alkali Syenites of the towns Faraday, Dungannon, Carlow and Monteagle.*

It is unnecessary to describe in detail the numerous and ofte or less isolated occurrences of the nepheline and alkali syenites portion of the belt. They, however, present one point of espec terest, namely, the presence in them in many places and often i amount of the mineral corundum.

This mineral, while known to occur in considerable quan several localities, has been actually worked in two places only, of the more important is Craigmont. This occurrence, therefore, m special reference.

Craigmont (formerly Robillard Mountain) is a well marked graphical feature rising abruptly from Campbell's marsh (an exp of the York river) and extending as far west as the post road be Combermere and Fort Stewart. It covers most of the first four l the eighteenth and nineteenth concessions of the township of Rag the county of Renfrew, the line between these two concessions ru along the southern slope of the mountain. According to the me several observations with two aneroid barometers, the "moun rises to a height of 500 feet above the dam at the old mill on the which latter is ninety-five feet above Campbell's Marsh. This, to 931 feet, the height given by White[1] for the junction of the and Madawaska rivers, gives 1426 feet as the height of the top of (mont above mean tide-level.

The rock composing the mass of the mountain is a rather coloured hornblende-granitite-gneiss, evidently representative of gneisses of the great Laurentian bathylith.

The corundum-bearing rocks form a layer or mass of compara small thickness which occupies the whole face of the hill lying o barren gneiss of the Laurentian and coinciding in strike dip with the direction of the hill's face. This strik N75°E with a southerly dip at an angle of 10° to The main body of the hill behind this layer is the

[1] Altitudes in Canada, 1901, p. 199.

the ordinary fundamental gneiss presenting the usual characters. This layer of corundum-bearing rock consists of:—

(1) Nepheline syenite, in places passing into an almost pure nepheline rock;

(2) White or grey alkali syenite;

(3) Fine grained pinkish alkali syenite like that found in the township of Methuen and elsewhere, frequently having a streaked character.

These three rocks often occur interbanded with one another and frequently pass into one another. In some places the red syenite can be seen to cut across the nepheline syenite.

All these rocks locally hold corundum in abundance. In some places bands of a dark micaceous rock conforming to the dip and strike are seen associated with the syenite; these, however, in certain occurrences can be distinctly seen to consist of altered basic dykes.

It is also to be noted that the sloping face of the corundum-bearing rock dips to the south beneath the sandy plain at its foot, through which runs a branch of the York river. Along this stream and elsewhere limestone is exposed at several places, showing that in all probability these corundum-bearing rocks here as elsewhere lie at the contact of the intrusive bathyliths of gneiss with the limestones of the Grenville series.

The corundum workings at Craigmont take the form of five cuts or trenches running up the face of the hill in parallel lines. The mill in which the corundum is concentrated from these syenites was producing 305 tons of corundum per month in the summer of 1906.

Nepheline Syenite.

Typical specimens of two extreme phases of the nepheline syenite from this locality were selected for analysis, one of these being very rich in nepheline and the other being rich in plagioclase and containing proportionately less nepheline. Both varieties contain corundum in well defined crystals, often having a barrel shape, the long axes of which lie at right angles to the foliation of the nepheline syenite.

Corundum-bearing nepheline syenite (rich in nepheline).—When examined in thin sections this rock is seen to be composed of nepheline, oligoclase, muscovite, biotite, calcite, magnetite and corundum. Some of the nepheline is comparatively fresh, but most of it has undergone more or less alteration, the resultant products consisting of a brilliantly polarizing aggregate of minute scales of muscovite, developed along certain irregular lines and cracks. The plagioclase is likewise somewhat

turbid from incipient alteration. Only occasional very small s
biotite were noticed and still more rarely small grains of m
The corundum in the thin sections consists of irregular sha
parently corroded individuals embedded in plates and scales of m

An analysis of the nepheline rich variety by Mr. M. F.
B.Sc., of the Geological Survey, shows it to have the followin
position:—

SiO_2	48.38
TiO_2	trace
Al_2O_3	30.54
Fe_2O_3	0.40
FeO	0.06
MnO	trace
CuO	trace
CaO	1.87
MgO	0.19
K_2O	3.70
Na_2O	13.94
P_2O_5	trace
CO_2	0.62
H_2O	0.50
	100.20

If the norm of this rock be calculated, it will be found to
follows:—

Orthoclase	21.68
Albite	10.48
Anorthite	5.56
Nepheline	57.94
Corundum	1.63
Calcite	1.42
Hematite	.40
Fosterite	.35
	99.46
Water	.50
	99.96

This gives the rock the following position in the quantitative classification:—

Class I	Persalane.
Order VII	Tasmanare (near Ontarare).
Rang I	Laugenase.
Sub-rang II	Craigmontose.

It is a new type for which we propose the name Craigmontose (Craigmontite). The mode or actual mineralogical composition of the rock is somewhat different from the norm as given above. It is as follows:—

Nepheline	63.18
Oligoclase	29.66
Muscovite	4.39
Calcite	1.42
Corundum	.50
Biotite	.50
Magnetite	.10
	99.75

Corundum-bearing nepheline syenite (poor in nepheline).—An analysis of the second phase of the nepheline syenite, namely that rich in plagioclase and corundum, but containing less nepheline than that just described, was also made by Mr. M. F. Connor, B.Sc., and was found to have the following composition:—

Corundum (determined separately)	4.45
SiO_2	55.45
TiO_2	0.30
Al_2O_3	21.65
Fe_2O_3	0.81
FeO	0.49
MnO	0.01
CaO	3.65
MgO	0.13
K_2O	1.62
Na_2O	9.31
P_2O_5	0.01
CO_2	0.88
H_2O	1.64
	100.40

[illegible] of this rock are calculated it will be as follows:—

[illegible]	9.45
[illegible]	56.59
[illegible]	12.51
[illegible]	11.93
[illegible]	4.45
[illegible]	1.98
[illegible]	.70
[illegible]	.61
[illegible]	.30
[illegible]	.21
	98.73
[illegible]	1.64
	100.37

[illegible] following position in the quantit[illegible]

[illegible]	[illegible]
[illegible]	[illegible] near Tasmanar[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] we propose the name [illegible]

[illegible] composition of this rock, [illegible] being representa[illegible] [illegible] the main pr[illegible] [illegible] nepheline, [illegible] calc[illegible]

[illegible] and passe[illegible] [illegible] and in [illegible] It may therefo[illegible] a transition betw[illegible] the former. T[illegible] with those presen[illegible] are absent. The [illegible] character in different occurre[illegible] ɔite, oligoclase and andesine having been found. As in the case of the nepheline syenite, separate occurrences of the rock seem to be characterized by the presence of one variety of plagioclase to the almost complete exclusion of another. Plagioclase often makes up from 75 to 95 per cent of the whole rock, the other constituents being biotite, muscovite, calcite, magnetite, and occasionally corundum, scapolite and nepheline. Some extreme phases of this rock are made up almost entirely of plagioclase with little or no ferromagnesian minerals. When such rocks contain an excess of alumina which has crystallized out as corundum, they are very closely related to, if not identical with, the rock pulmasite described by Lawson.[1]

The specimen selected for examination as typical of this variety of rock was obtained, not from Craigmont, but from a large exposure of the rock on lot 12, con. XV of the township of Dungannon. It is worked for corundum at this locality, although some varieties of the corundum "ore" are richer in corundum. The rock is well foliated.

The corundum is by no means uniformly distributed through this rock, and large portions are completely barren of this mineral, while certain rather ill-defined areas on the other hand contain a very high percentage. In outcrops exposed to the weather the corundum is very conspicuous, weathering out with pronounced relief from the surrounding matrix. It occurs for the most part in small imperfect crystals and grains, although occasional, characteristic barrel-shaped hexagonal crystals are several inches in length. In freshly broken rock the corundum is scarcely noticeable, unless it assumes the prevailing and characteristic bluish colour. Many of the individuals have exceedingly rough and jagged outlines due no doubt to the removal of much of the associated micaceous material. Some of the individuals show rather perfect crystallographic development, but, for the most part, the mineral occurs in imperfect crystals or irregular grains. Much of the corundum shows the peculiar parting planes or pseudo-cleavage, especially those parallel to the faces of the rhombohedron and the base, both of which are perfectly developed. The colour is not uniformly distributed, but indefinite patches of white, blue and brown are often noticed. Most of the mineral has quite a distinct and often pronounced sapphire blue colour. Occasional fragments show a comparatively deep brownish colour arranged in parallel bands with well defined straight lines as boundaries. These brownish streaks alternate with others, which are nearly, if not quite colourless under the microscope. Some of the individuals have little

[1] Bull. Geol. Dept. of the University of California, Vol. III, No. 8, pp. 219-229.

PLATE 1

CORUNDUM-SYENITE

CRAIGMONT, ONT.

Hills of Nepheline Syenite, two miles east of Bancroft, Dungannon township.

PLATE 4

Nepheline Syenite Pegmatite—Township of Glamorgan, Lot 30, Concession IV.
Nepheline with Albite (standing out on weathered surface). The cavities in the surface of the Nepheline are caused by inclusions of calcite which have weathered out, x ⅔

PLATE 5

Crystals of Nepheline and Albite from Miarolitic cavity in Nepheline Syenite. Lot 25, Con. XIV., Dungannon township. (Block measures 26 inches in length).

PLATE 6

Crystal of Corundum (measures 7 x 2½ inches) showing Muscovite developed along basal parting plane.
Craigmont, Raglan township, Ontario.

PLATE 7

Curved Crystal of Apatite in Nepheline Syenite with Calcite
Lot 25, Con. XIV—Dungannon township.

PLATE 8

Crystals of Magnetite from Nepheline Syenite. Lot 30, Con. XV.—Faraday township.
(Larger crystal weighs 7¼ lbs.)

Monmouthite—Township of Monmouth, Lot 11, Concession VIII.
Nepheline with subordinate Albite (white) and Hastingsite (black) x ½

PLATE 10

Nephelme Syenite (x58 diam.) Lot 32, Con. VI.
Township of Glamorgan.

Biotite, Microcline and Nepheline.

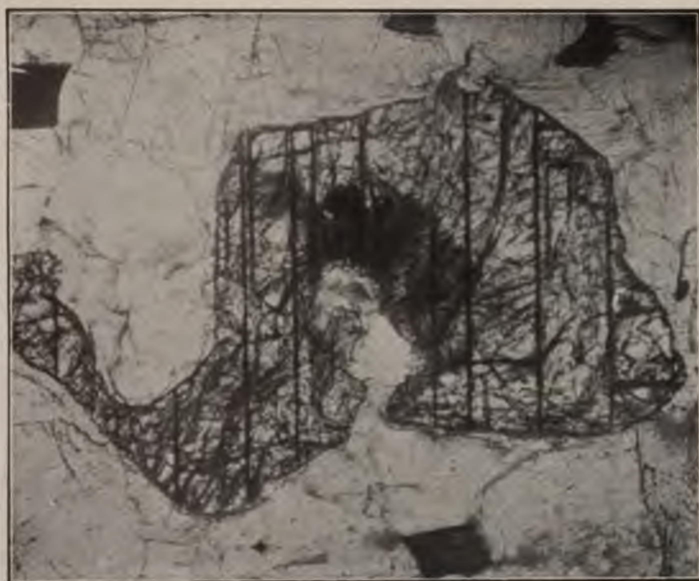
The section shows two grains of Calcite, one lying between the Biotite and Nepheline and the other (at the edge of the slide) enclosed in the Microcline. All the minerals are absolutely fresh and show no trace of decomposition products.

Corundum enclosed in Muscovite.

From Red Alkali Syenite just west of Blue Mountain, Township of Methuen, Ont. (x50 diam. between crossed nicols).

CORUNDUM IN MUSCOVITE
(BLUE MOUNTAIN, METHUEN TOWNSHIP, ONTARIO)
CORUNDUM IS OFTEN SURROUNDED BY A "CORONA" OR MANTLE OF MUSCOVITE.

O. E. PRUDHOMME, DEL.



Corundum—Showing planes of parting, with Andesine, Biotite and Muscovite.
Lot 12, Con. XV.—Dungannon township. (x40 diam.)

Corundum with Muscovite, Biotite and Plagioclase.
Lot 2, Con. II.—Monteagle township. (x40 diam.)

CRYSTAL OF CORUNDUM IN SYENITE PEGMATITE. THE SYENITE PEGMATITE OR FELDSPAR MATRIX FILLS IN THE BASAL CRACKS.

CRAIGMONT, RAGLAN TOWNSHIP, ONTARIO.

D. E. PRUDHOMME, DEL.

Nepheline Syenite showing regional foliation near York River bridge.
Lot 13, Con. XII—Dungannon township.

formed in addition to the corundum. This mineral was, however, not seen in the thin sections, nor was it found in any of the outcrops where this rock specimen was collected.

The norm of the rock is as follows:—

Quartz	1.26
Orthoclase	7.23
Albite	41.92
Anorthite	29.19
Corundum	13.46
Hypersthene	4.12
Magnetite	1.39
Calcite	.37
	98.94
Water	.84
	99.78

In calculating this norm from the chemical analysis, there was as shown an excess of 1.26 per cent of silica above that required and which appears in the norm as quartz. By direct experiment it was subsequently shown that most, if not all, of this silica was derived from the agate mortar and pestle which was used in grinding the sample. There is no free silica or quartz shown in the thin sections, nor was any of this mineral found in the separation of the rock by means of the heavy solution.

The mode or actual mineralogical composition cannot be calculated with certainty on account of the presence of the two micas and the scapolite, the latter having about the same formula as the feldspar. The corundum, magnetite and calcite are normative, i. e., they are present essentially in the percentages given in the norm. From an inspection of the slides the following would seem to be a very close approximation tc the mineralogical composition of the rock:—

Andesine (near Ab_3An_2)	72.00
Nepheline	3.00
Scapolite	2.00
Corundum (by trial)	13.24
Biotite	5.00
Muscovite	3.00
Magnetite	1.39
Calcite	.37
	100.00

Owing to the large percentage of corundum present, the rock is a very peculiar and unusual one, and represents a new sub-class, order, rang and sub-rang in the Quantitative Classification. We accordingly propose the following names for the new order and rang, and the name Dungannonite for the rock itself:

Class I..	Persalane
Sub-class II (Section I)..	Dosalone
Order 5..	Indare
Rang 3..	Dungannonase
Sub-rang 4..	Dungannonose

An analysis of the andesine occurring in the rock was made by Mr. M. F. Connor, B. Sc. This is given under I. The material for the analysis was obtained by separating the feldspar with Thoulet's solution. It was somewhat impure, owing mainly to the admixture of a small amount of biotite. This accounts for the iron, potash and magnesia found in the analysis. Neglecting these, the composition corresponds rather closely to that of an andesine with the formula Ab_3An_2. The specific gravity of a feldspar with this formula should be 2.68, while that of the andesine separated from the rock was 2.668. For purposes of comparison the theoretical composition of andesine corresponding with the generally accepted formula for plagioclase with the ratio of the soda to the lime of 1:1 (Ab_2An_1) is given under II, while under III the composition of andesine made up of albite and anorthite in the ratio of 3:2 is shown.

	I	II	III
SiO_2..	57.15	59.84	58.11
Al_2O_3..	26.74	25.46	26.62
Fe_2O_3+FeO	0.25		
MnO..	trace		
CaO..	6.66	6.97	8.34
MgO..	0.59		
K_2O..	0.38		
Na_2O..	6.83	7.73	6.93
Loss of ignition..	0.90		
	99.50	100.00	100.00
Specify gravity	2.668	2.671	2.680

regular or ragged scales, with strongly marked pleochroism and absorption. This brownish biotite has a distinct greenish tinge. The various cracks and fissures are filled with reddish brown iron oxide which also stains the orthoclase and microcline. The rock is younger than the nepheline syenite which it sometimes intersects, and decidedly later than the surrounding crystalline limestone. Its association with the nepheline syenite, however, strongly suggests that both are the products of the differentiation of a single magma.

A similar type of rock prevails along the southern slope of the hill at Craigmont in Raglan township. Its mode of occurrence, association and relations to the Laurentian gneisses as well as to the nepheline syenite have already been described. This reddish or pinkish rock frequently contains bands of a dark coloured, highly micaceous rock which may represent deformed and altered dykes of basic composition. In places masses and patches of almost pure hornblende occur. A specimen of the reddish highly feldspathic variety of the rock, with a distinct streaked appearance, owing to small ragged scales of biotite with more or less parallel arrangement, was analyzed by Mr. M. F. Connor, B.Sc., with the following results:—

SiO_2	56.05
TiO_2	0.47
Al_2O_3	17.02
Fe_2O_3	9.10
FeO	4.20
MnO	0.08
CaO	0.72
MgO	0.12
K_2O	5.12
Na_2O	6.10
P_2O_5	0.04
H_2O	0.36
	99.38

The ratio of $(CaO+K_2O+Na_2O)$	:	Al_2O_3	:	SiO_2
.162	:	.165		.934
1	:	1	:	5.7

microscope, is seen to be an irregular intergrowth of orthoclase and albite, the former feldspar being the more abundant. Associated with this microperthite are corundum, biotite, scapolite, calcite, magnetite, hematite (micaceous iron ore), molybdenite, pyrrhotite, chalcopyrite, chrysoberyl, spinel, and quartz. All these, with the exception of the first mentioned, occur as accessory constituents in certain places and are usually present in small amount. Although quartz and corundum are commonly supposed to be mutually exclusive, specimens have been found in which small quantities of both of these minerals are present.

An analysis of a typical specimen of the corundum syenite pegmatite from Craigmont was made by Mr. M. F. Connor, B.Sc., the results adjusted to a basis of 100 are given under I. For purposes of comparison the analyses of the corundum syenite pegmatite and of the corundum syenite from Nikolskaja Ssopka in the Urals, Russia, are included under II and III. (Tschermak's Min. und Petr. Mittheil., XVIII, 1898, p. 219). Under I (a) is given the analysis of I, omitting the corundum and recalculating it to a basis of 100. Under II (a) and III (a) are similarly included analyses of II and III, in which the corundum is omitted and the remaining constituents recalculated to a basis of 100. Under IV is an analysis of the separated microperthite from the corundum syenite pegmatite of Craigmont, Ont. Under V is an analysis of a similar feldspar from the corundum syenite pegmatite from Sivamalai, India (Mem. Geol. Surv., India, Vol. XXX, Part 3' 1901, p. 202).

	I.	II.	III.	Ia.	IIa.	IIIa.	IV.	V.
Corundum	34.62	35.40	18.55	....	....	....	....	....
SiO_2	40.53	40.06	52.34	62.30	62.71	64.65	63.43	63.26
Al_2O_3	13.62	13.65	16.05	20.93	21.37	19.83	20.78	21.87
Fe_2O_3	0.19	0.35	0.45	0.29	0.55	0.56	0.29	0.22
FeO	0.04	....	....	0.06	....	....	....	....
CaO	0.67	0.30	0.20	1.02	0.47	0.25	1.00	0.21
MgO	....	0.15	0.16	....	0.23	0.19	0.07	....
K_2O	5.92	5.20	6.58	9.10	8.14	8.14	8.00	3.09
Na_2O	3.40	3.71	4.77	5.23	5.81	5.89	5.20	10.25
H_2O	1.01	0.46	0.40	1.07	0.72	0.49	1.00	0.78
	100.00	99.28	99.50	100.00	100.00	100.00	99.79	99.68

behaviour, at once removes all doubt as to the pyrogenetic origin of the mineral, showing clearly, that it is one of the first products of the crystallization of a magma supersaturated with alumina and very poor in ferromagnesian minerals. The chemical analyses, as given above, are in remarkably close agreement with the law formulated by Morozewicz, as a result of direct experiments with artificial magmas, not only as to the conditions essential to the solution of alumina in such alumino-silicate magmas, but also with regard to the subsequent separation of all excess of alumina as corundum, as these solidify on cooling.

SUMMARY.

1. The nepheline and associated alkali syenites of this district present one of the most extensive developments of these rocks which is known. They form part of the Pre-Cambrian complex of the Canadian Shield, and occur along the border of the batholiths of Laurentian gneissic granite, where these cut the crystalline limestones of the Grenville series.

2. They differ from most occurrences of these rocks which have been described from other parts of the world, in that they have not usually the massive character of ordinary intrusives, but possess a distinct gneissic structure.

The gneissic or foliated structure which they usually display is combined with a schlieren or streaked structure, which gives rise in small exposures, to a banded appearance, the several bands differing in the relative proportion of constituents present. The foliation is not such as would be produced by the direct crushing of a massive rock. Cataclastic structures are very seldom seen, and the rock very rarely shows any distinct evidence of pressure. The arrangement of the component minerals, with their longer axes in the same direction, produces the foliation, while their variation in amount from band to band serves to emphasize it. The rock is, as a general rule, poor in iron magnesia constituents, and its appearance on the weathered surface so closely resembles that of the crystalline limestones of the Laurentian, which are often more or less impure from the development of secondary silicates in streaks and bands through them, that it is often impossible to tell the two rocks apart at a distance of a few yards.

3. The nepheline syenite magma throughout the area is one which was relatively very rich in soda. The plagioclase present is in most cases albite, but sometimes oligoclase or even andesine, and these feldspars preponderate largely over the orthoclase and are frequently the only feldspars which the rock contains. The rock furthermore differs from

5. All phases of this magma were in certain localities supersaturated with alumina, which when the magma was low in MgO and FeO, crystallized out as corundum, giving rise to several new rock types, three of which, Raglanite, Craigmontite and Dungannonite are described in this paper.

The development of corundum from these magmas follows the law established experimentally by Morozewicz in his researches on molten magmas.

6. Another striking feature presented by the nepheline syenites of the district under discussion is the frequent appearance of very coarse grained or pegmatitic developments of the rock. The constituent individuals are in many places a foot in diameter, while on the York branch of the Madawaska river, in the township of Dungannon, where this stream is crossed by the road running east from Bancroft, the rock contains individuals of nepheline two and a half feet in diameter, while masses of pure nepheline a yard in diameter are found in the nepheline pegmatite on lot 30 of range VI of the township of Glamorgan. These pegmatitic developments in some cases have the form of dykes cutting the normal nepheline syenite or some other rock, but elsewhere they are very coarse grained masses or " flammen " in the finer grained nepheline syenite, apparently of the nature of " contemporaneous veins " and correspond to the developments of pegmatite so often found in connection with granite.

7. The nepheline syenite occurs almost invariably along the border of the granite intrusions where they cut limestone. When the actual contact of the nepheline syenite and limestone can be seen, masses of the limestone, great and small, are found scattered through the nepheline syenite along the contact. These masses are in course of replacement by the magma, and at a distance from the contact are seen to be greatly reduced in size and often disintegrated. Still further from the contact they are represented by irregularly rounded grains of calcite lying between the perfectly fresh individuals of the several constituent minerals of the nepheline syenite, or, in some cases, actually as inclusions in these minerals.

8. For convenience of reference the twelve analyses of the nepheline and alkali syenites of this region which have been given in this paper are tabulated below. These include analyses of the four new rock types described.

	Syenite. (Phlegrose) Monmouth, Con. Lot.	Nepheline Syenite. (Essexose) Monmouth, Con. IX, Lot 16.	Nepheline Syenite. (Essexose) Monmouth, Con. VIII, Lot. 11.	Nepheline Syenite. (Vulturose) Monmouth, Con. VIII, Lot 11.	Monmouthite. (Monmouthose) Monmouth, Con. VIII, Lot 10.	Alkali Syenite. (Miaskose) Methuen, Con. X, Lot 13-14.	Alkali Syenite. (Kalleruose) Methuen, Con. X Lot 13-14.	Nepheline Syenite with Corundum (Craigmontose) Raglan, Craigmont.	Nepheline Syenite, with Corundum. (Raglanose). Raglan, Craigmont.	Alkali Syenite with Corundum (Dungannose) Dungannon, Con. XV, Lot 12.	Alkali Syenite with Corundum. (Umptekose) Raglan, Craigmont.	Syenite Pegmatite with Corundum, Raglan, Craigmont.
SiO_2	64.15	51.58	43.67	42.72	39.74	59.68	65.89	48.38	55.45	49.56	56.05	40.53
TiO_2	.....	.35	.78	.38	.13	none	none	Trace	.30	.....	.47	.....
Al_2O_3	19.04	19.40	20.91	25.08	30.59	23.48	19.73	30.54	21.65*	33.70	17.02	13.62 (°°)
Fe_2O_3	1.02	4.26	3.54	2.00	.44	.59	2.03	.40	.81	.93	9.10	.19
FeO	.93	[illegible].25	8.01	4.36	2.19	.37	.75	.06	.49	1.42	4.20	.04
MnO	.16	.20	.05	.16	.03	none	Trace	Trace (o)	.01	.....	.08	.....
CaO	1.37	3.64	7.37	6.92	5.75	.26	.46	1.87	3.65	5.89	.72	.67
MgO	.37	.49	1.46	.97	.60	.21	.27	.19	.13	.97	.12	.....
K_2O	7.10	4.23	2.25	2.69	3.88	4.68	3.95	3.70	1.62	1.23	5.12	5.92
Na_2O	5.37	7.49	6.73	11.02	13.25	9.52	6.59	13.94	9.31	4.95	6.10	3.40
P_2O_5	.10	.15	.11	.19	(A)	none	none	Trace	.01	.....	.04	.....
CO_2	.70	1.53	2.37	2.99	2.17	.04	.44	.62	.88	.17	.....	1.01
H_2O	.27	1.02	2.52	.88	1.00	.66	.34	.50	1.64	.84	.36	.....

II.—*Bibliography of Canadian Zoology for 1907.*

(Exclusive of Entomology)[1]

By LAWRENCE M. LAMBE, F.G.S.

(Read May 26, 1908.)

INVERTEBRATA.

CŒLENTERATA.

BROWNE, EDWARD T.

A Revision of the Medusæ belonging to the family Laodiceidæ.
The Annals and Magazine of Natural History, December, 1907, vol. 20, No. 120, pp. 457-480. (Reference is here made to certain Canadian Atlantic and Pacific species.)

PRINCE, E. E.

Professor Macallum on the Chemistry of Medusæ. A condensed résumé of results.
Further Contributions to Canadian Biology, being studies from the Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, pp. 121-128.

ECHINODERMATA.

CLARK, AUSTIN H.

A new species of Crinoid (Ptilocrinus pinnatus) from the Pacific Coast, with a note on Bathycrinus.
Proceedings of the United States National Museum, 1907, vol. xxxii, pp. 551-554, pl. liii, and three text-figures.
The species of *Ptilocrinus* was obtained by the United States Fisheries steamer " Albatross " off the coast of Moresby Island, Queen Charlotte Islands, B.C., in 1890.

CLARK, HUBERT LYMAN.

The Apodous Holothurians: A monograph of the Synaptidæ and Molpodiidæ.
Smithsonian Contributions to Knowledge, 1907, part of vol. xxxv, pp. 1-231, pls. 1-13.
(A number of species known from Canadian waters are included in this memoir.)

---

[1] Communicated by permission of the Acting Director of the Geological Survey of Canada.

EDWARDS, CHARLES LINCOLN.

The Holothurians of the North Pacific Coast of North America, collecte the "Albatross" in 1903.
Proceedings of the United States National Museum, September, 1 vol. xxxiii, No. 1558, pp. 49-68, with text figures 1-12.

HERRICK, C. JUDSON.

Review of Professor E. W. MacBride's paper on "Some Further Poin the Development of *Ophiothrix fragilis*."
Science, May. 1907, vol. xxv, No. 646, Zoology at the New Y meeting. II. pp. 776-777.

MACBRIDE, E. W.

The Development of Ophiothrix fragilis.
The Quarterly Journal of Microscopical Science, November, 1907, 51, pt. 4, pp. 557-606, pls. 31-36, and 4 text-figures.

MOLLUSCOIDEA.

CORNISH, GEORGE A.

Report on the Marine Polyzoa of Canso, N.S.
Further Contributions to Canadian Biology, being studies from Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fishe Fisheries Branch, 1907, pp. 75-80.

MOLLUSCA.

BARTSCH, PAUL.

A new Parasitic Mollusk of the Genus Eulima.
Proceedings of the United States National Museum, 1907, vol. x pp. 555-556, pl. liii.
(The new species of mollusk, *E. ptilocrinicola*, here described, discovered, parasitic on *Ptilocrinus pinnatus*, Clark, near the coast Moresby Island, Queen Charlotte Islands, B.C., at a depth of 1 fathoms.)

CLAPP, GEO. H.

Helix hortensis on Magdalen Isalnd.
The Nautilus, January, 1907, vol. xx, No. 9, pp. 105-106.

DALL, WILLIAM HEALEY.

A Review of the American Volutidæ.
Smithsonian Miscellaneous Collections, 1907, vol. xlviii, pt. 3, pp. 373.
(*Volutomitra grœnlandica* Beck (p. 372), is mentioned as occurring the coast of Greenland from Disco bay southward, and probably on the Labrador coast.)

DALL, WILLIAM HEALEY, AND BARTSCH, PAUL.

The Pyramidellid Mollusks of the Oregonian faunal area.
Proceedings of the United States National Museum, 1907, vol. xxxiii, pp. 491-534, pls. xliv-xlviii.
In this paper are described a number of new species of Turbonilla and Odostomia, from the Pacific coast of Canada, based principally on specimens from the collections of the Reverend George W. Taylor and Dr. C. F. Newcombe.

IVES, C.

Some notes on the Land, Fresh-water and Marine Mollusca of Prince Edward Island.
Prince Edward Island Agriculturist, Summerside, P. E. I., March, 1907.

WHITEAVES, J. F.

Notes on some Fresh-water Shells from Manitoba.
The Ottawa Naturalist, March, 1907, vol. xx, No. 12, pp. 239-240.

VERMES.

MONTGOMERY, THOMAS H., JR.

The Distribution of the North American Gordiacea, with descriptions of a new species.
Proceedings of the Academy of Natural Sciences of Philadelphia, June, 1907, vol. lix, pt. ii, pp. 270-272, text-figures 1-3.
(*Gordius villoti*, Rosa, and *G. platycephalus*, Montg., are recorded from Ungava.)

STAFFORD, J.

Preliminary Report on the Trematodes of Canadian Marine Fishes.
Further Contributions to Canadian Biology, being studies from the Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, pp. 91-94.

ARTHROPODA.

PILSBRY, HENRY A.

The Barnacles (Cirripedia) contained in the collections of the U. S. National Museum.
Smithsonian Institution, United States National Museum, Bulletin 60, 1907, pp. 1-122, pls. 1-xi, text-figures 1-36.
(Certain species that occur off the coast of Canada are here included.)

VERTEBRATA.

PISCES.

BURQUE, L'ABBÉ F. X.

Glanures d'Histoire Naturelle (Poissons-Lampes).
Le Naturaliste Canadien, December, 1907, vol. xxxiv, No. 12, p. 196.

CORNISH, GEORGE A.

Notes on the Fishes of Canso.
Further Contributions to Canadian Biology, being studies fr
Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fi
Fisheries Branch, 1907, pp. 81-90.

DACHY, ALPHONSE.

Les Poissons Rouges.
Le Naturaliste Canadien, December, 1907, vol. xxxiv, No. 12, p
191.

GILL, THEODORE.

Stone-gathering Fishes.
The American Naturalist, July, 1907, vol. xli, No. 487, pp. 468-4
(Reference is here made to Dr. Alfred W. G. Wilson's art
"Chubs' Nests" (Amer. Nat., May, 1907) observed on tribut
the upper Ottawa River.)
Some Noteworthy Extra-European Cyprinids.
Smithsonian Miscellaneous Collections, 1907, vol. xlviii, pt.
297-340, text-figures 36-102.
(Some of the species here included are referred to as occur
Canada.)

HALKETT, ANDREW.

Some Curious Facts about Fishes.
The Ottawa Naturalist, March, 1907, vol. xx, No. 12, pp. 229-2

KNIGHT, A. P.

A Further Report upon the Effects of Sawdust on Fish Life.
Further Contributions to Canadian Biology, being studies fr
Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fi
Fisheries Branch, 1907, pp. 37-54.
Sawdust and Fish Life.
Final Report by Professor A. P. Knight, Queen's University
ston, Ont., Idem, 1907, pp. 111-119.

M'CREADY, S. B.

Land-locked Trout of Gillies' Lake.
The Ontario Natural Science Bulletin, No. 3, 1907, p. 40.

NASH, C. W.

The Brook Trout.
The Farming World, May 15th, 1907, with figure.
The Black Bass.
Idem, July 1st, 1907, illustrated.

PRINCE, E. E.

The Eggs and Early Life History of the Herring, Gaspereau, Shad and other Clupeoids.
Further Contributions to Canadian Biology, being studies from the Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, pp. 95-110, with three plates.

The Local Movements of Fishes.
40th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, Special Reports, I, pp. lix-lxvi.
(Sessional paper, No. 22)

VINCENT, SWALE.

The Islets of Langerhans in the Elasmobranch Fishes.
Proc. Physiol. Soc., May 18, 1907.
Journ. of Physiol., vol. xxxv (with Mrs. W. H. Thompson).

WILSON, ALFRED W. G.

Chubs' Nests.
The American Naturalist, May, 1907, vol. xli, No. 485, pp. 323-327, with three text-illustrations.

AMPHIBIA AND REPTILIA.

COX, PHILIP.

Lizards and Salamanders of Canada.
Proceedings of Miramichi Natural History Association, 1907, vol. v, pp. 46-55.

MARCOTTE, LÉON.

Addition a notre Faune Batracienne.
Le Naturaliste Canadien, October, 1907, vol. xxxiv, No. 10, pp.155-157.

BIRDS.

ALLEN, E. C.

Nature Study Information.
I. A Simple Method of keeping Ornithological Notes.
II. Bird Observations for 1906, at Yarmouth, N.S.
Journal of Education, Nova Scotia, October, 1907 (I), pp. 184-186, (II) 186-190.

ALLAN, JOHN, JR.

A Nest of the Great Horned Owl.
The Ontario Natural Science Bulletin, No. 3, 1907, p. 38.

BEEBE, C. WILLIAM.

Notes on the Early Life of Loon Chicks.
The Auk, January, 1907, vol. xxiv, No. 1, pp. 34-41, pl. ii.

Bent, A. C.

Summer Birds of Southwestern Saskatchewan.
The Auk, October, 1907, vol. xxiv, No. 4, pp. 407-430, plates

Brooks, Allan.

A Hybrid Grouse, Richardson's + Sharp-tail.
The Auk, April, 1907, vol. xxiv, No. 2, pp. 167-169, pl. iv.

Brown, W. J.

Peculiar Nesting Site of American Bittern.
The Ottawa Naturalist, June, 1907, vol. xxi, No. 2, p. 50.

Chapman, Frank M.

The Warblers of North America.
D. Appleton & Co., New York, 1907, 8vo., p. 306, pl. 36.

Clarke, C. K.

The Gooseander in Ontario.
The Ontario Natural Science Bulletin, No. 3, 1907, pp. 30-31.

Criddle, Norman.

Nesting of the American Goshawk in latitude 49.42.
The Ottawa Naturalist, June, 1907, vol. xxi, No. 3, pp. 51-52.

Deane, Ruthven.

Unusual Abundance of the American Goshawk (*Accipiter atricapi*
The Auk, April, 1907, vol. xxiv, No. 2, pp. 182-186.
Great Gray Owl (*Scotiaptex nebulosa*).
Idem, April, 1907, vol. xxiv, p. 215.

Dedham, R. C.

Nest of the White-throated Sparrow near Woodstock.
The Ontario Natural Science Bulletin, No. 3, 1907, p. 39.

Eifrig, G.

Scarlet Tanager (*Piranga erythromelas*) at Ottawa, Canada.
The Auk, January, 1907, vol. xxiv, No. 1, p. 103.
Early Appearance of Certain Northern Species at Ottawa, Canada.
Idem, January, 1907, vol. xxiv, pp. 110-111.
Some Notes on Winter Birds.
The Ottawa Naturalist, February, 1907, vol. xx, No. 11, pp
Remarkably Early Arrival of the First Migrants of this Season.
Idem, May, 1907, vol. xxi, No. 2. pp. 35-37.
The Second Chapter in the Story of the Migration of Birds of Spring.
Idem, August, 1907, vol. xxi, No. 5, pp. 83-88.
The American Goshawk near Ottawa.
Idem, September, 1907, vol. xxi, No. 6, pp. 96-97.
American Goshawk (*Accipiter atricapillus*) versus Man and Barr
The Auk, October, 1907, vol. xxiv, No. 4, pp. 437-438.

FARLEY, F. L.

Dates of Arrivals of Birds at Camrose, Alta., in 1906 and 1907.
The Ottawa Naturalist, October, 1907, vol. xxi, No. 7, pp. 111-113.

FLEMING, JAMES H.

Birds of Toronto, Canada, part II, Land Birds.
The Auk, January, 1907, vol. xxiv, No. 1, pp. 71-89.
The Fulvous Tree-duck in British Columbia.
The Ottawa Naturalist, February, 1907, vol. xx, No. 11, p. 213.
The Disappearance of the Passenger Pigeon.
Idem, March, 1907, vol. xx, No. 12, pp. 236-237.
The Unusual Migration of Brünnick's Murre (Uria lomvia) in Eastern North America.
Proceedings of the Fourth International Ornithological Congress, London, June, 1905, forming vol. xiv of " Ornis " (published London, February, 1907), p. 528.

GALE, J. E., and ALLAN, J., JR.

Nest of the Myrtle Warbler.
The Ontario Natural Science Bulletin, No. 3, 1907, p. 38.

GREEN, J. ORNE.

September among the Game Birds of Miscou Island.
Bulletin of the Natural History Society of New Brunswick, 1907, No. xxv, vol. v, pt. v, pp. 553-558.

HUBEL, FREDERICK C.

Preliminary List of the Summer Birds of the Cobalt Mining Region, Nipissing District, Ontario.
The Auk, January, 1907, vol. xxiv, No. 1, pp. 48-52.

KLUGH, A. B.

The Golden-crowned Kinglet in Ontario in Summer.
The Ottawa Naturalist, June, 1907, vol. xxi, No. 3, p. 51.
The Spring Migration (of birds) on the Bruce Peninsula.
Idem, September, 1907, vol. xxi, No. 6, pp. 89-92.

MACCALLUM, G. A.

Wilson's Phalarope.
The Ottawa Naturalist, May, 1907, vol. xxi, No. 2, p. 38.

MACOUN, W. T.

An Interesting Observation on the Food Habits of the Yellow-bellied Sapsucker (*Spyropicus varius*).
The Ottawa Naturalist, December, 1907, vol. xxi, No. 9, p. 183.

MILLS, T. WESLEY.

A Short Chapter in Comparative Physiology and Psychology.
Proceedings and Transactions of the Royal Society of Canada, second series, vol. xii, 1906 (1907), section iv, pp. 291-300.

TOWNSEND, CHARLES W., and ALLEN, GLOVER M.

Birds of Labrador.
Proc. Boston Soc. Nat. Hist., vol. xxxiii, No. 7, pp. 277-428, pl. xxix (map), July, 1907.
Reviewed in The Auk, October, 1907, vol. xxiv, No. 4, pp. 451-452 by J. A. Allen.

TOWNSEND, CHARLES W.

Along the Labrador Coast. Illustrated. Boston, Dana Estes and Co., 1907.
Reviewed in the Auk, October, 1907, vol. xxiv, No. 4, p. 452 by J. A. Allen.

TUFTS, H. F.

Notes on some Seal Island (Yarmouth Co., N.S.) Birds.
The Ottawa Naturalist, September, 1907, vol. xxi, No. 6, pp. 93-95.

YATES, WM.

Natural History Notes.
Journal and Proceedings of the Hamilton Scientific Association, 1907, No. xxiii, pp. 110-119.

YOUNG, REV. C. J.

Notes on some Warblers of Eastern Ontario.
The Ontario Natural Science Bulletin, No. 3, 1907, pp. 25-28.

MAMMALS.

BOND, HERBERT.

Flying Squirrels.
The Ontario Natural Science Bulletin, No. 3, 1907, pp. 31-34.

BROOKS, ALLAN.

The Deer of British Columbia.
Canadian Magazine, October, 1907.

CRIDDLE, NORMAN.

Skunks as Destroyers of Poultry. Two personal experiences.
The Ottawa Naturalist, November, 1907, vol. xxi, No. 8, pp. 162-163.

GAUVREAU, EM. B.

Etude sur les Appendices Caudaux.
Le Naturaliste Canadien, August, 1907, vol. xxxiv, No. 8, pp. 113-125.

GOLDIE, ALEX.

A Mammal new to Wellington County.
The Ontario Natural Science Bulletin, No. 3, 1907, p. 40.
Records the occurrence of the Hairy-tailed Mole (*Parascalops breweri*).

MISCELLANEOUS.

ACLOQUE, A.

Quelques Questions Controversées.
Le Naturaliste Canadien, February, 1907, vol. xxxiv, No. 2, pp. 17-22.

HALKETT, ANDREW.

Report of the Canadian Fisheries Museum.
40th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, Appendix No. 14, p. 321-349.

OTTAWA FIELD NATURALISTS' CLUB.

Report of the Zoological Branch, 1906.
The Ottawa Naturalist, September, 1907, vol. xxi, No. 6, pp. 100-102.

PIERS, HARRY.

Report of Provincial Museum of Nova Scotia and Science Library for 1906 (1907).
(Herein is mentioned (pp. 8-9) additions to the museum of birds, batrachians, and a fish, *Tarpon atlanticus*, a southern species, for the first time recorded from Nova Scotian waters.

PRINCE, E. E.

Unutilized Fishery Products in Canada.
40th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, Special Reports, II, pp. lxvii-lxxxviii. (Sessional paper, No. 22.)

STAFFORD, J.

On the Fauna of the Atlantic Coast of Canada.
Further Contributions to Canadian Biology, being studies from the Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, pp. 31-36.

WHITEAVES, J. F.

Notes on two recent additions to the Zoological Collections in the Museum of the Geological Survey of Canada.
The Ottawa Naturalist, December, 1907, vol. xxi, No. 9, pp. 177-179.

WRIGHT, R. RAMSAY.

The Plankton of Eastern Nova Scotia Waters. An account of floating organisms upon which young food-fishes mainly subsist.
Further Contributions to Canadian Biology, being studies from the Marine Biological Station of Canada.
39th Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 1907, pp. 1-19 with seven plates.

III.—*Bibliography of Canadian Entomology for the Year* 1907.

Contributed by REV. C. J. S. BETHUNE, D.C.L.

(Read by title, May 27th, 1908).

AINSLIE, CHARLES N.

Notes on the swarming of a species of Crane-fly. (An account of the airy dance of a swarm of males of *Trichocera bimaculata*.) Canadian Entomologist, Guelph, Ontario, xxxix, 26-28, January, 1907.

ALDRICH, J. M.

The Dipterous genus Scellus, with one new species. (Two of the seven species reviewed are Canadian, *S. spinimanus* from Fort Resolution, Hudson's Bay Territory, and *S. monstrosus* from British Columbia.) Entomological News, Philadelphia, xviii, 133-136, April, 1907.

BANKS, NATHAN.

A Catalogue of the Acarina, or Mites, of the United States. (A useful list, with bibliographical references, of 450 species which have been chiefly found in the Eastern States and Canada.) Proceedings U. S. National Museum, Washington, xxxii, 595-625 (No. 1553), June, 1907.

BANKS, NATHAN.

New Trichoptera and Psocidae. (Descriptions of six Caddice-flies and six Psocids, one of the latter, *Elipsocus occidentalis*, being from Victoria, B.C.) Journal N.Y. Ent. Soc. xv, 162-166, September, 1907.

BANKS, NATHAN.

Descriptions of New Trichoptera. (Thirty new species of Caddice-flies are described, including one *Neuronia Canadensis*, from Guelph, Ont., and synoptic tables of genera and species are given.) Proc. Ent. Soc., Washington, viii, 117-133, three plates, August, 1907.

BANKS, NATHAN.

A list of Perlidae from British Columbia and Alberta. (Includes a Key to the genera of Stone-flies and descriptions of five new species.) Can. Ent., xxxix, 325-330, figures, October, 1907.

BARNES, WILLIAM.

New species of North American Lepidoptera. (Includes one species, *Cerma cuerva*, taken at Victoria, B.C.) Canadian Entomologist, xxxix, 10-15 (January, 1907); 64-68 (February); 93-98 (March).

BETHUNE, C. J. S.

Insects affecting Fruit-trees. (Treats of the species that are com met with and that year after year require attention on the part fruit-grower. The most effective remedies are given.) Bulleti Ontario Agricultural College, June, 1907; 36 pages, 50 figures. Pul by the Ontario Department of Agriculture, Toronto.

A second edition, in which is incorporated an account of the pr "Fungus Diseases affecting Fruit-trees," by Tennyson D. Jarvis, was by the Ontario Department of Agriculture, December, 1907; 48 pa figures.

BETHUNE, C. J. S.

Report of the Professor of Entomology and Zoology. 32nd Annual of the Ontario Agricultural College and Experimental Farm, 1906, pp

BETHUNE, C. J. S.

Injurious Insects of 1906 in Ontario. (Treats of a number of affecting garden plants and fruit and shade trees.) 37th Annual F Entomological Society of Ontario, 1906, pp. 45-56, figures.

BETHUNE, C. J. S.

Editorial Notes, Reviews, etc. Canadian Entomologist, Guelph, O xxxix, 1907; 37th Annual Report, Entomological Society of O Department of Agriculture, Toronto, 1907.

BIRD, HENRY.

New histories in Papaipema. (A continuation of a series of articl terrupted for some time, describing the habits and larval and other of many species of this genus of moths which were formerly included Hydroecia.) Can. Ent., xxxix, 137-141, April, 1907; 269-276, A 309-317, September.

BRADSHAW, GEORGE H.

A swarm of Butterflies. (An account of a late summer assembly Milk-weed, or Monarch, Butterfly, *Anosia plexippus*, observed at M Manitoba. Note by Dr. Fletcher and two figures.) Ottawa Natu xx, 211-213, February, 1907.

BREMNER, O. E.

The Ambrosia Beetle, *Xyleborus xylographus*, Say, as an orchard (Describes a serious attack upon healthy trees by this Scolytid b which was usually supposed only to injure those that are disease dying.) Can. Ent., xxxix, 195-196, June, 1907.

BUENO, J. R. DE LA TORRE.

On *Rhagovelia obesa*, Uhler. (A description of the remarkable str of the intermediate tarsi of this water-bug and some account of it habits.) Can. Ent., xxxix, 61-64, figures, February, 1908.

BUENO, J. R. DE LA TORRE.

On the Cornicles of the Aphidæ. (An abstract of a paper by Professor von Horvath of Buda-Pesth in which it is shown that honey-dew is excreted from the anus, and that the product of the cornicles is a viscous excretion which is a means of defence against insect enemies.) Can. Ent., xxxix, 99-100, March, 1907.

BUENO, J. R. DE LA TORRE.

Diplonychus, Laporte (=Hydrocyrius, Spinola) and its relation to the other Belostomatid genera. (A discussion of the systematic position of the various genera of this family of Water-bugs, with keys and descriptions of characters, bibliography, etc.) Can. Ent., xxxix, 333-341, October, 1907.

BUSCK, AUGUST.

Revision of the American Moths of the genus Argyresthia. (Gives a key to the species and full descriptions. Several are found in Canada, including *A. conjugella*, which attacks apples, and *A. thuiella*, the larva of which mines and destroys the terminal shoots of *Thuja occidentalis*.) Proceedings U. S. National Museum, Washington, xxxii, 1-24 (No. 1506), January, 1907. Three figures and two plates.

CAESAR, L.

How Insects are distributed. (A popular and interesting account of the various instrumentalities that produce the world-wide distribution of many kinds of insects.) Can. Ent., xxxix, 85-90, March, 1907.

CAUDELL, A. N.

The Deticinae (a group of Orthoptera) of North America. (An important paper on this difficult group. Twenty genera, fifty-nine species and ten varieties, many of which are new, are described, useful keys are given, and 94 figures of details and of the complete insect are furnished.) Proc U. S. National Museum, xxxii, 285-410. (No. 1530), May, 1907.

CAUDELL, A. N.

Kirby's Catalogue of Orthoptera. (A review of the second volume of this work, with notes on the genera and species occurring in North America.) Can. Ent., xxxix, 287-292, August, 1907.

COCKLE, J. W.

Notes on Breeding Lepidoptera. (Deal with Eggs and Larvae.) Bulletin of the British Columbia Entomological Society, Nos. 6 and 7, June and October, 1907.

COOK, JOHN H.

Studies in the genus Incisalia. (A series of papers giving full life-histories of several species of this genus of Butterflies, with plates in illustration of the different stages.) Can. Ent., xxxix, 145-149, (May, 1907); 181-187 (June); 229-235 (July); 257-260 (August); 293-295 (Sept.); 405-409 (December).

COOK, JOHN H., AND WATSON, FRANK E.

A new Butterfly of the genus Incisalia. (A full description of *I. po* comparison with other species of the genus.) Can. Ent., xxxix, : June, 1907; 235 (plate), July.

COOK, JOHN H.

In defence of Incisalia Henrici. (A reply to Dr. Henry Skinner's tion in Ent. News for April, that this species is the same as (*Thecla*) *irus*.) Journal of the New York Entomological Soci 123-128, September, 1907.

COOK, JOHN H.

A correction of some recent synonymy in the genus Thecla. (A Dr. Henry Skinner's contention in Ent. News for February, that *T.* and *Edwardsi* are the same species.) Journal N.Y. Ent. Soc., xv, September, 1907.

COOLIDGE, KARL R.

A review of the genus Chrysophanus. (Records the following sp these butterflies from Canada: *C. xanthoides*. Calgary; *dione*, M *thoe*, *epixanthe* and *hypophleas*, widespread; *mariposa*, British Co *helloides*, Vancouver Island; *dorcus*, northern British America ar rador; var. *dorus* only known from " Garrett's Ranch, British Ar *arethusa* Calgary; *Snowi* and *rubidus*, Alberta). Psyche, xiv, Dec., 1907.

CRAWFORD, J. C.

Notes on some species of the genus Halictus. (Comprises the Bee have no green upon them and which are found in the United Sta Canada. Tables for the identification of both sexes are given and species are described, one of which *H. Quebecensis*, is from Montreal Journal N.Y. Ent. Soc., xv, 183-189, December, 1907.

CRIDDLE, NORMAN.

Habits of some Manitoba " Tiger-beetles "—Cicindela. (A very int account of the habits of a number of species, especially of their me hibernation.) Can. Ent., xxxix, 105-114, April, 1907.

DOD, F. H. WOLLEY.

Notes on *Chrysophanus hypophlæas* and its allies, with description species. (*C. arethusa* is described and its relationship with *C. hy* and other forms discussed.) Can. Ent., xxxix, 169-171, May, 190

DENNY, E.

Notes on the collecting of *Sthenopis* (*Hepialus*) *thule*. (An accou capture of a number of specimens in the neighbourhood of Montre interesting species of " Ghost Moth.") Can. Ent., xxxix, 402-404, ber, 1907.

DYAR, HARRISON G., and KNAB, FREDERICK.

On the Classification of the Mosquitoes. (Two tribes are recognized, the Culicini and Sabethini; tables of the genera in each are given and a list of the American genera and the principal synonyms according to the views of the writers.) Can. Ent., xxxix, 47-50, February, 1907.

DYAR. HARRISON G.

Report on the Mosquitoes of the coast region of California, with descriptions of new species. (Several of the eighteen species recorded have been found in British Columbia, and others will probably be met with there.) Proc. U. S. National Museum, xxxii, 121-129 (No. 1516), February, 1907.

DYAR, HARRISON G.

The identity of *Brephos Californicus* and *B. melanis*. (A note on Prof. John B. Smith's article on the Brephidae in the preceding number.) Can. Ent., xxxix, 411, December, 1907.

DYAR, HARRISON G.

New American Lepidoptera. (Includes one new species of Geometer, *Pygmaena simplex* taken at Laggan, Alberta, the first record of the genus in America.) Journal N.Y. Ent. Soc., xv, 226-234, December, 1907.

EVANS, JOHN D.

A home-made and effective Insect-Trap. (A description with diagrams of a very successful method of collecting insects attracted by light.) Can. Ent., xxxix, 150-152, May, 1907.

EVANS, JOHN D.

List of Coleoptera taken by Prof. John Macoun along the line of the Grand Trunk Pacific Railway between Portage la Prairie, Manitoba, and Edmonton, Alberta, in 1906. Ottawa Naturalist, xxi, 98-99, September, 1907.

EVANS, JOHN D.

List of Coleoptera collected by Mr. J. M. Macoun in British Columbia. (Includes several species not previously recorded from Canada.) Ottawa Naturalist, xxi, November, 1907.

FELT, E. P.

Gall Gnats or Cecidomyiidæ. (An appeal for specimens of this family for the purpose of study. Figures are given of the wing-venation of four genera.) Can. Ent., xxxix, 143-144, April, 1907.

FLETCHER, JAMES.

Report of the Entomologist and Botanist. (Treats of the Insects affecting Cereals, Roots and Vegetables, Fruit Crops, Forest and Shade trees, throughout the Dominion. A full account of the occurrence of the Brown-tail Moth in New Brunswick and Nova Scotia.) Experimental Farms' Report for the year 1906. Ottawa, 1907, pp. 201-234, one plate and index.

The Oyster-shell Bark-louse, April 3.
The Brown-tail Moth, May 3.
Bed Bugs, May 22.
Grubs in Spruce Beams, July 31.
The Larder or Bacon Beetle, July 17.
The Larch Saw-fly, September 4.
Cabbage Worms, October 2.
The Bag-worm, October 16.

FLETCHER, JAMES, AND GIBSON, ARTHUR.

Notes on the Preparatory Stages of some species of Canadian Lepidoptera. (Contains descriptions of the egg and larval stages of eight species of moths.) Trans. Royal Society of Canada, Section IV. Volume i, 3rd Series, pp. 57-70, September, 1907.

FLETCHER, JAMES, AND GIBSON, ARTHUR.

Entomological Record, 1906. (The sixth annual publication of this most useful record of captures of new and rare insects made by collectors throughout the Dominion in the Lepidoptera, Coleoptera, Diptera, Hemiptera and Odonata. Valuable notes are included by Mr. W. D. Kearfott, Rev. G. W. Taylor, Mr. E. P. Van Duzee, Dr. E. M. Walker and Prof. J. G. Needham.) 37th Annual Report, Ent. Soc., Ont., 1906, pp. 86-104.

FLETCHER, JAMES, AND OTHERS.

Reports of the Entomological Branch of the Ottawa Field Naturalists' Club for 1906-07. Ottawa Naturalist, xx, 202-205, January, 1907; 243-246, March; xxi, 39, May; 65-67, July; 116-118, October.

FYLES, THOMAS W.

Hemiptera. (A popular account of some of the common bugs found in the Province of Quebec.) 37th Annual Report, Ent. Soc., Ont., pp. 73-78, figures.

FYLES, THOMAS W.

The Notodontidæ of the Province of Quebec. (Contains brief descriptions of a number of species.) 37th Annual Report, Ent. Soc., Ont., 1906, pp. 107-110, figures.

FYLES, THOMAS W.

In the tracks of *Nematus Erichsonii* Hartig. (An account of the destruction by this Sawfly of tamarack forests in the Province of Quebec.) 37th Annual Report, Ent. Soc., Ont., 1906, pp. 105-106.

GIBSON, ARTHUR.

Basswood, or Linden, Insects. (A continuation of the descriptive lists published in two preceding issues of the Annual Reports, increasing the number of species to one hundred and twenty-two.) 37th Annual Report, Ent. Soc. Ont., 1906, pp. 78-80.

HARVEY, R. V.

Bulletin of the British Columbia Entomological Society, Nos. 5-8, March to December, 1907. (Contains many interesting notes, lists of species, etc.) Victoria, B.C.

HARVEY, R. V.

Notes on the distribution of Insects in British Columbia. Bulletin of the B.C. Entomological Society, No. 5, pp. 1-2, March, 1907; No. 6, pp. 1-2, June; No. 7, pp. 2-3, October.

HARVEY, R. V.

Some of our Noctuidæ. Bulletin of the British Columbia Entomological Society, No. 5, p. 4, March, 1907; No. 7, pp. 3-4, October; No. 8, p. 4, December.

HERRICK, GLENN W.

Fumigation with Hydrocyanic Acid Gas for Bed-bugs. (Describes the successful methods adopted to get rid of these insects infesting large buildings.) Can. Ent., xxxix, 341-345, October, 1907.

HINE, JAMES S.

Records of Diptera from Lake Temagami, Ont. (A list of 27 species, with a description of *Mesembrina mystacea* a European Muscid). Can. Ent., xxxix, 98-99, March, 1907.

HOWARD, L. O.

A new Canadian species of Copidosoma. (A Chalcid parasite of the larvæ of *Anacampsis lupinella* which is described under the name of *C. Lymani.*) Can. Ent., xxxix, 102-103, March, 1907.

HUARD, V. A

De la Chasse aux Insectes. (Continuation of a series of popular papers instructing beginners how to form a collection of Insects.) Le Naturaliste Canadien, xxxiv, 33-37, Mars, 1907.

HUARD, V. A.

Ce qu'est l'Entomologie—A quoi elle sert. Le Naturaliste Canadien, xxxiv, 53-58, Avril, 1907.

HUARD, V. A.

Entomologie. (A series of papers dealing with the structure, anatomy, etc., of Insects.) Le Naturaliste Canadien, xxxiv, 70-74, Mai 1907; 88-93, Juin; 150-155, Oct.; 172-176, Nov.; 179-185, Decembre, figures.

HUARD, V. A.

La Chenille d'un Papilio. (A description with figures of the caterpillar and chrysalis of *Papilio turnus.*) Le Naturaliste Canadien, xxxiv, 129-132, Sept., 1907.

JARVIS, C. D.

A new pest of the Apple. (A brief description with figures o leaf Miner, *Tischeria malifoliella*, Clemens, which has recei destructive in Ontario and the adjacent northern States.) T Horticulturist, xxx, 26-27, February, 1907.

JARVIS, TENNYSON D.

Two insects affecting Red Clover-seed production. (Describe and loss caused by the Clover-seed Midge, *Cecidomyia legun* on the other hand the good work effected by Bumble Be pollination of the flowers.) 37th Annual Report, Ent. Soc., Or pp. 41-45.

JARVIS, TENNYSON D.

Insect Galls of Ontario. (A descriptive list of a large numl produced by Mites and Insects of various orders found by tl this Province.) 37th Annual Report, Ent. Soc., Ont., 1906, six plates.

JARVIS, TENNYSON D.

The Locust Mite. 37th Rep., p. 111, figs.
The Oyster Shell Bark-louse.. 37th Rep., pp. 111-116, fig from Can. Ent.. 1906.

JOHNSON, CHARLES W.

Some North American Syrphidæ. (Critical and descriptive no species and their variations. *Pipiza femoralis* and *festiva* a from Canada, and also *Chrysotoxum ventricosum*, *derivatum* and j Psyche, xiv, 75-80, August, 1907.

JOHNSON, CHARLES W.

A review of the species of the genus Bombylius of the East States. (Describes three new species and gives a key to ten t region referred to; several of these are found in Canada.) I 95-100, October, 1907.

KEARFOTT, W. D.

New North American Tortricidæ. (Includes descriptions of : species from Ontario and a large number from the North-Wes and British Columbia.) Trans. of the American Entomologi Philadelphia, xxxiii, 1-98, February and March, 1907.

KEARFOTT, W. D.

New Micro-Lepidoptera. (Includes a number of species taken parts of Canada from the Province of Quebec to British Colum Ent., xxxix, 1-9 (January, 1907); 53-60 (February); 77-84 (Marc (April); 153-160 (May); 211-212 (June).

KNAB, FREDERICK.

Culicid characters. (A criticism of Miss E. G. Mitchell's paper on the Classification of the Culicidæ in the June number.) Can. Ent., xxxix, 349-353, October, 1907.

LOCHHEAD, W.

The Oyster-shell Scale. (A brief account of the life-history of the insect and instructions for dealing with it.) Can. Horticulturist, xxx, 53-54, March, 1907. One figure.

LYMAN, H. H.

A hunt for a Borer. (Gives an interesting account of an effort to find and rear the larvæ of *Hydroecia appassionata*, which feed on the roots of the Pitcher Plant.) 37th Annual Report, Ent. Soc., Ontario, 1906, pp. 39-41.

LYMAN, HENRY H.

Further notes on the occurrence of *Hepialus thule* Strecker, at Montreal. (An interesting account of the pursuit of this remarkable species of "Ghost Moth.") Can. Ent., xxxix, 397-400, December, 1907.

LYMAN, HENRY H.

Thecla calanus and *Thecla Edwardsii*. (A contention, supported by the literature bearing upon the subject, that these forms are distinct species.) Ent. News, xviii, 420-425, December, 1907.

MATHESON, ROBERT.

The life-history of *Apanteles glomeratus*. (A description of the habits of this parasite of the Cabbage Butterfly, *Pieris rapæ*, and its mode of attacking the larva.) Can. Ent., xxxix, 205-207, June, 1907.

MITCHELL, EVELYN G.

The Classification of the Culicidæ. (Argues against the inclusion of the Dipterous families Dixidæ and Corethridæ in the Culicidæ, and relates the distinctive characters of the sub-families Culicinæ and Psorophorinæ.) Can. Ent., xxxix, 198-201, June, 1907.

MOORE, GEO. A.

List of the Hemiptera taken at Como, Quebec. Can. Ent., xxxix, 161-163, May, 1907; 189-191, August.

MORDEN, JOHN A.

Sugaring for Moths in the autumn. (A short account of methods adopted for attracting moths of the genus Scopelosoma and other late autumn species.) Can. Ent., xxxix, 385-386, November, 1907.

ONTARIO DEPARTMENT OF AGRICULTURE.

Remedies for the San Jose Scale. (Contains instructions fo tion and application of the standard remedies, and gives t Legislature "to prevent the spread of the San Jose Scal 157, March, 1907, 12 pages.

OSBURN, R. C.

The Syrphidæ of British Columbia. (Contains a list of all th far found in that Province.) Bulletin of the B. C. Entomolo No. 8, December, 1907.

PARROTT, P. J.

The San Jose Scale, its Life-history, Spread and Remedie account of the results of experiments made at Geneva, N.Y. tions for making and applying remedies.) 38th Annual I Growers' Assoc. of Ontario, 1906, pp. 48-55.

PEARSALL, RICHARD F.

Nomenia and Euchoeca finale. (An effort to finally clear culties relating to several species in these two genera of Geom Can. Ent., xxxix, 22-24, January, 1907.

PEARSALL, RICHARD F.

A review of our Geometrid Classification—No. 3. (An attem the species of this family of Moths under genera based upon stable characters.) Can. Ent., xxxix, 91-92, January, 1907

PEARSALL, RICHARD F.

Geometrid Notes—No. 2. (Discusses some species of C Ent., xxxix, 171-172, May, 1907.

PEARSALL, RICHARD F.

The Geometrid genera Alsophila, Hubn. and Paleacrita, Ri of the classification of these two genera of Canker-worms a the venation and other characters.) Can. Ent., xxxix, 282- 1907.

PEARSALL, RICHARD F.

Our species of Nyctobia, Hulst. (An effort to establish the t ship of the species of Geometrid Moths included in this genu upon the synonymy). Can. Ent., xxxix, 371-373, November,

PROUT, LOUIS B.

Synelis enucleata, Guen.: a correction. (Refers to Mr. L. notes on the genus in the April number and sets forth a fur of the species.) Can. Ent., xxxix, 412, December, 1907.

SEARS, F. C.

The Tussock Moth in Nova Scotia. (An account of damage done to the fruit as well as to the foliage of apple trees, by the caterpillars of this insect.) Farmer's Advocate, London, Ont., xlii, 1904, July 4, 1907, figure.

SHULL, CHARLES ALBERT.

Life-history and habits of *Anthocharis* (*Synchloe*) *Olympi* Edw. (A Butterfly which ranges from West Virginia to Colorado and from Northwest Canada to Texas.) Entomological News, xviii, 73-82, March, 1907.

SHULL, A. FRANKLIN.

The stridulation of the Snowy Tree-cricket, *Œcanthus niveus*. (A full account, with diagrams and tables, of the rate of chirping and its relation to temperature and other conditions.) Can. Ent., xxxix, 213-225, July, 1907.

SKINNER, HENRY.

The identity of *Thecla calanus* and *Edwardsii*. (A comparison of a number of specimens of the latter form from Toronto and London, Ont., with others from various parts of the United States, and an account of their intergradations.) Entomological News, xviii, 47-48, February, 1907.

SKINNER, HENRY.

Studies of *Thecla irus*, Godart, and *T. Henrici*, Grote and Robinson. (Contends, in opposition to the views expressed by Mr. J. H. Cook in the Canadian Entomologist, that these two forms are one and the same species.) Ent. News, xviii, 129-132, April, 1907; 333-334, October.

SKINNER, HENRY.

Thecla (Incisalia) polios. (A statement that this Butterfly, described as a new species by J. H. Cook and F. E. Watson in the Canadian Entomologist, is not specifically distinct from *T. Mossi*, Hy. Edws., which is a variable species and has a range across the continent.) Ent. News, xviii, 327, October, 1907.

SMITH, JOHN B., AND GROSSBECK, J. A.

Studies in certain Cicada species. (The authors shew that our species, so long known as *C. tibicen*, Linn., is not the one described by Linnæus and being unnamed, is now designated *C. Linnei;* for a similar reason *C. pruinosa*, Say, is named *C. Sayi*. Three plates of details of these and other species are given.) Ent. News, xviii, 116-129, April, 1907.

SMITH, JOHN B.

New species of Noctuidæ for 1907. No. 1. (Describes 29 new species, of which four are Canadian, viz: *Tæniocampa saleppa*, *Orthosia acta* and *antapica* from British Columbia, *O. agressa* from Manitoba and *Homoglæa dives* from B.C.) Trans. Am. Ent. Soc., Philada., xxxiii, 125-143, May, 1907.

SMITH, JOHN B.

Notes on some American Noctuids in the British Museum. (Ar review of the nomenclature and synonymy of a large numbe based upon the author's inspection of the museum collections N.Y. Ent. Soc., xv., 141-162, September, 1907.

SMITH, JOHN B.

Notes on the Brephidæ. (Contains translations of the origi tions of *Brephos Californicus* and *B. melanis*, Boisduval, and t tion of a new species *B. Fletcheri* taken at Coldstream, B.C.; a upon *Leucobrephos Middenedorfi* and *brephoides*.) Can. E 369-371, November, 1907.

SMITH, JOHN B.

Notes on the species of Amathes, Hubn. (A revision of the speci included in the genus Orthosia with keys and descriptive n of the species are found in Canada.) Trans. Am. Ent. Soc xxxiii, 345-362, two plates, December, 1907.

SWAINE, J. W.

The Scolytidæ or Engraver-beetles. (A popular account of bark and timber beetles and their economic importance.) xxxix, 191-195, June, 1907; 252-256, July.

SWETT, L. W.

Geometrid Notes.—On the genus Synelys. (Discusses the s Can. Ent., xxxix, 141-142, April, 1907.

TAYLOR, GEO. W.

Notes on *Plataæ Californiaria*, Herr.—Sch., and its allies. (up of the confusion which has existed regarding the species of t Geometrid Moths). Can. Ent., xxxix, 101-102, March 1907.

TAYLOR, GEO. W.

Notes on *Euchoeca perlineata*, Packard. (A protest against t of this species under a new name by Mr. R. F. Pearsall.) xxxix, 132-133, April, 1907. (This contention is acknowledged t by Mr. Pearsall, ib. 143.)

TAYLOR, GEO. W.

The Eupitheciæ of Eastern North America. (A discussion known species found in this territory, with detailed description forms.) Can. Ent., xxxix, 164-168, May, 1907; 276-280, Augus

TAYLOR, GEO. W.

Description of *Eupithecia Fletcherata*, a Geometrid Moth fron new to science. The Ottawa Naturalist, xx, 200-202, Jan Reprinted in the Can. Ent., xxxix, 384-385, November, 1907.

VAN DUZEE, E. P.

Studies in North American Fulgoridæ. (Contains keys to the subfamilies, genera and species known to inhabit the United States and Canada, and descriptions of a number of new species.) Proc. Acad. Nat. Sci., Philadelphia, lix, 467-498, December, 1907.

VARLEY, W. B.

San Jose Scale: Outline of work performed by the Ontario Department of Agriculture, 1897-1907. (Gives an interesting history of the official efforts made to control this destructive Scale insect in the Province of Ontario during the last eleven years.) 38th Annual Report, Fruit Growers' Assoc. of Ont., 1906, pp. 101-106, Appendix D.

VIERECK, H. L.

Andrenæ of the Canadian, Alleghanian and Carolinean Plant Zones occurring or likely to occur in Connecticut. (Consists of tables and a list of a large number of species, several new ones being described.) Ent. News, xviii, 280-288, July, 1907; ib. p. 365, October.

WALKER, E. M.

A new Somatochlora, with a note on the species known from Ontario. (Describes *S. Williamsoni*, a new species of Dragon-fly taken in Ontario and elsewhere, with figures of the abdominal appendages.) Can. Ent., xxxix, 69-74, plate, March, 1907.

WILLIAMS, E.B.

Two new North American Dragon-flies—Odonata. (One species, *Boyeria Grafiana*, was taken at Heyden and Searchmont, Ontario,) Entomological News, xviii, 1-7, January, 1907.

WILLIAMS, J. B.

The Walking-stick Insect—*Diapheromera femorata*. (A popular account of the life-history of this insect and its occurrence in remarkable numbers at Niagara Glen, with a plate illustrating different stages.) Can. Ent., xxxix, 261-263, August, 1907.

IV.—*Aesculin Bile Salt Media for Water and Milk Analysis.*

By F. C. HARRISON AND J. VAN DER LECK.

Bacteriological Laboratories, Macdonald College, P. Q., Can.

(Read May 26, 1908.)

The considerable diversity of "presumptive" tests used in England and America for *B. coli* and other excretal organisms renders an apology almost necessary when introducing yet another test to the attention of laboratory workers. Such a presumptive test (and by this term we mean a simple test which will indicate in the majority of cases whether a water contains excretal organisms or not) largely used in American laboratories is the production of gas in a fermentation tube containing dextrose broth, with a gas formula of $H:CO_2=2:1$.

In English laboratories the bile salt broth of McConkey and Hill[1] or the modification of this medium with neutral red as suggested by Grünbaum & Hume[2] is more commonly employed. Phenol broth, lactose-litmus agar, and other media have also been used by various workers.

Several investigators[3] have pointed out the limitations of these tests. Thus in the case of the fermentation of dextrose, that the amount of gas, and the percentage of CO_2 are subject to variation, even with pure cultures of *B. coli*, and that *B. coli* is frequently present in fermentation tubes in which the amount of gas was less than 10% after 48 hours incubation at 37° C.

Irons[4] in an investigation comparing the results obtained with the dextrose fermentation tube and with neutral red broth found in 285 determinations 35 per cent of positive results with the fermentation tube and 47 per cent of positive results with the neutral red method. Prescott and Winslow[5] in a paper on the relative value of dextrose broth, phenol broth and lactose bile as enrichment media for the isolation of *B. coli* examined 176 samples of water from various sources. From the data they obtained they considered the bile medium inferior to dextrose broth as an enrichment medium in the process for the complete isolation of *B. coli*, but as a presumptive test, when the full working out of *B. coli* was impossible the bile medium offered distinct advantages. Thus they sum up their experimental facts as follows:—

"If the proportion of cases in which *B. coli* was actually isolated (70 out of these 176 samples) be taken as 100, the percentage of complete, positive results, using bile for preliminary enrichment, was 91. If the dextrose broth fermentation test alone had been considered positive 120 "presumptive" tests would have been obtained, or 171 per

The æsculetin then combines with the iron salt (iron citrate) used in the medium to form a dark brown salt.

The reaction takes place only in sugar-free media. Colonies of *B. coli* in media containing æsculin, are black with a black halo around them, and they are thus very easily seen, and can be readily counted against a white background.

It is true that other organisms besides *B. coli* give the reaction, notably *B. lactis aerogenes,* lactose fermenting yeasts, and some moulds, but the last two may be disregarded, as they are seldom found in water, and the appearance of the colonies is characteristic. *B. lactis aerogenes* may be regarded as an excretal form, and hence it is of some benefit to be able to recognize its presence, and with very little practice the appearance of the colonies of this organism on the æsculin medium may be readily noted, as the colonies are usually larger, moister and more raised than those of *B. coli.* Some forty species[1] or varieties of bacteria and yeasts have been grown in media containing æsculin with negative results. *B. cloacae* is excluded by the æsculin method.

The preparation of æsculin media is easy, and different lots are very uniform in composition. Our usual method of preparing is to first weigh out:

1 or 2 per cent Witte's peptone
.5 per cent Sodium taurocholate (commercial).
.1 per cent aesculin
.05 per cent iron citrate
100 c. c. Tap-water

After steaming from 15 to 30 minutes the medium is filtered and filled into test tubes.

For æsculin agar 1.5 per cent of agar is used, and after dissolving the agar in part of the water the remaining ingredients are added, brought to the boil and then filtered or else the medium is cooled for the addition of white of egg or albumen, again brought to the boil and then filtered and tubed.

The tubes may be either sterilized in the steam sterilizer on three successive days, or autoclaved for 15 minutes at 15 lbs. pressure.

We advise using both bile salt broth and æsculin agar for the routine examination of water, as the former acts as an enrichment method, and the latter indicates the number of colonies of *B. coli.* pre-

[1] *B. fluorescens*; *B. fluor. liquefaciens*; *B. prodigiosus*; *B. lactis viscosus*; Slimy milk bacteria, 3 species; *B. butyricus*; *B. Zopfii*; *Proteus vulgaris*; *B. mesentericus*; 5 species lactic acid bacteria; *B. cloacae*, one culture from Jordan and one from Johns Hopkins University, etc.

be easily and accurately estimated. Such a method is furnished by the use of æsculin bile salt agar, which will permit of an accurate determination of the number of *B. coli* and *B. ærogenes* present, and thus give information regarding the amount of filth and particularly manure in the sample. One of us in a previous investigation [10] has shown that *B. ærogenes* is as frequently present in cow manure as *B. coli*, and also that both organisms are present in large numbers on the bodies of various species of flies.

We have already pointed out that æsculin will give black colonies with both *B. coli* and *B. ærogenes*, hence both organisms may be counted on the plates, and on account of the different character of their colonies separate counts may be made of each. In practice we usually make 1 in 100 and 1 in 500 dilutions for ordinary milk, but this is hardly sufficient for poor milk and a higher dilution may be necessary.

At this stage of work, we can hardly suggest a standard until other laboratories give the æsculin method a trial and confirm our results, but tentatively we may suggest that if the 100,000 bacteria per c.c. standard is in use, the number of *B. coli* and *B. ærogenes* should not exceed 1,000 per c.c. or 1 per cent.

We are also of the opinion, as the result of a large number of analyses that compared with ordinary beef peptone agar, æsculin bile salt gives a better idea of the sanitary condition of milk samples and gives such results in 24 hours, and if only one set of plates was made from each sample, we should prefer to use æsculin bile salt agar. The class of liquefying bacteria which are also able to give some indication of the sanitary condition of stables, etc., cannot be estimated on agar plates, and this point is mentioned because the milk committee of the American Public Health Association have recommended agar plates in preference to gelatine, in the routine examination of milk in public health laboratories.

No experimental data are given in this paper, but the experimental results on which this paper is based will be given at an early date.

REFERENCES.

1. *McConkey & Hill.* Thompson Yates Laboratories. Reports IV. p. 151, 1901.

2. *Grünbaum & Hume.* British Medical Journal, 1902, p. 1473.

3. *Winslow & Hunnewell.* Journal of Medical Research, VIII., p. 502.

Whipple. Technology Quarterly XVI., p. 18.

Fuller & Ferguson. Journal of Infectious Diseases, Supplement 1, 1905. p. 142.

4. *Irons.* Journal of Hygiene, II, p. 314.

5. *Prescott & Winslow.* American Journal of Public Hygiene, 1 page 19.

6. *Savage.* Bacteriological Examination of Water Supplies, L page 222.

7. *Savage.* *ibid*, page 232.

8. *Savage.* *ibid*, page 226.

9. *Houston.* Metropolitan Water Board Reports for 1905. C Savage.

10. *Harrison.* Centralblatt f. Bakt. II Abte., 14. p. 359, 1905.

V.—*A method for Preparing Gelatine Plates for Museum or Class Purposes.*

By F. C. HARRISON, Bacteriological Laboratories, Macdonald College, P.Q., Canada.

(Read May 26, 1908.)

It is often necessary to prepare gelatine plates for class purposes, and whilst the preparations of giant colonies as prepared by Kral are very useful yet they do not present the features often desired in a preparation.

The method consists in preparing gelatine plates in the ordinary manner, but, as a rule, four or five dilutions are made from the first tube of melted gelatine. After the tubes are inoculated and well shaken by rolling between the palms of the hands, the contents are poured on to sterilized plates of glass 3¼" x 4¼" old photographic plates which have been carefully cleaned being generally used. The plates are very carefully levelled, and as soon as the gelatine has set, they are placed in proper double dishes and set in the cool incubator until the colonies develop. When the colonies have attained their most typical appearance, the plates are placed in a dish containing a solution of 5 to 10% of formalin, and allowed to remain in this liquid for one to three hours, depending on the thickness of the gelatine. They are then taken out and the edges trimmed with a knife, leaving a slab of gelatine about 3" x 3" square in the middle. They are then immersed again in the formalin bath and a clean sterilized glass plate of the same size is gently placed on the top of the gelatine so as to exclude all air bubbles. The gelatine plate and its cover are then taken out, allowed to drain for a moment, and then the four edges are successively dipped into melted paraffine kept in a tray about 5" long. As soon as the paraffine has solidified, the edges are carefully inspected and if any holes are noticed they are filled in with melted paraffin poured from a small spoon. Thus a glass cell is formed with paraffine sides. After cleaning off the surplus paraffine on the glass, the sides are bound with linen or paper binding strips, the same as used for lantern slides, and known as passe partout binding. The name of the organism and other information is written on the binding strip in white ink and the slides stored in the same manner as ordinary diapositives.

Most bacterial colonies give good preparations this way; even liquefying bacteria, if the colonies are not too old, give good prepara-

VI.—*Notes on a proposed New Base for the Cambrian Rocks of Southern New Brunswick.*

By R. W. ELLS, LL.D.

(Read May 27, 1908.)

Many papers relative to the age and the several divisions of the Cambrian rocks of southern New Brunswick have been printed in various scientific journals during the last forty years. As a result of more recent studies the range downward of the system has been considerably extended, as compared with the original conception of the structure and distribution of these rocks, since the classification given in the report to the Geological Survey of Canada, 1870-1, by Drs. L. W. Bailey and G. F. Matthew.

To the latter much of the credit belongs for working out many details regarding the general distribution of these sediments, and for deciphering the abundant fauna which they contain, both in New Brunswick and Nova Scotia, by means of which the whole series has been divided into several distinct divisions. Within the last few years, owing to the investigations of Dr. C. D. Walcott, the recent Director of the United States Geological Survey, both in the rocks about St. John city and in similar formations of eastern Nova Scotia and in Newfoundland, a number of new features have been brought to light which have tended to simplify the general structure of the Cambrian system as a whole, and have greatly modified the views formerly held, by including in the Cambrian proper a considerable portion of the underlying formations once regarded as the Coldbrook division of the Huronian system.

It is not proposed in this paper to review in detail the various changes of opinion which have been held from time to time as to the classification of the rocks of this system; but rather to direct attention to certain points of structure, and to the occurrence of certain organisms found at different localities, which hitherto do not appear to have received the consideration which they deserve; in order, if possible, to render the structure of the Cambrian rocks proper, and their relations to those which have been, for a long time, regarded as occupying a much lower horizon, more intelligible. Recent study of the areas about St. John city have shewn that these lower rocks are closely related to and may form, possibly, an integral portion of the Cambrian system regarded as a whole.

In the earlier classification of the rocks about St. John city, 1870-1, they were arranged under three heads or groups comprising the Laurentian, the Huronian and the Cambrian systems. Of these but occasionally overlies the Kingston and Coldbrook, while in the west part of St. John city, as at the suspension bridge, the upper or Bretonian division of the Cambrian is in contact with the limestone, quartzite and slates which have been regarded as belonging to the upper Laurentian series. This is the series which is at present of special interest from the geological standpoint; and the contact of the Bretonian is marked by a fault which extends from the end of the suspension bridge eastward along what is known as the strait shore.

This age of the upper Laurentian division was assumed by Drs. Bailey and Matthew, and supported in part by Sir William Dawson, partly on lithological grounds and partly from finding in portions of the limestone certain peculiar forms supposed to be organic in character, and to be related to the form known as Eozoon, which occurs in the Grenville series of Quebec and the Hastings series of Ontario. In southern New Brunswick it received the name, given by Matthew, of Archæozoon. The history of this supposed Laurentian organism is somewhat interesting, and as it has a somewhat important bearing on the original interpretation of the structure of the St. John rocks may be here briefly stated.

The peculiar form known as Eozoon was first found in Quebec nearly fifty years ago, associated with the upper Laurentian formation north of the Ottawa river, and shortly after somewhat similar forms were recognized in eastern Ontario. It was chiefly studied by the late Sir William Dawson, and was supposed to represent the earliest known form of life. In the course of investigation on these old rocks of Ontario and Quebec, where this form was principally recognized, it was ascertained that as regards the Ontario specimens, the organic nature of the supposed fossil could not be maintained, since the specimens known as the Tudor and Burgess Eozoon were closely and clearly associated with igneous rocks which occurred as dikes cutting the crystalline limestone, and the supposed organism owed its peculiar structure to forms developed in the intrusive portions, which were diabasic in character, rather than to occurrences in the limestone itself.

In course of time, therefore, the contention as to the organic nature of these forms from Ontario was gradually abandoned, but the organic nature of the Quebec specimens was still maintained, chiefly by Sir William Dawson. The best specimens of Eozoon were found principally in a quarry at Côte St. Pierre, about forty miles east of Ottawa. A subsequent critical examination of this locality clearly shewed that in this case also, the Eozoon structure was due to the association with igneous rocks, principally a gabbro diorite, with limestone. The quarry was originally opened in a serpentinized zone of the limestone near the contact with the gabbro mass, f extraction of asbestos (crysotile), a mineral occurring at a n of places in the crystalline limestone of eastern Quebec as small t or veinlets.

This serpentinized portion when present always occurs at o the base of the calcareous bands, and often is accompanied v development of the crysotile. Attempts to mine this mineral been frequently made near the igneous contacts, and it was ev on careful study of the conditions at a number of these openings the alteration to serpentine and the development of the cr veins was due to the action of the intrusive masses on the basal p of the limestone bands. The original contention therefore that forms known as Eozoon were of organic origin has practically c to exist or to find supporters.

As regards the peculiar forms found in the crystalline lime in the vicinity of St. John, which have been described under the Archæozoon, from several localities, the same intimate associ of igneous masses is frequently observed. In the report t Geological Survey, 1870-1, by Bailey and Matthew, they are refer as occurring in beds of limestone exposing "over a surface n ten feet square, large numbers of concentric nodular masses, be much resemblance to some genera of corals, but apparently des of organic structure, and probably concretionary." From thei sence, however, in limestone in which sponge spicules are found, may possibly belong to one of the lower orders of sponges, related t Archæocyathus of Newfoundland. They certainly bear but sma semblance, either in mode of occurrence or general aspect, to the known as Eozoon Canadense of Ontario or Quebec. A descri of this form was published by Dr. Matthew in Bull. No. IX, Hist. Soc., N.B., 1890, in which its organic nature is maintained

In the same bulletin Dr. Matthew also pointed out that i so called upper Laurentian of southern New Brunswick, as f about St. John, three zones were recognizable which contain forms. These were held to be separated from the then recog base of the Cambrian by the Huronian series. His statement the occurrence of these fossils in these upper Laurentian rock there given, may be briefly summarized, in order to arrive, if pos at a clearer understanding of the problem of their structure, w is now a matter of considerable geological importance.

As already intimated, the rock formations of this series co of crystalline limestone, slate and quartzite with masses of intr rocks. The sediments contain organic remains, of which the o apparently is in the quartzite portion belonging to the lower pa this division of the system, and consist of the remains of hexactonellid sponges probably allied to the genus Cyathospongia. The second series of organisms is in the upper limestone division of this series, the fossils here found being of a different nature from the ordinary sponge spicules in having a calcareous coral-like structure, somewhat resembling certain forms found in the basal portion of the Cambrian elsewhere. The structure of this organism has not yet been definitely worked out, but it consists of elongated cylindrical objects with bodies from one to three inches across and several inches in length. This is the object described as Archæozoon Acadicum.

The third zone is that of the graphite beds or graphitic slates in which occur great numbers of sponge spicules, arranged in parallel sets, one set crossing another at an acute angle. This type of sponge is apparently Monactinellid. As only straight needle-like spicules without rays have been obtained of this sponge it probably was a mass of sarcode or jelly, protected and sustained by the spicules which traversed it.

In a second paper in the same bulletin, 1890, Dr. Matthew more definitely describes the occurrence of these sponges in the upper Laurentian rocks of this district. Here in beds of quartzite associated with the limestone of Drury Cove several miles north-east of St. John, also regarded as of upper Laurentian age, both solitary spicules and fragments of the net-work of a sponge, apparently of the genus Cyathospongia eozoica occur, resembling fragments of Hexactinellid sponges found in the lower beds of the Etcheminian division of the true Cambrian of that area. These forms were also obtained from smooth graphitized layers in the limestone itself as also in large numbers from the graphitic slates associated with the crystalline limestone near the suspension bridge across the St. John river, at the west end of Douglas avenue. These are referred to Sir William Dawson's provisional genus Halochondrites. The horizon of these beds is stated to be the lower half of the upper division of the upper Laurentian. These forms occur in other localities where the containing rocks are highly graphitized. Above these beds, in the original scheme of classification are placed the Huronian system with an estimated thickness of more than 25,000 feet to the base of the Cambrian as usually understood.

In considering the horizon of the slates, quartzite and crystalline limestone about St. John just described, it will be seen that any evidence derivable from a comparison of these fossils with the supposed organisms from the Grenville and Hastings series, may be practically disregarded. According to the latest examination of these rocks in Quebec and Ontario, they appear to be referable to the Huronian rather than to the Laurentian proper, and neither of these seri yielded any fossil evidence whatever of determinative value.

The age of much of the granite and other igneous rocks in the classification of 1870-1, were assigned to the lower Laurı is also largely problematical; and the same remarks will apply tı portions of the original Huronian, which in the published n southern New Brunswick were described under the head o Cambrian. These views were latter modified as a result of examinations in Charlotte country. For while without doubt are areas of these rocks which are fairly entitled to be classed a Cambrian, other large portions, both of the igneous and stratified about St. John and westward, once regarded as Laurentian or I ian, have been found to be newer intrusives which alter sedi containing Silurian fossils, or to be still newer sediments, in ı Devonian age, which have been changed into schists and crys limestone, in which the remains of organisms can be readi served. As for the supposed Laurentian rocks about St. Sı in Charlotte county, on which much of the geological c cation of this part of the province was based, it must be sai they present but small evidence, either in their physical cha or their stratigraphical relations, to entitle them to such a po

On the other hand, the general aspect of the crystalline stone, associated slate and quartzite of the series resembles ı the recognized Cambrian rocks of the district but in a highei of metamorphism. Such alteration has been largely local in cha: and the causes can be readily seen in the presence of large ma: igneous intrusive rocks, the metamorphism being more marl these igneous rocks are approached. Much of the alterati also doubtless due to the large amount of folding which has af great portions of the several formations. In the case of the lim such alteration is evident in the fact that otherwise bluish slat: are changed to the white crystalline character, while the granit diorite often cut across the limestone and slate and sometimes pieces of the adjacent rock in the igneous mass.

The limestone developments are often quite local, occurrir quently as small narrow lenses surrounded by slate or quartzite, in other places they spread out into areas of considerable e though in such cases the limestone is broken up and largely re by the granite. In the occurrence of these limestone bands closely resemble portions of the lower Sillery formation of e Quebec.

The presence of sponge spicules in these rocks is also interı Similar forms are very abundant in the lower and middle

(Cambrian) as at Métis and elsewhere, from which Hexactinellid sponges were obtained some years ago, and described by Sir William Dawson in a paper read before this Society in 1889. Some of these forms from the Cambrian of Quebec appear to be almost identical in character with those from the beds about St. John; but nowhere in Canada or elsewhere, in so far as known have they been obtained from rocks of lower horizons than the basal Cambrian; the species known as Archæocyathus, found in Newfoundland many years ago, and doubtfully referred to the upper Huronian or lower Cambrian being the oldest known form yet recorded. The exact nature of this organism, whether a coral or a sponge, is still somewhat uncertain. It is generally regarded, however, as representing the lowest known representative of the sponges.

To separate these low forms found in the St. John rocks from other low types of sponges obtained from the Etcheminian division of that city by some 20,000 feet or more of Huronian rocks is a problem requiring careful consideration ; since if the former determinations of horizons are to be taken as correct, it would imply an enormous interval of time with but little change in the character of the organisms which occur in the middle and lower Cambrian and those from the so-called upper Laurentian of this area.

Summing up the present evidence bearing on the question, it would seem that the portion of these St. John rocks, formerly assigned to the horizon of the upper Laurentian, is more closely related to the recognized middle and lower Cambrian, both as regards their physical character, their stratigraphical sequence and their contained fossils, than to any other series of formations found in the area about that city. It may be mentioned in this connection that in the list of organisms published by Dr. Matthew as occurring in the Etcheminian portion of the Cambrian (Bull. Nat. Hist. Soc. Vol. X) a number of forms are given, including several varieties of Archæocyathus such as pavenoides, elegans, elongata, virguloides, all of which are referred to Div. C. of the St. John group with remains of Protospongia; while several forms including Dichoplectella, Hyalostelia, and Plotoscyphia, are referred to the horizon of the Etcheminian or lowest division of the Cambrian. The forms Cyathospongia and Halichondrites, found in the supposed upper Laurentian of St. John, are given in Sir William Dawson's list as occurring in the Sillery division of the Quebec group (Cambrian) at Metis.

Another point of considerable interest in connection with the lowest hitherto recognized beds of the Cambrian of southern New Brunswick, is the apparent absence in all the sections made in the several areas about St. John city and eastward to Handford brook,

of the genus Olenellus, regarded as marking the basal member (
Cambrian, but which up to the present time has not been found in
Scotia or New Brunswick though it occurs in the basal beds (
Etcheminian of Newfoundland and in their supposed equivale
Georgia series of Vermont.

In the lowest portion of the Cambrian section as developed
Handford brook, the species Colonoides which is found asso
with Olenellus elsewhere, was obtained from the Etcheminian o
section. In the vicinity of St. John the recognized Etchemin
rear of Seely street, as measured by Walcott, has a thickness o
150 feet, as contrasted with 1040 feet developed on Handford l
In the former area however, a belt of greenish eruptive felsiti
sometimes slaty rocks underlies the sediments of the fossili
Etcheminian and extends from the vicinity of Main street in th
past Lily lake and eastward for some miles. This is terminated (
ward by beds of dark slates, altered sandstone and bands of cr
line limestones, sometimes graphitic, and is evidently a portion (
formation which contains remains of sponges already described.
part of the series presumably is included in the Cambrian term
brookian.

Their extreme metamorphism is evidently due to the prese
large masses of generally reddish granite, and it is quite possibl
they may represent in this direction the missing basal beds (
Etcheminian as developed elsewhere. It is also possible that a c
search might reveal the existence of the missing Olenellus zone
its associated fossils. So far in the study of this part of the fiel
little attention has been directed to this aspect of the case,
at this locality or elsewhere, possibly on the assumption that
supposed upper Laurentian age was against the probability of fi
any such organisms; but the abundance of sponge spicules in
lower rocks, as already indicated, now makes it very desirable t
close search be made in order that this missing lowest fossili
zone of the Cambrian system in this portion of the province m
discovered ; unless indeed the high state of metamorphism to
these rocks have been subjected may have entirely destroy
trace of any such organisms.

VII.—*Geological Cycles in the Maritime Provinces of Canada.*

By G. F. MATTHEW, D.Sc., LL.D.

(Read 26th May, 1908.)

In an address to the Biological and Geological Section of this Society delivered some years ago,[1] the writer outlined the result of studies of the Cambrian geology of this part of North America up to the time when that address was written, in relation to its physical geology and topography. The following paper is more limited in the area treated of, but more extented as relates to geological time. It treats of the Acadian region only, but it carries the history onward from the earliest Geological Age of which there is a record in this region, to the middle of Mesozoic Time.

The region of Acadia, or the Maritime Provinces of Canada, is one in which fossil remains give us less guidance in tracing geological relations than could be desired. Indeed, its foundation rocks possess three terranes (or formations) in which many geologists still refuse to recognize the presence of any organisms that can be determined from having left any hard parts of the body as fossils. This debatable ground has been referred by various geologists, who have studied the region, to geological systems from "Primary" to Devonian. The result of the earlier studies were condensed, classified and extended by the members of the staff of the Geological Survey of Canada in the reports of that survey of 1870 to 1889, and other works of authors for New Brunswick, and of reports, etc., mainly by Messrs. H. Fletcher, E. R. Faribault, and L. W. Bailey, for Nova Scotia, and by R. W. Ells, for Prince Edward Island. Dr. Ells has also resurveyed southern New Brunswick in the last two or three years, but as I have not had a chance of testing the changes made from the earlier reports, a part only of Dr. Ells's results are embodied in this article.

One cause of the difficulty attending the determining of the age of the older Palæozoic and Eozoic systems in these provinces is the extreme folding and faulting which the rocks have undergone. From this cause the succession is often obscured by overthrusts, or a whole terrane may be overturned from base to summit, (as the Cambrian at the west end of the city of St. John), and left in such an attitude that the true succession would not have been suspected had not the fossils revealed it.

It is not claimed that the following statement of the Physical Geology of this region, in successive periods of Geological Time, is

[1] Trans. Roy. Soc. Can., Vol. X, Sec. IV, p. 3.

not open to correction in the direction of greater accuracy of
It is the first essay made in this field as regards the Palæozoic
ations for this area,[1] but it will serve as a basis for future anc
accurate statements when the geology of the country shall have l
better known, and the data already gathered more fully digested

A cause of much confusion in the treatment of the geol
this region is the attempt to exactly parallel its geological terra
formations with those of England on the one hand, or of New
State on the other; whereas its geological history has been esse
different from that of either of those regions. The region o
England and the Maritime Provinces of Canada (Acadia) was su
to vicissitudes and changes which did not correspond chronolc
with those of the two other regions above cited, and *so the cy
deposition are not synchronous.*

The Laurentian Cycle.

As in the case of the Cambrian cycle described on a later pa
have found this system well developed in two districts only,
southern New Brunswick, the other in Cape Breton. The se
best exhibited near St. John, in a section extending from Indi
on the St. John river nearly to the harbour of St. John. Els
in the district the succession is much broken and confused by
folding and the intrusion of granitic masses.

Above the gneiss and syenite of Indiantown is the fo
succession:[2]

1. Variegated and crystalline gray limestone and dolomite, gneiss, and argillites ....
2. Gray, rusty-weathering quartzose gneiss (further east this becomes a feldspathic quartzite) ....
3. Gray and dark gray to black, flinty mud rock, often in thin alternating layers ....
4. Dark gray and gray crystalline limestone, and gray dolomite.[3]
5. Thin-bedded limestones, alternating with pyritiferous gray argillites, graphite, and beds of dark gray rusty-weathering diorite ....

The most marked and persistent, as well as the most easily
nized, members of this cycle are the quartzites (No. 2), and th

[1] Prof. L. W. Bailey has written some article bearing on this
e.g., "Notes on the Highlands of Northern New Brunswick," Bull. Na
Soc. of N.B., Vol. V, p. 93.

[2] Rep. Prog. Can. Geol. Surv., 1875-6, p. 386.

[3] In other sections this member is much thicker than here.

stones (No. 4), which, with the intervening member (No. 3) show the passage of an old sedimentary series from rather shallow water conditions, to the deeper waters of an open sea, comparatively free from sediment.

In comparing the series with the corresponding one in Cape Breton, the intrusions of igneous rocks there are even more confusing than at St. John. However, a section at Crane Brook[1] presents some of the main features of the succession; numbers 5-11 of that section show about 600 feet of quartzites; numbers 12 to 16 intrusions that separate the quartzites from the limestones; the limestones themselves (in Nos. 17 to 30) are greatly broken up by intrusive syenite, etc., but show over 200 feet of limestones and dolomite, exclusive of spaces where the measures are concealed.

St. John is evidently the best point at which this old cycle of sedimentation may be studied, though even here its base cannot clearly be made out, without more careful study than has been devoted to it. In the quartzites we find sediments like those of the lower part of the gold bearing rocks of Nova Scotia; in the overlying silicious dark argillites the condition which supervened when the sea-bottom sank so far as to be out of reach of strong currents; in the limestones a continuance of similar submergence, but with clearer ocean waters and probably a higher temperature; and in No. 5 a recurrence of clay beds (with diorite flows) may indicate the approaching elevation of the sea-bottom which terminated this cycle of sedimentation. It at least indicates a temporary reversion to conditions resembling those that prevailed when No. 3 was deposited. The prevalence of earthy graphite and the abundance of sulphurets distributed in No. 5 may lead one to surmise the existence of abundant organisms of low order at this time. In these respects No. 5 resembles the upper member of the Lower Huronian, and also the upper part of the succeeding Cambrian (Cambro-Ordovician) terrane.

This old cycle is of interest from several points of view. It is the only one in all this eastern region which exhibits large masses of limestones, except the Lower Carboniferous; hence, where it occurs it may be used with confidence as a stratigraphical unit in determining the presence of a definite horizon, even where overlying palæozoic terranes cannot be determined for lack of palæontological data.

Another feature of this cycle is the peculiar condition of the intrusives, of which there are large masses. They do not have the bright crystalline aspect of the crystalline intrusives of the later terranes, but are often notable for the changed condition of the magnesian

[1] Rep. Prog. Can. Geol. Surv., 1875-76, p. 386.

…ded with alternate light and dark red, and in the upper part of … series interbedded with the limestones and quartzites; they are …companied by hornblende and mica schists, into which they sometimes …ade. The diorites included a variety of rocks, some of which seem … be altered sediments, while others are altered igneous rocks, gabbros, …artz diorites and diabases.

The Lower Huronian Cycle.

In the earlier geological explorations in Nova Scotia and New Brunswick large areas of slates and quartzites were met with which were first called grauwacke, and, subsequently, Cambrian; in these areas fossils were rare or absent, and when found, were not of a kind to throw much light on the age of the beds in which they occur. Such was a large area in Nova Scotia, cut up by granite intrusions, in which gold in paying quantities was afterwards found, hence called the gold-bearing series. When Upper Cambrian fossils were found in the rocks of the Mira river, Cape Breton, which proved to be quite different in appearance from the gold-bearing series in Nova Scotia, the latter was called Lower Cambrian, and is now so called in the reports of the Geological Survey of Canada, and so designated on its maps.

But since this name was so used, a careful study of the areas in which Cambrian fossils have been found, has been made, and while the Cambrian terrane in southern New Brunswick agrees almost exactly in the succession and aspect of the members with that of the corresponding terrane in Cape Breton, it does not at all agree with those of the geographically intervening (so called) Cambrian of the mainland of Nova Scotia. There is, therefore, strong reason to suppose that the latter is an entirely different terrane and of a different age. It is custom and precedent that has retained for the latter the name of Lower Cambrian. Unfortunately, this Maguma or gold-bearing series is not seen in contact with any Palæozoic series older than Silurian, and our reasons for placing it beneath the Palæozoic systems will be seen in the latter part of this article.

A great deal of detailed surveying on the Maguma series has been done by the officers of the Geological Survey of Canada and others, and its strata have been found to be of enormous thickness, yet of remarkable uniformity. According to Mr. E. R. Faribault, they consist essentially of two divisions,[1] a Lower or Quartzite Group, and an Upper or Graphite and Ferruginous Slate Group.

In this report (1883) Mr. Faribault does not give the thickness of these groups, although saying that the quartzite group is over 10,000

[1] Rep. Prog. Geol. Surv. Can., 1883, p. 145P.

feet thick. Of the upper group he says that it has over 4 of beds.

Mr. Faribault has been working on these rocks (the gol rocks of Nova Scotia) for more than twenty years, in various eastern Nova Scotia, and has found these thicknesses much l actual bulk of this great system. Thus, he found the quartz in Moose river gold district in Halifax County attains a thi *three miles*, and the upper slate division in Rawdon, Hants a thickness of *two miles*. Twenty-six thousand feet is an thickness for a single series of sedimentary rocks to posses this series is not swollen by the accession of volcanic deposits conglomerates, and throws it out of relation of the *true Cam* the Maritime Provinces of Canada, as exhibited in its two ar and N.E. of the region occupied by the gold-bearing seri part of the St. John Group (Cambrian) which corresponds lith to the Gold-bearing series in Nova Scotia, viz.: Divisions 2 an not exceed in thickness 2,700 to 3,000 feet, and so is only al eighth of the bulk of the great Nova Scotian gold-bearing series

Moreover, we do not find that a single characteristic C fossil has been found in Nova Scotian gold-bearing series, neither by lithological nor fossiliferous proof is this terra referred to the Cambrian.

We find the nearest parallel to this great Nova Scotian in the Intermediate System of Alexander Murray, in Newfo

Murray's exposition of the bulk and succession of these given in his report[1] is:—

		FEET.
Quartzites, diorites, etc.		1,300
Slate conglomerate and slate		1,650
Green, red, purple and white weathering slates in frequent alternations		3,300
Dark brown or blackish slates, with ripple marks on some surfaces		2,000
		8,250
The *Signal Hill sandstones* is added to these:—		
Gray fine-grained sandstones	1,300	
Dark red sandstone	1,320	
Red conglomerate, quartz and pebbles.	500	
		3,120
		11,370

[1] Geol. Surv. of Newfoundland, p. 145.

Professor Walcott has examined the Newfoundland pre-Cambrian rocks described above, and called them the Avalon terrane, giving Murray's description and thicknesses of the several portions and applying names to these groups.

He has also distinguished an overlying terrane, the Random terrane, occurring at Smith and Random sounds in Trinity Bay, and having a thickness of about 1,000 feet; these rocks are chiefly gray sandstones.

If the lower portion (8,200 feet) of Mr. Murray's Newfoundland pre-Cambrian rocks be compared with the gold-bearing series of Nova Scotia, a similarity of succession will be observed, especially if compared with the series as developed in the western part of that province.

This is clearly seen if the deposits of the Newfoundland area be compared with that of the western part of Nova Scotia, where Prof. L. W. Bailey found a group of variegated slates interposed between the quartzites and the black slate group of the eastern part of that peninsula. This resemblance may be presented as follows:—

Newfoundland.	Nova Scotia.
1. Quartzites, diorites, etc., slate conglomerate and slate.	1. Quartzites, some clay slates.
2. Green, red and purple slates in frequent alternation.	2. Greenish gray, purple and bluish gray slates, the latter with conspicuous banding.
3. Dark brown or blackish slates.	3. Black, with some blue and gray slates, very rusty-weathering.

Of the Nova Scotian terrane Dr. Bailey states the thickness of the two lower members at 5,000 feet or more, and the highest member to be at least 3,000 feet. His assistant, Mr. Prest, found for the whole system on the Sissaboo river a thickness of 28,000 feet,[1] which is somewhat in excess of the thickness found by Mr. Faribault in the eastern part of the province.

Yet, from this enormous thickness of widespread sediments, not a characteristic Cambrian fossil has been taken, while in both areas of sedimentation of the true Cambrian rocks, St. John, N.B., and Cape Breton, ample palæontological proof of the age of the rocks is forthcoming. Therefore, both on stratigraphic and palæontological grounds, we are compelled to admit that this is a separate series from the Cambrian, and as we shall see further on, must be of an older cycle of deposition.

[1] Rep. Prog., 1898, p. 88M.

Prof. J. E. Woodman, of Dalhousie, who has treated t from an independent point of view, and brought to its eluci advantages of a modern scientific training, has given the s names. For the series as a whole it is the ***Meguma se*** quartzite division bears the name of the *Goldenville formatio* black slate division the *Halifax formation.*

With such a great development of these pre-Cambriar Nova Scotia it is natural that we should look for a simil sediments in the neighbouring province to the northwest. study of the strata in southern New Brunswick, the survey Canadian Geological Survey thought they had found such a i in the areas which are marked "A-B" on the geological i three most important areas thus marked are in eastern St. Jol western King's County, and southwestern Charlotte County.

A section of these rocks is found on the lower part of tl river, in King's Co., New Brunswick, where, with a further s the west side of the St. John, a broken anticline of ancient schists is exposed.[1]

Here are found southward of the Silurian terrane, a th ancient clastics. The heart of the anticline consists of gray grits with very considerable bodies of gray clay slates inter and some bands of brown conglomerates. The mass has a of about 7,000 feet, and, as half dips to the north and h south, there would be about 3,500 feet on each side of the a it be such. These coarse beds have resting upon them on about 2,000 feet of gray clay slates, with dark purple sla bottom. Omitting a space of 1,500 feet occupied by dark g like those of the St. John Group (Cambrian), which may r possible addition of that thickness to the grits and slates, this i of the lower terrane may be counted as 5,000 feet. There a the opposite. on southern side of the anticline, a similar bod slates and of about the same thickness.

Following these to the south is a great body of dark gray clay slates and gray feldspathic slates that extend to I point, in nearly vertical beds. These, perhaps, are the uppe slate division of the Lower Huronian repeated.[2] The corr strata to the southwest on the Passamaquoddy Bay have a m body of black slates, and those on the St. Croix are v weathering.

[1] Rep. Prog. Can. Geol. Surv., 1870-71, p. 113.
[2] Rep. Prog. Geol. Surv., 1870-71, p. 120.

The comparison of the Lower Huronian terrane in western Nova Scotia and southern New Brunswick shows a considerable resemblance in the sedimentation:—

Nova Scotia.	New Brunswick.
1. Quartzite, some clay slate.	1. Gray granitoid grits and much gray slates, 5,000 feet.
2. Green, gray, purple and bluish gray slates, the latter with conspicuous banding. The two divisions 6,000 ft.)	2. Gray clay slates and dark purple slates, 2,000 feet.
3. Black, with some blue and gray slates, very rusty-weathering 3,000 feet.	3. Dark gray and gray clay slates, and gray feldspathic slates, about 3,000 feet.

The coarser condition of No. 1 (the lower division) in New Brunswick may be due to the closer proximity of an emerged area of granitic rocks of an earlier period, such as would have been afforded by the Laurentian rocks described on the preceding page. To such a source also may be ascribed the interraned conglomerates of this system in New Brunswick, which are so singularly absent from the corresponding rocks of Nova Scotia.

In northern Nova Scotia, in Pictou and Antigonish counties, are bodies of fine flinty, dark slates and other clastics which on the maps of Geological Survey are ascribed to a Cambro-Silurian (= Ordovician) age, apparently because they underlie (unconformably) the recognized Silurian (Upper) of the Arisaig Section. These, I think, are to be regarded as a deep-water phase of the Huronian or Meguma Series.

On a succeeding page it will be shown that the Cambrian System in these provinces is part of a closed geological cycle that includes the lower Ordovician, and it is impossible to recognize in these so-called Cambro-Silurian strata of northern Nova Scotia, the succession of Cambrian strata that is so clearly seen in New Brunswick and Cape Breton. The age of these strata in northern Nova Scotia has not been determined by the evidence of fossils, and, in fact, there are no fossils of this Age (Ordovician) known for hundreds of miles to the north and west of this area, other than those that occur in connection with recognized Cambrian areas. It appears more natural then, to assume that these fine-grained, dark, flinty rocks should be assigned to the lower Huronian as a deep-water phase of the same.

This set of beds has been designated by Mr. Hugh Fletcher, of the Canadian Geological Survey, as "The Lower Flinty slates and quartzites of James river (and Eigg Mountain)."[1] They described as greenish gray, flinty, rubbly slates and quartzites—red green splintery pyritous slates (on Gulf Road)—grayish and gree reddish, jointed tough flaggy quartzites (on the shore of the Gu St. Lawrence), dark slates with light gray bands finely jointed.

Such sediments as these may very well have been thrown dov deeper waters than those in which the Goldenville terrane was depo and where the agitation of the water was not sufficient to hold eve smaller silicious particles in suspension; hence the accumulatio these dark, flinty slates.

The Upper Huronian Cycle.

Among the Huronian rocks there remain to be considered "Kingston series." This immediately overlies the lower Hur rocks of King's county, New Brunswick, that we have described a and to which the two lower divisions of the Kingston series o Canadian Geological report[2] described in this paper on a previous have been attached. The remainder of the Kingston group consis distinctly effusive rocks, and while they form very prominent ridge cover considerable areas in southern New Brunswick, they are not n sarily of prominence elsewhere.

A synclinal of these volcanic rocks, if one may judge it to syncline, though infrequent dips only are visible, is found at the L End in King's county, New Brunswick, where the volcanics sh thickness of about 8,000 feet, and on New River, in Charlotte co a monocline of these rocks has a greater thickness and a more re succession. The effusive masses here dip at a high angle to the sout and show much diorites and hornblende schists in the lower part, i felsites in the middle, while toward the top they have the appearan feldspathic schists and approximate in appearance to the feldsp schists of the Laurentian terrane to the south of them.

Dr. W. D. Matthew, who has studied these rocks lithogically scribes the amount of alteration which they had undergone as comp with those of the Coldbrook group,[3] Cambrian or Etcheminian sives of St. John county, for which see a following page. He "They are a group of volcanic rocks parallel to those of the Coldb but far more altered. The acid members are strongly sheared,

[1] Rep. Geol. Surv. Can., 1886, 18P.

[2] Rep. Prog. Geol. Surv. Can., 1870-1, p. 121.

[3] Effusive and Dyke Rocks near St. John, N.B. Contrib. Geol. De Columbia College, No. XXX, p. 209.

unrecognizable as volcanics, and with a great development of secondary micas, making a quartzose or feldspathic mica schist. Ash rocks now changed to flinty felsites are sometimes still recognizable. The basic rocks are even more changed. Though mostly less cleaved they are coarsely crystalline hornblende schists, with no traces of their original structure visible under the microscope. Remnants of the porphyritic feldspars sometimes still appear as white spots scattered through the dark schists, but their original form is lost."

Resting unconformably on the flinty slates of James river, referred to on a previous page, Mr. H. Fletcher found two groups, largely of volcanic clastics, which may be parallel in age to these Kingston or Upper Huronian rocks. One he calls the "Soft slates of Baxter and Brian Daly Brooks,"[1] the other the "Reddish gray sandstone, grit and conglomerate of Bear Brook."[2] One or both of these may be equivalent in age to the Kingston volcanics of the neighbouring province.

The Baxter Brook rocks are further described as greenish, smooth, somewhat pearly argillites and fine gray micaceous sandstones—slaty porphyritic felsite followed by red and green mottled, soft, friable slates—also greenish and reddish flinty fine-grained, or compact friable sandstones.

The Bear Brook rocks are further described as reddish gray, very flinty conglomerate or quartzites and gray red spotted compact porphyritic felsite, with green and gray or bluish striped splintery slates.

Here we would place the Signal Hill sandstones of Alex. Murray, which skirt the Atlantic Coast in front of St. John's, Newfoundland, and show a thickness of 3,000 feet or more. We have found red sandstones nor infrequently associated with volcanic deposits as levigated effusives, though the oxidation of sandy and clayey strata may be due to other causes.

Falling into this gap is another set of gray and reddish sandstones, seen on Smith's and Random sounds, in Newfoundland, and containing over 1,000 feet of strata. Secretary Walcott, of the Smithsonian Institution, who has named this group the Random terrane, found it to overlie the Signal Hill sandstones.

Although both these groups show much quartzose strata they lack the dark gray slates which characterize the Maguma series at top, and is also found in the St. John slates of Newfoundland; hence the two groups of sandstones above described are more probably Upper Huronian.

---

[1] Rep. Geol. Surv. Can., 1883, p. 22P.

[2] *Ibid*, p. 33P.

THE CAMBRO-ORDOVICIAN CYCLE.

As an example of a series of strata which in this area Maritime Provinces has been more fully exploited than most and which is a good example of a complete geological cycle, ı mentioned the Cambrian, or, more properly, Cambro-Ordovician.

In this cycle we include the Etcheminian deposits which u what was formerly recognized as Cambrian, and apparently u the Olenellus Zone. The meagre faunas that are contained i rocks are essentially Palæozoic, and so there seems good reason f necting them with the Cambrian.

In this range of deposits there are presented the following tions, and we attempt their interpretation:—

Coldbrook—Volcanic effusions over a region that for a lon had been above the sea; and so continued during thi

Etcheminian—Land below sea level, deposits mostly of le effusives, red and green colours prevalent in the clastics.

St. John Group:

Division 1.—Clastics of various kinds, the faunas th sheltered bays and shallow basins.

Division 2.—Sands and muds of ocean-shoal character, (swept and ripple marked. Depth less than 100 fa

Division 3*a-d*.—Dark gray and black muds of deeper wate tected from currents. Depth about 100-300 fathom *e*.—Return to shallow conditions (in the band 3*e*). sands, now mostly eroded.

The division probably ended with a complete emergence, as is no continuous sedimentation into the next terrane.

The geological text-books tell us that a limestone formation come in the middle of a geological cycle, but this is not the c northern regions where cold and deep waters prevent the grov corals and other lime secreting organisms. So in this cycle the d 3 of the St. John group takes the place of the usual calcareous m of deposits in the warmer seas.

Another peculiarity in the geological cycles of this regior which does not seem to be noticed as marking geological cycle where, is the intercalation of a member of comparatively barren (and muds) between the shore deposits and those of deep water (Such a member, the Goldenville terrane, is enormously developed great Huronian cycle below the Cambrian, and is also a marked f of the latter cycle. This member, it appears to me, to be due exposure of the sea bottom by the continuous sinking of the (

crust to strong ocean currents, while as yet the sea bottom is not far from the surface, and still to some extent affected by wave action.

A parallel condition now exists on the coast of New England and Nova Scotia in the fishing banks that line it near the border of the continental shelf. The late Professor A. S. Packard has called the fauna characteristic of this tract of the sea bottom a *Syrtensian* fauna, and such a phase of deposits may be called *Syrtensian*.

Now, if we were to compare the Cambrian cycle of Acadia with that of the Cambrian system, as limited by Director Walcott, and accepted later by the European geologists, we find that the former is much more comprehensive. This is shown by the faunas. Here are some of the characteristic forms:

Coldbrook—*Achrothyra* (related to Acrotreta).
Etcheminian—*Holasaphus, Acrothyra.*
St. John Group.

Div. 1	Band *b*.	*Protolenus,* (*Olenellus* horizon?)
	" *c*.	*Paradoxides, Conocoryphe.*
Div. 2	" *a*. and *b*.	*Paradoxides* cf. *Forchammeri.*
	" *c*.	*Olenus,* horizon of, not known in Acadia.
Div. 3	Band *a*.	*Parabolina.*
	" *b*.	*Peltura.*
	" *c*.	*Dictyonema.*
	" *d*.	*Tetragraptus.*
	" *e*.	*Leptobolus.*

The Coldbrook rocks are mostly subærial volcanics and an early terrestrial phase of the Etcheminian, so that practically these form one terrane. Shall we separate these from the Cambrian as belonging to an older sysem? It now seems to me undesirable to do so (although I have elsewhere advocated this), because they are parts of one geological cycle with the Cambrian, and the faunas are essentially Palæozoic, though different from the Cambrian faunas previously known. The trilobite *Holasaphus* resembles some early genera of the Ordovician, and was referred to this system by the writer when first described. A study of the stratigraphical relations of the beds in which it occurs, showed clearly that it belonged to the base of the Cambrian succession, and not to the top. So that although the Etcheminian fauna has features of its own, these are not so decidedly different from the later Cambrian types as to make it desirable to separate it from that system.

At the top of the cycle another difficulty is encountered, for the faunas here show that the two upper bands are Ordovician and not Cambrian, in the sense that Cambrian is now defined. And so our cycle does not agree with the systematic divisions adopted in E Practically it is impossible to map these two bands separately fr rest of the St. John terrane, owing to the rarity of fossils and th lithological resemblance between bands *c* and *d*, one Cambrian a other Ordovician, and also the thinness of the Ordovician.

THE SILURIAN CYCLE.

Between the cycle last described and this there was a great l for there is no trace of the Upper Ordovician in all this region. the great Trenton limestone, and Lorraine shales were being de in the more central part of the continent and along the valley St. Lawrence, the region of Acadia appears to have been above th or at least there are no marine deposits in any part of it, which by organic remains show that the sea covered any part of the land time. Such being the case we are prepared to look for shore de as those which shall usher in the beginning of a new cycle of depr

When free from the irregularities due to the proximity of or to volcanic ejections, this cycle is found to consist in southern Brunswick of the following members:—

1. Quartzites or coarse slates....................Medina hori
2. Black argillites or shales....................Clinton "
3. Dark gray argillites or shales................Niagara "
4. Pale gray argillites or shales..............L. Helderberg "

A shallow water and a thin phase of this cycle is seen in the carene series in the S.W. of New Brunswick which consists of [1]:

1. Hard gray feldspathic slates and argillites..............
2.—Black and dark gray silicious beds, with distinctly alternating bands of colour; obscure remains of plants.............
3. Gray sandy flags and argillites, with gray sandstones........
4. Greenish and reddish sandstones and argillites.............
5. Dark red felsite, effusive...............................

Here the cycle appears to have been cut short by the rising land, for a Niagara fauna has been found in the equivalent c third member, and the fourth and fifth are largely made up of vo effusives, and so may have accumulated rapidly.

[1] Rep. Prog. Geol. Surv. Can., 1870-71, p. 145.

A fuller exhibit of this cycle is to be found about fifty miles further east, in a peculiar manifestation exhibiting great numbers of land plants.[1]

This phase of the cycle, as originally described, is as follows[2]:—

	FEET.
Bloomsbury Conglomerate; coarse reddish gray, with beds of red slate	500
Dadoxylon Sandstone; gray sandstone and grit, with beds of dark gray shale (from 500 to 2,800)	1,600
Cordaite Shales and Flags; green and red argillites and dark gray shales, reddish and gray sandstones, grits and conglomerates, alternating with argillaceous beds; pale olive green flags and shales, with partings of gray shale......	2,400
	4,500

The two upper divisions of the Mascarene section are wanting in this area, but the thickness of the terrane is more than doubled.

(The rocks of the Mispec group, which are red conglomerates and argillites, and which, in the Report of 1870-71, were associated with this series, have since been found to overlie it unconformably.)

The Bloomsbury conglomerate and slate, with a part of the Dodoxylon sandstone, may be considered as equivalent to the Medina, while the rest of the sandstone division will represent the Clinton black shale. The important member of the Cordaite shales and flags will in this case cover the rest of the Silurian, including, perhaps, the Lower Helderberg Group.[3]

If the succession of members in this cycle in southern New Brunswick, including the plant bed series—Little river Group—be compared

[1] This mass of strata has hitherto been classed as Middle Devonian on account of its plants, so placed by Sir W. J. Dawson, but as will be shown further on, there is no proof of marine forms of this part of the Devonian System either in the plant beds or elsewhere, in all this region.

[2] Rep. Prog. Geol. Surv., 1870-71, p. 170.

[3] Some of the leading palæontologists in the United States, including J. M. Clarke and Chas. Schurchert, now include the Lower Helderberg fauna in the Lower Devonian. Without entering into the merits of this question which can only be judged of by an experienced palæontologist, the writer has continued to include the rocks referred to this horizon in the Maritime Provinces to the Silurian, because of the nature of the deposits and the contained flora, which are nearly uniform with underlying strata and plants, the true Devonian flora not appearing in this district until the age of the Oriskany is nearly or quite reached.

In Nova Scotia rocks of a similar age occur at Torbrook and Nictau, where the iron ore beds are rich in brachiopods and other forms of Lower Devonian age. Here the terrane passed through a wider range of conditions than in New Brunswick, for it has quite a body of fine dark slates at the top, but these are not so fossiliferous as are the beds below. Going east from Nictau, certain fine slates and calcareous beds come in which contain a Silurian fauna, and to which these beds of Nictau are probably superjacent, as are certain red beds at Arisaig, which overlie the Silurian terrane there. These beds at Arisaig contain Lower Devonian fish remains, and, therefore, would seem to be of the same terrane as the red strata of Nictau and Mispec.

In New Brunswick, north of the immediate shore of the Bay of Fundy, no strata of this terrane have been found, and no fauna of the Middle Devonian is known in all Acadia and in Maine. These facts seem to favour the presumption that all this area was above the sea in Middle and most of it in Lower Devonian time. If we couple this with the fact that extensive extrusions of granite occurred in the two Canadian provinces and in Maine with great folding and crushing of all the older sediments, it will be seen that Early and Middle Devonian time, was a critical period in the geology of Acadia.

In New Brunswick the pebbles of the conglomerates in the Lower Devonian are derived from rocks immediately north of them, and though the accompanying slates contain only poorly preserved plant remains, the corresponding strata in Nova Scotia have yielded *Psilophyton* and other fossils of types peculiar to the Devonian age. But nothing has been found which recalls the peculiarly rich and varied earlier flora of the St. John plantbeds. It would appear that the conditions which had encouraged the growth of that vegetation had been removed. Chief among these, no doubt, was the change from an insular to a continental climate, the barriers which shut off the cold and dry north winds were removed, and the flora which had had its home in Gaspé invaded the continental and insular parts of Acadia.

THE UPPER DEVONIAN CYCLE.

This consists of beds which, for a long time, have been classed in New Brunswick as Lower Carboniferous. It is true that in the first geological survey of New Brunswick Dr. Abraham Gesner placed them as "Old Red Sandstones," but as he classed the Lower Carboniferous limestone as Lias Limestone, it is evident that his determinations of the sandstones and shales were based on lithological data, as was the custom in the early days of the last century. The later reference of these

groups in New Brunswick, as the Lower Carboniferous, by l
porary, Dr. James Robb, has been followed since. While
Lyell determined the age of the limestones in Nova Scotia t
Carboniferous.

Since these authors wrote, much information in relati
rocks has been accumulated, and in both New Brunswick
Scotia red conglomerates and sandstones are found to und
formably the Carboniferous limestone, hence they are made
cycle. No marine remains have been found in them, but the
contain are Upper Devonian, with a liberal admixture in plac
that pass to the Carboniferous. The investigations of Mr. Hu
and Dr. R. W. Ells, field surveyors of the Canadian Geolog
in Nova Scotia, show the limestone and the Upper Devoni
rocks are unconformable.

Taking the latter as a small, closed cycle, we find it be
the Cambrian and the Silurian, with deposits of weathered
debris that had been thoroughly oxidized; and in some dis
volcanic effusives, producing extensive deposits of red conglon
marls or muds. These form the first member of the cycle and
widespread in southern New Brunswick and northern Nova S

Upon this lower member of red rocks rests another m
prevalence of gray sandstones and shales, often with nume
remains, fishes, and crustaceans.

In New Brunswick and northeastern Nova Scotia this
distinguished by its gray colour, and consists of sandstones
in frequent alternations. Many of these beds abound in remai
plants, and others are highly bituminous. This terrane is th
Coal Measures" of Sir Wm. J. Dawson, for it resembles the coa
in appearance and in the numerous plant remains which it
The Albert shales of New Brunswick belong here; also tl
beds and Riversdale terrane in Nova Scotia.

The next terrane of this cycle, although still plant-bearin
the bright red colour in the sediment which marks lowest
Perry conglomerate member.

This cycle cannot be considered one of the ordinary typ
depression of the earth's crust has gradually resulted in th
of the land by the sea, for no strictly marine forms are kn
The depression which occurred when its middle members were
appears to have resulted in the formation of lakes and mars
large amount of bituminous matter in the Albert shales, with
dant fish remains which are found in the Petitcodiac and Ke
valleys in New Brunswick point to lacustrine rather than m

ditions; and around the Basin of Mines in Nova Scotia there are abundant indications of marsh and lagoon deposits in the middle of this cycle. The whole cycle may have been epicontinental.

THE LOWER CARBONIFEROUS SUB-CYCLE.

The geologists who have studied the Lower Carboniferous rocks in New Brunswick and Nova Scotia agree that this cycle is distinctly marked off from the preceding by an uncomformity. This is clearly set forth in the report of Messrs. Bailey and Ells on the Albert shales;[1] and of the corresponding beds in Antigonish county Mr. Fletcher says, "it rests unconformably upon all the formations from the pre-Cambrian to the Carboniferous conglomerate" (*i.e.*, Upper Devonian conglomerate).

The cycle opened, therefore, with the submergence of an extensive tract in southern New Brunswick, northern Nova Scotia, and Cape Breton, below the sea. There is no means of judging its width, as Carboniferous and later terranes cover the areas to the north, but in the neighbourhood of the bands of territory which in Silurian time had supported a littoral fauna, this marine Lower Carboniferous fauna spread itself.

There was, however, almost immediately a return to re-elevation by slow degrees, for above the limestones containing marine invertebrates are marls with beds of gypsum and saliferous clays, and other indications of a gradual desiccation of the surface of the land. The prevalence of red clays and sands in this terrane also tend to show a dry climate and long exposure to oxidation.

Going westward in New Brunswick the limestones become thinner and the mass of the deposit less, hence it seems probable that the sea in Lower Carboniferous time invaded this area from the eastward, but was soon excluded.

THE CARBONIFEROUS CYCLE.

That the epoch of the Millstone grit was the beginning of a new order of things in the Maritime Provinces of Canada is evident from the change in the nature of the sediment and in discordance in dip which may be observed almost everywhere at the contact of this with the preceeding terrane.

The red colour of the sediments and the proofs of drying up of ponds and flats, which are so prominent a feature of the Lower Car-

[1] Rep. Geol. Surv., 1886, p. 79P, par 3.

boniferous shales, give place prevailingly to sandstones of a gr and the encroachment of these sands on the red marls and lim the anterior time.

Still it would appear that the region was not much depr the coal measures are beds which would have been deposited the lagoons and marshes of a widely extended flat and low

The geographical outlines of the coal measures as they spread out in Acadia was more or less the outlines of that gr over which the coal measures accumulated and are now expo material being supplied by the rivers that flowed down from th ing highlands to the south and, perhaps, to the northwest. boniferous plain was an extended triangular basin facing the St. Lawrence, having its apex at Oromocto lake in New B and the sides spread out to the east in Nova Scotia and nor New Brunswick.

Of this cycle the Millstone grit is essentially a part of measures, but by the greater prevalence of red sandstones an shows a relation in its climate and conditions to the underlyi Carboniferous series.

Sir Wm. Dawson well describes the conditions that may vailed here in Carboniferous Time in his account of the Joggi in Cumberland county. He says, "The whole series of even preceding historical sketch has depended on the following cond Gradual and long continued subsidence, with occasional elevate ments, going on in an extensive alluvial tract, teeming with life and receiving large supplies of fine detrital matter.... a very long period these opposing forces (of subsidence and re-e were alternately victorious, without effecting any very decide manent conquest." "It is impossible to contemplate this va of deposits (of the Joggins section of coal measures, 13,000 fe out being forcibly impressed with the great lapse of time and th of change which it indicates...... It is to be borne in m that this section represents the structure of the whole plain of land, and in a less precise manner that of the whole Carbonifer in Nova Scotia and New Brunswick."

It will be noted that all the forms of animal life describe W. J. Dawson as inhabiting this great Carboniferous plain a of the land, or of ponds and lagoons, the sea margin may h far away to the northeast at the present deeper waters of the St. Lawrence, outside of the Magdalen Islands and the northe of Cape Breton.

outbursts of the period, for near where the volcanic masses largest the depth of water in the bay is greatest. The great Triassic times form the long ridge of the North Mountains Scotia, and towards this the depth of the soundings increase f north side of the bay, except in one locality, viz., off the coas island of Grand Manan, which is on the northern side of the bay its mouth; in this part the deep water extends across the bc the bay from side to side, and Grand Manan is the only plac north side of the Bay of Fundy where there was an extensive o Triassic trap. It might be inferred from these conditions th extensive discharges of Mesozoic lavas and ashes had so fa ened the earth's crust here as to cause a subsidence in this a thus give form to the bottom of this arm of the sea.

The sediments of this period where, as on the north sid bay at Quaco, N.B., they show their greatest fulness and diver of three kinds. The lowest group are bright red sandstone cement more or less calcareous, well laminated and often showing lamination. It has been the custom to attribute this structure t ful tidal currents, and hence it has been supposed that strong such as traverse the Bay of Fundy at the present time, were res for such structures as we now see in the Triassic sandstones found in its basin. It seems, however, difficult to reconcile w hypothesis the entire absence of marine organisms from these san or the bright red colour and uniform appearance which they eve exhibit.

In regard to rocks of this appearance and this age in the C cut and New Jersey outcrops, it appears to the writer that th thesis of Mr. J. Volney Lewis, that they form the deposit of mont plain has much applicability.[1] In addition, he sugg prevalence of an arid climate. Such an hypothesis would, better than any other, account for the peculiarities of the "N Sandstone," or Triassic sandstones of the Bay of Fundy. The co would not, therefore, greatly differ from those of the preceding time, except in the presence of a drier and probably a colder

The second or middle member of this cycle, however, pr very different series of beds. There is a distinct and sudden tr from the fine and homogeneous red sands to coarse pebble beds, might have gathered on a shingle beach; these beds of pebbles a without a matrix, except such as has been furnished by calcite sul to the deposition of the beds, and are so thoroughly rounded th

[1] Annual Report of the State Geologist, Geol. Surv. N. Jersey, 190

could hardly be anything else than the product of a shingle beach, beaten upon by a heavy surf. Whatever the underlying red sandstones may tell us, these boulder beds would appear to have been accumulated on a sea beach, and tell of the encroachment of the sea, perhaps, at the time of the volcanic eruptions on the opposite side of the Bay. The cobble stones of these beds are almost all derived from the Cambrian felsites and purple quartzites of the close-by hills, and have travelled but a short distance from their source.

These cobble beds, by the addition of sandy layers, gradually pass up into the third member of the Jura-Trias of this basin, consisting of sandstones and shales, mostly reddish brown colour, with some gray sandstones. These sands and clays contain scattered plant remains[1] which by their character appear to have been derived from Mesozoic plants.

The Jura-Trias cycle then, though showing a sudden depression below sea-level in its middle term, seems, like its predecessor, to have been mostly epi-continental.

This is the last cycle of sedimentation which has left its impress on the Maritime Provinces of Canada until one reaches Post-pliocene Time, so there must have been an exceedingly long period of time marked by geological cycles of deposition in other parts of the world which have left no record in this region. This period would have included a great part of the Mesozoic and practically all the Kainozoic Ages.

[1] Bull. Nat. Hist. Society of N. Brunswick, Vol IV, p. 68.

VIII.—*Cellular Osmosis and Heredity.*

By A. B. MACALLUM, Ph.D., Sc.D., LL.D., F.R.S.

(Read May 26th, 1908.)

The constant review of the concepts of science, the testing of them at every point and the consequent revision of their accepted values contribute a special feature which distinguishes the scientific thought of our day and measures the vigour of the scientific spirit. Science no more than dogma can be infallible, for though it may aim at infallibility, it should never claim to have attained it. Science is acceptable only because its tenets are being constantly subjected to the closest scrutiny by a perpetual procession of researchers whose verdict is always being rendered, but whose final word on all points may never be uttered.

To question any doctrine or concept commonly received in science is therefore, not evidence of heresy in the critic and it may, however, be an imperative duty, for only in the questioning spirit may be found the true attitude of mind which in the final summing up will prove of service to science.

These introductory remarks are to constitute an explanation of the position which I am to take in the following pages, for I am to discuss in the questioning spirit the application of two of the doctrines of physical chemistry to the physiological phenomena of osmosis. One of these doctrines is that in solutions, the substance dissolved is in such a condition that its molecules are separated from each other as they would be if such substance were in a gaseous condition, occupying the same volume as the solution, and that it, in such solutions, illustrates all the gas laws. The other doctrine is associated with the first, and indeed, inseparable from it. In all the discussions and speculations of the last thirty years on the nature of physiological osmosis, it has occupied a central point, and it is now almost a common place in physiological text-books and treatises. This second doctrine is that of the semi-permeable membrane.

The concept of a semi-permeable membrane postulates a diaphragm which is freely permeable to water, for example, but not to any substance dissolved in it. If, for instance, sugar is the solute, the membrane will not permit it to pass through to the other compartment, but the water of the latter diffuses through to dilute the solvent of the sugar. The membrane is so constituted as to retard completely the passage of the molecules of the solute, but not the solvent.

The molecules whose passage through the membrane is p exercise a kinetic effect with the result that they establish a known as osmotic pressure, in proportion to the strength of the in the case of a non-electrolyte, but in proportion to its conc and ionisation in the case the solute is an electrolyte.

This conception of a semi-permeable membrane was first in by the botanist, Moritz Traube,[1] who, in 1865, began the study are now known as precipitation membranes. These may be mad ing tannin to gelatine, which has been boiled for a long time in convert it into β gelatine. This results in the formation of tan gelatine which constitutes a membrane. A more typical forn a semi-permeable membrane may be obtained in the following first proposed by Traube. A piece of narrow glass tubing abo more inches in length, open at one end, but covered at the other b of rubber tubing compressed with a clip, is taken, and into this a few drops of a 2.8 per cent. solution of cupric acetate. The is now lowered into a test tube containing a quantity of a 2.4 solution of potassic ferrocyanide. The liquid in the inner tu shifting the pressure on the rubber tubing, made to form a plan at the mouth of the tube and cupric ferrocyanide is deposited t fine transparent film which closes the opening. This film or m prevents the diffusion of the copper salt downwards and of the p ferrocyanide upwards, as shown by the facts that the cupric ferr does not occur above or below the film, and that the film rema considerable time transparent and of very great tenuity, but sufficient density and grain to prevent either salt passing throu

That water, however, does pass through such a membran demonstrated by showing that the refractive index of the soluti immediate neighbourhood of the film is increased, this indicating concentration of the solute is increased at that point, or it may b strated by placing a crystal of the chloride or sulphate of cop moderately concentrated solution of potassium ferrocyanide. latter case there is formed a precipitate of cupric ferrocyanid form of a membrane about the crystal which distends gradually, only by the penetration of water alone, for the distension may re rupture, and then there escapes a drop of concentrated sol chloride or of sulphate of copper which in contact with the exter gives a new precipitate repairing and thus closing the ruptur original membrane. Through this also the water passes and d continues till the osmotic pressure inside and outside is the same

[1] Arch. für Anat. und Physiol., 1867, p. 87.

These films are, however, so delicate and so easily ruptured, that they cannot be made to furnish data which would enable us to determine the pressure exercised by the dissolved substances. Pfeffer[1] met the difficulty which they present by causing the precipitate of cupric ferrocyanide to be deposited in the walls of unglazed porous earthenware or porcelain vessels. This he succeeded in doing by pouring one of the solutions, e.g., the cupric sulphate, in the porous vessel which was then placed in the other solution. The two solutions diffused through the pores of the wall of the vessel and met forming a precipitate film which, owing to the firm support afforded by the wall, could not be displaced, and, after washing away and dissolving out all traces of the two solutions, the porous pot was now made to serve as a membrane to determine the pressure exercised by dissolved substances. This was done by putting into the porous receptacle some of the solution which required to be examined, closing the vessel with a firmly fitting stopper through which penetrated a manometer connection to indicate the pressure. When the vessel was placed in distilled water the latter passed through the wall of the porcelain tube and as there was apparently no corresponding movement in the opposite direction, the pressure inside rose and was registered by the manometer.

With such membranes, Pfeffer obtained some striking results, but the chief one was that the pressure was found to be dependent on the strength of the solution, being almost proportional to the concentration in the case of organic solutes like cane sugar and dextrose and also in proportion to the rise of absolute temperature, but in the case of salts the results were not so constant.

Pfeffer did not account for the causation of his results, and it was van't Hoff who was the first to offer an explanation of them. This explanation practically embodies the now well known theory of the gas nature of solutions which is accepted widely as a cardinal principle of physical chemistry.

Pfeffer and Traube, in postulating the existence of a semi-permeable membrane led by a desire to explain how it happens that the living cell and particularly, the vegetable cell, placed in aqueous media maintains its normal turgor and at the same time retains all its organic constituents, dextrose for example. The facts then known apparently indicated the existence of a membrane which allowed water to enter the cell, but not the organic substances to escape. Such a membrane implied a semi-permeable character.

---

[1] Osmotische Untersuchungen. Leipzig. 1877.

It may be doubted if physical chemistry would now includ concept of a semi-permeable membrane, were it not for the diff experienced by botanists and physiologists in accounting for the ca of living cells to retain their organic constituents. There are, how parallel physical phenomena which might in themselves have sugge different explanation, and one of these is manifest in the action of dium on hydrogen.[1] At ordinary temperatures palladium absorbs h gen, but gives it up again when heated in vacuo to temperatures 100° C. Palladium does not so act towards any other gas, and in sequence at about 200° C. it can be constituted as a membrane p able, of course, to hydrogen, but impermeable to carbon monoxide, c dioxide or nitrogen.

If any of these gases be contained in a palladium tube surro with hydrogen, the latter will pass through the palladium and cau increase in pressure in the tube equal to 90 per cent. or more of th the external hydrogen. Like palladium acts also platinum, accordi Richardson, Nicol and Parnell.[2] That we have in either palladiu platinum material which would constitute a semi-permeable mem may at once be denied, for the absorptive power of palladium in r to hydrogen is due merely to solution of the hydrogen in the palla while the semi-permeable membrane in the meaning of Pfeffer, Hoff and others is practically a sieve, the meshes of which are enough to allow molecules of water to pass through, but not th sugar. If, for a moment, we admit that the membrane plays a than passive part in the exchange which takes place through it, once practically alter fundamentally the concept of a semi-perm membrane.

Even, however, when we are dealing with precipitate memb we must abandon the sieve theory. Barlow[3] has pointed out th ferrocyanide membrane is more readily permeable under mech pressure to alcohol than it is to water, that is the larger molecule through more readily than the smaller. He found also that when percha membrane separated pure alcohol and pure water, the a passed through to the water, the reverse of what happens when a c ferrocyanide membrane is used. Pringsheim[4] by varying this m of forming the precipitated membrane, obtained some interesting r He took a U-shaped tube into which he poured enough liquified ge to fill the bottom and lower portion of each limb of the tube. O

[1] Ramsay, Zeitschrift für Physik. Chem., Vol. 15, p. 518, 1894.

[2] Phil. Mag. (6), Vol. 8, p. 1, 1904.

[3] Phil. Mag. (6), Vol. 10, p. 1, 1905.

[4] Observations published after his death, in 1895.

"setting," he poured into one limb a solution of potassic ferrocyanide and into the other a solution of either the chloride or the nitrate of copper. The two solutions diffused into the gelatine and towards each other, forming where they met a regular continuous well-supported membrane. From his experiments with this membrane, he concluded that its permeability does not depend on its chemical nature, but on the conditions of its formation. Nevertheless, it is not the size of the molecules which determine whether they shall go through the membrane; it is rather more or less the affinity of the dissolved substances for the substance constituting the membrane that is the deciding factor.

It must not be overlooked that the term semi-permeable has been applied to other membranes than the precipitated ones. An instance is that of Nernst.[1] He used pig's bladder to separate a saturated solution of water in ether from a quantity of the same solution, in which, however, benzene was dissolved. The membrane allows the ether water to pass through it, but keeps back the benzene. Another example of a so-called semi-permeable membrane differing from the precipitates is that of Raoult,[2] who employed a rubber membrane to separate ether and a solution of ether in methyl alcohol. In this experiment the ether, but not the alcohol, passed through the membrane. A like septum was employed by Flusin, who found that it was "permeable" to carbon disulphide, chloroform, toluol, ether and every organic fluid which dissolves caoutchouc. The velocity, however, of the diffusion through the membrane varied almost directly according to the solubility of the diffusing compound in the rubber.

All these results distinctly point to an action on the part of the membrane which is not postulated in the semi-permeable membrane of Pfeffer and van't Hoff. The rubber dissolves the "permeating" substance and, in the case of the pig's bladder used by Nernst, the substance of the bladder membrane dissolves the water-ether solution, but does not dissolve the benzene, and hence the latter is held back.

It is obvious that if this view is correct the currently received explanation of osmosis fails. This postulates that the solute is in a state of gas, the molecules and the dissociated ions of which bombard the membrane and the free surface of the solution, and this bombardment tends to extend the limits of the solution, which can only happen if the membrane permits the molecules of the solvent in the other compartment to pass through it. This theory absolutely ignores any activity on the part

---

[1] Theoretische Chem., 2nd ed., p. 167.

[2] Zeit. für Physik. Chem., Vol. 17, p. 737, 1895; Comptes Rendus, Vol. 121, p. 187, 1896.

must be decreased and in consequence the layer of liquid in contact with the wall will become richer in salt than the rest of the solution.[1] When the solution moves through capillary tubes, along a filter or upwards through finely divided quartz, the salt will collect on the capillary walls, on the fibres of the filter, or on the particles of quartz, and the current, as it ascends, will become more and more dilute until finally it is distilled water. J. J. Thomson and Monckman filtered potassium permanganate from its solution by passing it through finely divided silica and a similar separation may be obtained by allowing dilute permanganate solutions to diffuse into filter paper. Perhaps the most striking illustrations of this phenomenon may be obtained by suspending long strips of filter paper so as merely to dip into a dilute solution of copper acetate. In a few minutes the fluid runs up several inches, but the upper half inch or inch of the moistened portion does not contain a trace of the copper solution, as may be shown by treatment with potassium ferrocyanide solution or ammonium sulphide.

When, in consequence, a septum is in contact with a solution whose air tension is high, the solute will tend to condense on the surface of the septum, while the solvent will pass through. This would cause the retention of such substances as sugar, urea, etc., while permitting the solvent, water, to transude.

It must, however, be admitted, that surface tension is not a factor sufficient to explain all the phenomena of osmosis, and especially those manifested in cellular absorption and diffusion. It will not explain the absorption of colloids in the intestine, the passage of fats and proteins through the endothelial lining of capillaries and the diffusion through living membranes of material which is not in solution, but rather in suspension as colloids. The difficulty of explaining these and the inadequacy of the concept of the semi-permeable membrane has promoted in recent years revival of the old doctrine of vitalism as a distinct force concerned in the exchange of material through the septa formed by living cells. To accept an hypothesis postulating the existence of a biotic or vital force distinct from the physical or chemical ones that we know and can examine is, I think, to despair of an intelligible solution of the problem and it does not seem justifiable as yet to adopt that attitude, the more so since the range of facts bearing on the problem has been recently greatly widened.

Overton,[2] who has investigated at great length the velocity with

[1] J. J. Thomson, Applications of Dynamics to Physics and Electricity.

[2] Vierteljahresschr. Naturforsch. Gesellsch. in Zurich, Vol. 44, p. 88, 1899; Arch. für d. ges. Physiol., Vol. 92, p. 261, 1902; Jahrb. für wiss. Bot., Vol. 34, p. 669, 1900.

which chemical compounds diffuse into living cells has formulated c clusions which associate this diffusion with the so-called distribution efficient. By this term is meant the constant relation in which a s stance independent of its quantity at a definite temperature distribu itself between two different solvents. An example of such a substanc succinic acid, which has a distribution coefficient between ether and wa of 5.2, that is, 5.2 times as much of the acid dissolves in the ether a taken up by the water.

Overton found that in general various compounds pass throu membranes the more soluble they are in such substances as fa cholesterin, lecithin, etc., and he holds in consequence that these lip bodies in cells are the cause of the diffusion into the latter of vari lipoid-soluble substances and, further, that the magnitude of the dist bution coefficient between fat, lecithin and cholesterin on the one ha and water on the other determines the velocity of osmosis. The lip material in a membrane takes up a solute from a fluid bathing it a velocity proportionate to the distribution coefficient and at the same ti the substance is passed on from the membrane to the interior of the c

In illustration of Overton's theory it would follow that a substa soluble in water, but not, or scarcely, in oil would not pass through membranes readily. For example, glycerine presents this feature and penetrates cell protoplasm slowly. The monochlor compound of it, mo chlorhydrin, is soluble in fat and diffuses into the cell quickly, l the dichlor compound, diohlorhydrin, which is extremely soluble in f almost instantaneously penetrates cellular elements. One may para these results with those obtained with the use of urea, monomethyl ur dimethyl urea and trimethyl urea, all of which have solubilities in increasing in the order named and with corresponding power to penetr cell protoplasm. On the other hand many very active electrolytes insoluble in fats, and it is found that they penetrate slowly the c protoplasm.

That lipoid material does obtain in cell membranes seems to be dicated by the results of *intra vitam* staining. Overton found that dyes which stain the living cell are those as a rule which are soluble fats, cholesterin and lecithin, in which the dyes incapable of produci a vital stain do not dissolve.

One of the most noteworthy points in Overton's generalizations the remarkable fact that all the principal narcotics, anæsthetics and ar pyretics are rapidly diffusing substances. This fact was also pointed independently by Hans Meyer, and both he and Overton hold that efficacy of a narcotic depends on its solubility in lipoids.

These speculations of Overton, while very interesting, do not solve the problem of osmosis wholly, for they offer in themselves difficulties which Traube has pointed out.[1] For instance, if there must be solution in the lipoid material of the cell wall before the substance can enter the cell protoplasm, then even the most rapid osmosis would be a very slow process. Further, it is impossible to understand why this lipoid material should not hold this dissolved material all the more tenaciously, the more forcibly it has attracted it, instead of passing it on to the interior of the cell. It is above all impossible, Traube holds, to understand how water can penetrate lipoid-holding membranes since it is not soluble in lipoids, and further, salts, as in the case of renal and other secretions, readily penetrate cells, which is quite irreconcilable with Overton's theory.

Moore[2] has also criticized the lipoid theory of osmosis in practically the same terms as Traube, pointing out also that it does not furnish any basis of explanation of how energy is expended in concentrating any secreted or absorbed substance, and he also holds with Traube that a lipoid as a good solvent for a given constituent does not give it the power to pass that substance through the cell in a more concentrated condition, or indeed, to alter the concentration of the solute anywhere save in the solvent itself.

The criticism of Traube that a lipoid-holding membrane is impermeable to water will not hold wholly, for lecithin, cerebrin and protogon swell up greatly in water and they are consequently permeable to water, but Nathansohn[3] points out that when lecithin swells up in water it thereby loses the capacity to dissolve the substances soluble in lipoïds. He, however, would still accept Overton's theory, but would modify it to account for the diffusion through lipoid-holding membranes of both water and lipoid-soluble material. This, he does by postulating that the membrane is a composite or mosaic structure in which a portion of the component elements consists of unswellable cholesterin impermeable to water and the remainder of protoplasmic material which has the properties of a typical semi-permeable membrane.

In support of this view of Nathansohn, there are facts which Pascucci[4] has determined. The latter found that the stromata of red blood cells is constituted, one-third of lecithin and cholesterin with a minute quantity of a cerebrin-like compound, and the remainder, two-thirds, of proteïd. As the stromata consists in large part of the membranes of the

---

[1] l. c.

[2] Recent Advances in Physiology and Biochemistry, edited by Leonard Hill, p. 156.

[3] Pringsheim's Jahrbuch, Vol. 39, p. 607, 1904.

[4] Hofmeister's Beiträge, Vol. 6, p. 543, 1905.

red cells, the postulated mosaic structure of Nathansohn may occı red blood cells at least.

The very fact that we are driven to postulate a mosaic membra order to apply Overton's theory, indicates how inadequate the latter explanation of osmotic phenomena. That lipoïd substances can facil the exchange between the exterior and the interior of a cell may b mitted, but that it is the only factor or the most important factor i acceptable, and one must trust to a larger conception of osmosis in (to be in a position to understand its phenomena.

This larger conception may be gleaned from the results o studies of Kahlenberg.[1] In order to understand rightly the signific of his observations, one must, to a certain extent, disregard the dis tion between colloids and crystalloids, which has been held valid Graham's time. We must recognize that a substance which acts colloid to water is not necessarily a colloid to every other solvent. deed, there is evidence that in the case of some of the typical coll solutions in addition to the ultramicroscopic suspension particles pr there is a quantity of the same material in the solution side by side the particles. This Hardy has shown in the case of agar and gela and the phenomena associated with all other colloids, except those o inorganic class, seem to indicate that there are two phases in all suspensions, namely, the solid-water phase, which enters into the stitution of the suspension particles, and the water-solid phase w forms a true solution. When the latter is eliminated there is bro about a conversion of some of the solid-water phase into the water- phase until equilibrium is established. It is, therefore, not corre speak of colloids as wholly suspensions.

On the other hand the very fact that a membrane does not ε the passage of a so-called colloid through it, is no evidence that the l is wholly a suspension, for, if the composition of the membrane is ru it will keep back even sodium chloride, that is, a crystalloid. This s how artificial is the distinction which we obtain by using one kin membrane as a means of distinction between suspension and solu If we wish to understand the phenomena of osmosis, we must discar the concepts which we have gained from the results obtained with ordinary dialysing membrane formed of parchment. It would be as reasonable to classify all substances into two groups in their rel to a rubber membrane, for neither rubber nor parchment membı exist in nature, and those membranes which do exist are not of the that make a distinction between the so-called crystalloids and coll

[1] Journ. of Physical Chemistry, Vol. 10, p. 141, 1908.

ted that of the so-called colloid substances which the products of, tissue and cellular activity, there luble in the fluids bathing such tissues or cells or fluids. To express it in another way, the reason h are concerned in the vital process circulate and ments is that the physiological fluids, extracellular ular, are so composed as to dissolve them.

Kahlenberg's observations, it may be pointed out that the first to use rubber membrane as septa for osmotic ce Flusin, Raoult, Tamman and others had done this was the first to investigate thoroughly the properties of ta and to indicate the significance of the results.

not detail fully the results of his observations, and I must o are interested in the study of osmosis to consult the r, for it is replete with descriptions of experiments which motic phenomena which cannot be obtained with parchment which help to clear up the chief difficulties experienced in the empts at explaining physiological osmosis. I shall here give w details to illustrate the significance of Kahlenberg's results. he first place, he found that the composition of the membrane isive factor in osmosis. He used in his experiments amongst membranes septa of pure rubber and various fluids as solvents, but ost striking results were obtained with pyridine. With pyridine n one side of the septum, but with the same medium containing sugar and copper oleate on the other, it was found that the colloid, er oleate, freely passed through the septum, but the crystalloid, e sugar remained behind. On the other hand, two crystalloids, mphor and cane sugar in solution in the pyridine, the camphor, but ot the cane sugar passed through the membrane. Here, two crystalloids ere separated from each other by osmosis. Further, Kahlenberg, as e stated in an address delivered to the chemical section of the American ssociation during its last session, has been enabled by this method to parate two colloids from each other.

The rubber membranes in Kahlenberg's experiments were not wholly npervious to sugar, for traces of it passed through them and so also id nitrate of silver and lithium chloride, but in very much smaller proortions than in the case of cane sugar. That means that the non-eleccolyte sugar diffuses through the membrane more readily than either of e electrolytes.

When, instead of rubber septa, which he found permeable to copper leate in benzene, he used a parchment septum with benzene on one side and benzene containing copper oleate in solution on the other, no pene tration of the membrane occurred, that is, the colloid copper oleate whic passed through the rubber septum does not pass through parchment.

These and other results of Kahlenberg's observations make it quit clear that the membrane is not a passive element in osmosis. In th case of rubber septa with pyridine only those substances would pas through which are soluble in hydrocarbons, whether they are crystalloid or colloids. "The current view that crystalloids always pass throug membranes," he says, "more readily than colloids is evidently untenabl as it has been shown that just the opposite may occur and that eve crystalloids may be separated from each other by dialysis when the prope septum is chosen. *Whether substances can be separated by dialysis o not, does not depend at all on their crystalline or non-crystalline natur as is so commonly supposed, but upon their affinity for the septum em ployed.*"

Of course, there are in nature no membranes like in composition t rubber, any more than there are membranes like parchment, or like th precipitated membranes of Traube and Pfeffer, but the one distinctiv point obtained from the use of rubber septa which membranes of othe composition do not permit us to ascertain, is that *osmosis is due to th solvent activity of the membrane, whatever its nature. From this w may conclude that the composition of the membrane and the solubilit in that membrane of the solutes on either side of it are all importan factors in determining whether osmosis shall obtain.*

With these generalizations and with a new view point, we are in position to appreciate and understand some problems which have ha their origin in the results of some investigations of my own on the micro chemistry of the cell and which, I believe, have a profound significanc in relation to heredity.

It is well known that caseinogen and egg albumen when put in loo of the intestine are absorbed apparently unchanged and excreted by th kidneys. When these same proteids are intravenously injected they ar then also excreted by the kidneys. In the former case the mucous mem brane of the intestine itself, composed of "colloidal" material, takes u the "colloidal" proteids and pass them on into the blood. In bot cases the reflected epithelium of Bowman's capsule, itself also of "col loidal" composition, allows the foreign proteids to pass through wit the water and salts. Again, we know that the normal proteids and fat of the blood plasms pass through the endothelial cells of the bloo capillaries to provide constituents of the lymph. The fats in the lymp are destined in part to penetrate the cytoplasm of certain connecti tissue elements to be deposited therein and from these intracellular deposits to diffuse away again according to the needs of metabolism. In this passage from blood vessels into cells, "colloids" diffuse through "colloidal" membranes and, as in the case of the casemogen and albumins, the only explanation possible that the membranes are of such a composition that they dissolve the water-solid phase of the "colloids" (proteins and fats), just as the rubber membrane in Kahlenberg's experiments dissolved the copper oleate or the camphor, and passed it through to the other side.

It is, however, in cells themselves that we see striking evidence of diffusion of colloid through colloid. In the villi during the absorption of fat the epithelial cells convey it to the underlying adenoid tissue and the latter pass it on to the lumen of the lacteal vessel. This transmission is not through the spaces or lacunæ of the adenoid tissue, but through the colloidal substance of the adenoid trabecular network stretching between the basement membrane and the wall of the lacteal vessel, and it is transmitted dissolved in this "colloidal" substance. Indeed, it penetrates the wall of the lacteal vessel only by dissolving in that wall. Even in the epithelial cells covering the villus, a part, at least, of the fat is dissolved in the cell, the protoplasm of which allows it to diffuse readily on towards the basement membrane, but in the lateral membranes of these cells it may be retained in a dissolved state after the cytoplasm has got rid of its charge of fat.

We know also that in developing nerve cells, the chromatin of the nucleus diffuses out through the membrane of the nucleus to form the substance of the Nissl granules which are so distinctive a feature of nerve cells in adult Vertebrates.[1] Further, in the developing ovarian ova of Amphibia, the chromatin of the nucleus alters in composition, gathers in small spherules immediately adjacent to the wall of the nuclear membrane and give off material which passes through the membrane to constitute the para-nucleoproteid of the yolk spherules.

A like diffusion occurs in the hæmatoblasts of Amphibia when the antecedent of hæmoglobin passes through the nuclear membrane to form hæmoglobin in the cytoplasm. In observations conducted by Sutherland Simpson and Hering,[2] hæmoglobin-like compounds occurred in the cavities of hepatic cell nuclei of the dog which were probably derived from red corpuscles, and some of the latter were observed inside liver cells, either intact or in the process of degeneration.[3] That hæmoglobin can diffuse into the liver cells and into the nuclei follows from the observa-

[1] Scott, Trans. Can. Inst., Vol. 6, p. 405, 1899.

[2] Proceedings Royal Soc., Vol. b. 78 p. 455 1906.

tions of Browicz,[1] who injected intravenously in a dog a quantity c solution of Merck's hæmoglobin and found crystals of hæmoglobin the hepatic nuclei. He observed also, that when red corpuscles bı down in liver cells, hæmoglobin is stored in their nuclei, and this only be explained on the assumption that hæmoglobin diffuses thro the nuclear membrane.

One may multiply the instances, but enough are detailed to sl that membranes in, and the protoplasm of, the living cell are capabl allowing "colloids" to diffuse through them, and that living ani membranes do not necessarily distinguish between colloids and crys loids, unless they are specially constituted for that purpose, and tł strange to say, they tend to be impermeable to crystalloids of the ir ganic class.

One of the most striking results of my microchemical studies is determination that the nucleus is absolutely free from chlorides ı phosphates, and as these form the typical salts of sodium, potassiı calcium and magnesium in tissues and physiological fluids it is obvi that these elements are absent also from the nucleus. Indeed, diı tests for potassium and calcium show unmistakably that salts of tł elements do not occur in the normal nucleus.

It is a fact that in the intestine absorbing iron salts the nuclei the epithelial cells whose cytoplasm gives a marked reaction for inorga iron are wholly free from inorganic iron. In fact, the wh cytoplasm may be surcharged with inorganic iron and yet not a trac found in the nucleus. Even in the liver in pernicious anæmia, when cytoplasm of the hepatic cells is markedly impregnated with inorga iron, their nuclei never show a trace of it.

From these and other observations, I put forward the doctrine t the normal cell nucleus does not know the inorganic world, that it the home of certain organic compounds only.

Is this merely due to the greater avidity of the cytoplasm for in ganic salts and thus none of the latter are allowed to leave the cytopla for the nucleus, or does the nucleus offer of itself an obstacle to the pe tration of it by inorganic salts?

The latter is, I believe, the correct answer. The head of the sp matozoon is an altered nucleus and in the seminal fluid apart from spermatic elements there are the chlorides of sodium and potassiı Now, if the cytoplasm is responsible for the freedom of the nucleus fr inorganic compounds, the head of the spermatozoon should be charı

[1] Bull. Internat. de l'Acad. des Sciences de Cracovie, July, 1899.

with chlorides and yet not a trace of chlorides have I ever found in the heads.

It is manifest then that the nucleus actively excludes inorganic salts and the question is how is it done. The answer is that the nuclear membrane is so constituted as to exclude them and the only structure so concerned is the nuclear membrane.

This impermeability of the nuclear membrane has in some cases been noted by others. Hamburger[1] found that when the intestinal epithelial cells are bathed with different concentrations of sodium chloride the cytoplasm is readily permeable to the salt, but the nucleus manifests little or no permeability. This, he found to be true also of the nuclei of the ciliated epithelial cells of the trachea, and of the nuclei of the epithelial cells of the bladder.

The absence of certain other compounds and these of the organic kind must be specially noted. Except in rare cases, all pathological, no fats are demonstrated in the nucleus even with the most sensitive microchemical reagents for fat, like scarlet red or sudan III. Further, intranuclear glycogen has never been observed in the normal cell and that of itself would postulate the absence of free sugar in the nucleus. We know also that free sugar has never been found microchemically in the nucleus. It is not quite certain but it seems probable from observations on the point that the nucleus does not contain free proteins, like globulins and albumins.

The total exclusion, not only of inorganic salts, but also of fats and free carbohydrates from the nucleus and the probable absence of free proteins, is a fact of prime importance and it throws a new light on the relation of the nucleus to the cytoplasm.

What is found in the nucleus is chiefly an iron-holding nucleoprotein which the histologist calls chromatin and which differs in different kinds of cells, that of the pancreatic nuclei being somewhat unlike in character that of the hepatic nuclei and this again different from the nucleoprotein isolable from the nuclei of renal cells, although all are like one another in the main in their composition. These iron-holding nucleoproteins are synthesized in the cytoplasm. Iwanoff[2] found that the zymase from yeast cells synthesized phosphoric acid and sugar and formed a compound in which the sugar was masked and which did not give a reaction for phosphoric acid until it had undergone treatment for some time with strong nitric acid. This points strongly to the probability that the synthesis results in the formation of the skeleton

---

[1] Osmotische Druck. und Ionenlehre, Vol. 3, pp. 2 and 57.

[2] Zeit. für Physiol. Chem., Vol. 50, p. 281, 1907.

of the nucleic acid molecule. As the yeast cell has no nucleus, and as zymase is a ferment or rather several ferments, it is very probable nucleic acid is formed in the cytoplasm of the various cells of the b The neucleic acid once formed readily combines with protein and the nucleoprotein diffuses out of the cell where it is synthesized, or the adjacent nucleus where it is stored. Those which diffuse out reach the interior of other nuclei or the nuclei of other species of c

The nuclear membrane is permeable to such iron-holding nuc proteins. The diffusion outwards from the nucleus of the develop nerve cell of all or nearly all its chromatin to constitute the mate of the Nissl granules has been already referred to. The presence prozymogen in the cytoplasm of secreting cells, such as those of salivary, gastric, and pancreatic glands is due to a chromatin-like c pound diffusing from their nuclei.

It is highly probable that the permeability of the nuclear membr by the iron-holding nucleoproteins is due to a degree of solubility the latter in the substance of the membrane, just as copper oleat soluble in the membrane of Kahlenberg's experiments. Why the ir holding nucleoproteins gather in the nucleus in such a quantity as find there and do not diffuse out again is easily susceptible of an expla tion. It probably passes through the membrane to the nuclear cavity the water-solid phase, that is, in the hydrophilous form, but in the nucl cavity it enters into the other condition, namely, the solid-water ph in which there is more solid and less water, and consequently, it is m less diffusible and more inert. There can be no doubt that the diffusible phase does occur inside the nucleus, for it constitutes chromatin loops so familiar to the cytologist and histologist. W transforms the one phase into the other can at present be only a mat of speculation as yet, but it may be suggested that the nuclear me brane brings about this change for the chromation in not a few spec of nuclei lines the inner face of the nuclear membrane, indicating t the transformation occurs in the membrane or in its immediate vicini

The nuclear membrane being permeable only or chiefly to ir holding nucleoproteins, several conclusions follow. One that iron-holdi nucleoproteins so long as they remain in the interior of the nucleus protected from chemical alteration due to the action of inorganic a other compounds which may invade the cytoplasm. Another is that t is the true function of the nucleus.

These two conclusions based on the composition and the propert of the nuclear membranes enable us to comprehend clearly what co stitutes the physical basis of heredity.

In Darwin's theory of heredity, every cell of the body gives off typifying particles which he called gemmules and which collect in the ova and spermatozoa to reproduce in the offspring all the features of both parents. This would account for the inheritance of immediately acquired characters, but the impossibility of such inheritance is now generally admitted. The main objection, however, to the theory is that it is impossible to conceive of such myriads of gemmules being accommodated in an ovum or spermatozoon.

The theory of heredity which has to-day received the widest assent is that of Weismann, which postulates that the inheritance of ancestral characters is due to transmission in the germ cells from generation to generation of a substance, the carrier of heredity, called the germ plasma, which is not affected by metabolic and other changes in the somatic tissues of the individual, but which may spontaneously vary and thus give rise to varieties in the offspring of the species. According to this theory no immediately acquired characters are transmitted to the offspring.

What provides for the protection of this germ plasma which is handed down from generation to generation unchanged or changed only in the fashion that suggest the spontaneous origin of "sport" modifications of forms, Weismann does not explain.

It seems to me that the true explanation of heredity lies between the theory of Darwin and that of Weismann.

A germ plasma in the sense implied by Weismann may exist, but on the view here advanced, its continuity is one of type rather than of identical molecules, for the nuclear membranes of the germ cells sort out or select from all the iron-holding nucleoproteins from the various portions of the body that reach such germ cells those of a certain definite fixed composition and any other nucleoproteins that may be present are excluded from the nuclei of the ova and spermatid cells. Such selected or sorted out iron-holding nucleoproteins may in a manner represent the gemmules of Darwin's theory. Such compounds transmit the inherited parental characters and, to continue the transmission in the offspring of such characters, provide for the maintenance of the same type of nuclear membrane in the germ cells of the offspring.

Slight changes in the nuclear membrane of the germ cells would provide for the variants or "sports," as they are called, in the offspring, but the nuclear membrane may itself be supposed to remain constant, although this constancy does not demand that the iron-holding nucleoproteins which pass through it are of an absolutely uniform type. Many isomers may be supposed to occur amongst these compounds and yet and this explains their readiness to undergo alterations from the condition of virulence to that of attenuation, or *vice versa,* in cultures, and in the animal body. Only in a parasitic or saprophytic life could such organisms continue their existence. The cells in the blue-green algæ are protected by two membranes exteriorly, and they thus escape the results of the direct action of the salts of their environment, but their perpetuation, probably almost unaltered, from a very remote period in the history of the globe, while other organisms have not been so continued except in species which are the results of an ever progressive evolution, shows what a handicap in evolutional modification these two external membranes constitute.

After the development of the nucleus came the differentiation into sex, and this was an additional factor in promoting the function of heredity, for the union of two germ plasmas, as occurs in the fertilization of ova, simply doubles the certainty that the main ancestral characters shall be transmitted to the offspring, and at the same time tends to communicate to all the individuals of a species characters which may be of immense advantage to it in evolution in the long run.

From all that precedes, it may be gathered how important it is to have a clear view of what osmosis fundamentally means from the physiological side, and it may be understood that through a form of it the cell nucleus which knows not the inorganic world, and which knows neither fat nor free carbohydrates is the sacred receptacle for the heredity-bearing substance, the germ plasma, alone. Through this conception of osmosis and of the function of the structure concerned, the nuclear membrane, it may be seen what an all-important part a simply physical property of matter, rightly comprehended, plays and has played in the progressive evolution of living forms on our planet.

IX.—*Dawsonite*: *A Carbonate of Soda and Alumina.*

By RICHARD P. D. GRAHAM, M.Sc.,

Lecturer in Mineralogy, McGill University.

(Presented by Dr. F. D. Adams and read May 26, 1908.)

The mineral described below was first collected as a probably new species by Sir William Dawson from a trachyte dyke which cuts through the Trenton limestone, near the western end of McGill College, Montreal, and an examination of the chemical composition by Dr. B. J. Harrington having proved this surmise to be correct, the latter named the mineral *Dawsonite* in honour of Sir William.[1]

The dyke in question is shattered by numerous joints, and along the narrow fissures so formed there has been a subsequent deposition of minerals, notably of calcite, dolomite and pyrite, with some galena and, less often, a black manganiferous substance. The surfaces are also occasionally found to be coated with a thin layer of white or colourless bladed crystals, which have a fibrous appearance and a bright glassy or somewhat silky lustre, and it is this latter mineral to which the name dawsonite has been given. The crystals often closely resemble the white variety of tremolite, and, indeed, Dr. Harrington found several specimens labelled as such in the mineral collection of Dr. Holmes, which the University had acquired in 1856; these, too, had been collected near McGill College. It is also interesting that this mineral had been observed by Dr. Sterry Hunt as early as 1863, when, in a description of the same dyke, he reported the occurrence of "thin bladed crystals of an aluminous mineral, apparently a zeolite" coating the surfaces of the joints; but he did not collect sufficient material for a complete analysis.

Harrington made several analyses, of which he published two in the paper referred to above, and these are reproduced on page 174 (columns I and II). Although these analyses agree fairly closely with one another, they do not lead to any simple formula, and Harrington could only conclude that the mineral is a carbonate of lime, soda, and alumina. It was, however, especially interesting from the fact that normal aluminium carbonate is unknown as a chemical substance, and although a naturally occurring carbonate of alumina and lime had been described by J. H. and G. Gladstone[2] under the name *hovite*, this latter

---

[1] Can. Nat. New Series, VII. 6, p. 305, 1874.

[2] Phil. Mag. XXIII. 461. 1862. The hovite occurs in association with collyrite, ($SiO_2.2Al_2O_3.10H_2O$.) The analyses all show the presence of silica, but the authors argued that it is really an Al-Ca-carbonate intimately mixed with collyrite. Both are soft white amorphous substances.

is of very doubtful composition and is, indeed, regarded by ma mixture of an aluminium silicate with calcium bicarbonate.

In the case of dawsonite, Harrington brought forward sever factory arguments in support of the view that the aluminium is in the form of carbonate. He pointed out that the excess of CO in his analyses over that required to form normal carbonates bases is about 11 per cent, which must either be in combination aluminium, or else the bases must be partly present as bicarbon the aluminium as hydrate. On the latter hypothesis, there is ju sufficient water present in the mineral to form the dihydrate, Al but this is a substance which can be prepared in the laborator found to be insoluble in the stronger acids, whereas dawsonite and completely dissolved by them. Further, the monohydrate (d is only soluble after ignition, and the trihydrate (gibbsite) is d soluble in acids, both the latter being well known as miner these grounds Harrington felt justified in concluding that the alu is present in the mineral in the form of carbonate, and eve dawsonite remains unique among minerals as being the only one thing like definite chemical composition which contains alumi this form.

Some years afterwards, in 1881, dawsonite was reported a been found in Tuscany[3] (Pian Castagnaio, Province of Sei Here it occurs in the form of extremely fine white needles, arr radiated groups and tufts (closely resembling some wavelli having a silky lustre. These form thin coatings along crevice marls and sandstones of the district, the associated minerals b cite, dolomite, pyrite, cinnabar, bitumen and fluor. These sm of white crystals had long been noticed by the miners, who ar have regarded their presence as a favourable indication in searc cinnabar.

Analyses of this material by Friedel proved it to be daws was evidently possible to obtain it in a purer condition for anal was the case with the Montreal specimens, and although it similar percentages for the main constituents, lime was four absent altogether; from the results of his analyses, Friedel c the composition to be $Al_2O_3.Na_2O.2CO_2.2H_2O$, which he also another form as $Al_2(CO_2Na)_2(OH)_4$.[4]

---

[3] C. Friedel. Bull. Soc. Min. 4. 28 (Jan.), 1881. M. Chaper. Ib (June) 1881.

[4] It will be noticed that these two formulæ are not identical. sideration of the chemical composition is left till p. 173.

Meanwhile, Dr. Harrington[5] had found other specimens of dawsonite at the Montreal reservoir, in a dyke which is probably a continuation of that in which the mineral had originally been discovered near McGill College. In the course of further analyses of this new material he found that the percentage of lime varied very considerably, some specimens containing as much as 16.85% CaO, while at the same time the ratio of the other constituents was always constant. He therefore concluded that the lime was not an essential constituent, but was present in the samples he took for analysis in the form of admixed calcite; and recalculating his analyses on this assumption, he was able to show that the Canadian dawsonite can be represented by the same formula as that obtained by Friedel for the material found in Tuscany.

A third occurrence of dawsonite, at Ténés, Algeria, was subsequently described by J. Curie and G. Flamand[6]: and specimens from this locality resemble those from Tuscany so closely in their mode of occurrence and appearance, that they can only with difficulty be distinguished from them. The analyses also agree well with the formula $Al_2O_3.Na_2O.2CO_2.2H_2O$.

So far as I am aware, these three are the only localities at which dawsonite has been found; but the position of the mineral as a well defined species has been fully established.

Crystallography and Optical Properties.

The capillary nature of the crystals, as found in Tuscany and Algeria, renders the determination of their symmetry by measurement on the goniometer an impossibility; and although the Montreal material is more suitable owing to its comparatively coarse crystalline structure, yet terminated crystals are almost never found, the striated blades (or fine needles lying in parallel position) being intergrown and reticulated in an apparently irregular manner.

In his first paper on the subject, Harrington stated that "as regards the crystalline form, I am uncertain, though it is probably monoclinic, with the inclination of the principal axis about 75°." Descloiseaux[7] also stated that the crystals are probably monoclinic, and was able to make a rough determination of some of the optical properties. He found they had a strong birefringence, a wide optic axial

---

[5] Can. Nat. New Series. X. 2. p. 84. 1881.

[6] Ann. Fac. Sc. de Marseille, II, 2, p. 49.

[7] Bull. Soc. Min. p. 8. 1878.

angle, the axial plane being perpendicular to the length of the ne
and that an optic axis emerged nearly normal to a cleavage face.

Curie and Flamand, from a study of the optical properties o
Algerian dawsonite, came to the same conclusion as regards the
metry. They showed further that when the needles are lying fl
the microscope stage, they always have straight extinction in pa
light, so that they must be elongated along the monoclinic ax
symmetry; and since the optic axial plane is normal to this dire
the *b* crystal-axis must coincide with the mean axis of elasticity
the crystals should exhibit inclined dispersion—all of which, of c
follows on the assumption that the crystals are monoclinic.

In order to learn something more definite, if possible, abou
symmetry and optical properties of the mineral, at the suggesti
Dr. Harrington I examined the specimens he had collected, of v
there is a fine suite both in the University collection and also i
private cabinet. After some search I succeeded in finding about a
terminated crystals, which gave on measurement the following resul

Symmetry:—Orthorhombic, holosymmetric class.

$$a : b : c = 0.6475 : 1 : 0.5339.$$

Forms observed: A(100), B(010), C(001), M(110), D(011).

Angle.	No.	Limits.	Diff.	Mean.	Calculated
MM, 110 : $\bar{1}10$	10	113° 56′ —114° 18′	22′	114° 9′	Used for calcul
MM, 110 : $1\bar{1}0$	8	65 19 — 66 10	51	65 52	65° 51′
CD, 001 : 011	22	27 38½ — 28 20½	42	28 6	Used for calcul
BD, 010 : 011	9	61 39 — 62 21	42	61 51	61° 54′
MD, 110 : 011	21	74 33 — 75 38	65	75 2	75° 10′
MD, $\bar{1}\bar{1}0$: 011	15	104 38 —105 27	49	104 57	104° 50′

The variations in angle observed are not greater than those
monly met with in measuring a number of crystals of the same
stance, and the mean values agree sufficiently closely with those calcu
The crystals are small, the slender needles being in most case
1mm. in thickness. The common habit is shown in

where the stoutness of the needles is much exaggerated; the same combination is represented in the spherical projection of fig. 2.

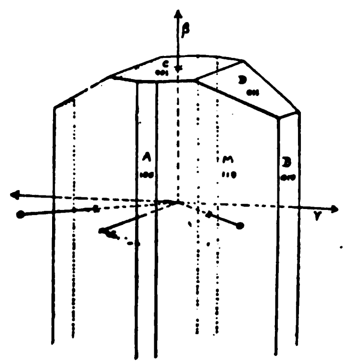


Fig. 1.—Common Habit of Dawsonite.

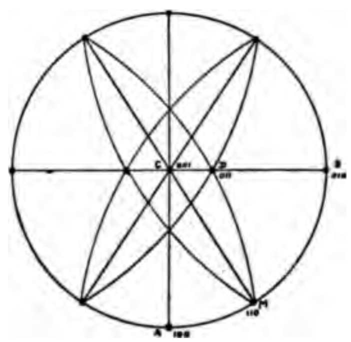


Fig. 2.—Spherical Projection.

In general, the crystal faces are bright and yield sharp reflections of the collimator signal, excepting in the prism zone, where the faces are striated longitudinally and sometimes give rise to a string of images. There is, however, a perfect cleavage parallel to the rhombic prism M(110), which enables the ratio between the *a* and *b* axes to be determined with fair accuracy.

In addition to the forms enumerated above, some of the crystals exhibit faces, usually solitary, which probably belong to the following forms:—

(130)	.. ..	observed on 4 crystals.
(230)	.. ..	" " 3 "
(101) (210)	.. ..	" " 1 "

The needles are elongated along the *c*-axis and generally striated in the same direction. The habit of the crusts on the dyke walls is platy or bladed, due to a parallel growth of these needles or to an oscillatory combination of M with A or B, which produces striæ parallel to the prism edge. The blades penetrate one another at all angles, but no twin crystals were found.

Optical Properties.

Examined under the microscope in parallel light, the needles show straight extinction and compensate when the quartz wedge is inserted along their length. If they are lying on a cleavage face, as is usually the case, an optic axis is seen to emerge nearly normally when view convergent light. The following are the optical characters observ

Axial plane = C (001). Ac. bis. ⊥ A (100).
Crystal-axis $a = \alpha$, $b = \gamma$, $c = \beta$.
Birefringence, negative, very strong.
Dispersion, $\rho < v$, not very marked.

The orientation of the indicatrix axes is shown in fig. 1.

The angle at which the optic axes emerge from a cleavage was determined for yellow (*Na*) light with the crystal in air ((the angle $2M^{air}$), and also after immersion in two oils of dif refractive index (giving $2M^{oil}$), and in one case a measuremer made using red light (lithium flame). The following results obtained:—

$2M^{air}_{Na}$ = 82° 40′ — mean of 12 experiments.
$2M^{oil,\,1.48}_{Na}$ = 77° 23′ — " " 10 "
$2M^{oil,\,1.558}_{Na}$ = 76° 35′. — " " 6 "
$2M^{oil,\,1.48}_{Li}$ = 77° 0′ approx.

In order to calculate the true internal axial angle, *2V*, a know of β was necessary. The first attempts to determine the refr indices were made by immersing a cleavage plate in an oil index was higher than that of the mineral, using the total refl method. As the examination in parallel light had indicated a high refractive index, oil of aniseed (*anithol*) was used for this pu its index was found to be 1.558 by minimum deviation. Prev only the oil of $\mu = 1.48$ had been employed in making the axial determinations, but as the same instrument (a Fuess axial apparatus) was to be used for measuring the refractive index, determinations were repeated with the oil of higher index; this, alt not necessary, affords a useful check, since the true angle, *2V*, s be identical as calculated from the three sets of determinations, and the two oils (see page 172). All that was necessary was to im the crystal in the rectangular trough filled with anithol, adjus measure the axial angle; then substitute a semi-cylindrical troug take readings for the two positions of total reflection. Yellow was used, and total reflection took place from a cleavage ||M.

With the crystal mounted vertically, in which case the light in a direction at right angles to the *c*-axis, we might expect to obta shadows for total reflection—one corresponding to the index β ar to light vibrating vertically, and the other, vibrating horizontally ing the index for light travelling through the crystal at right angles to M (110), which would have a value somewhere between α and γ. Only one shadow could be found, however; the angle between the two positions of total reflection was 151° 13′ (mean of 4) giving 75° 36½′ as the angle of incidence (fig. 3), whence $n = 1.558 \sin 75° 36½' = 1.510$.

Examination of the reflected light by means of a Nicol prism showed it to be vibrating horizontally, and the index obtained is therefore that for light travelling normal to (110) in the crystal; as will appear later, it lies between α and β.

The crystal was then suspended with its length horizontal and an M (cleavage) face in a vertical position. Total reflection from M

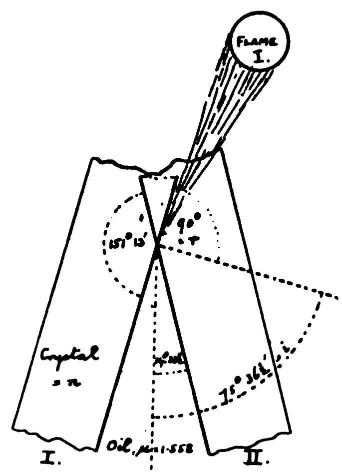


Fig. 3. Total Reflection Method.

in a suitable medium would give two dark bands corresponding to α and γ; but since the above experiment had not yielded readings for the mean index, β, it was not to be expected that the γ ray would suffer total reflection in the present case; for the index γ is higher than 1.558, as was found later. The line due to the total reflection of the α ray was sharply defined, giving 140°20′ (mean of 4) as the angle between the two positions, which corresponds to an angle of incidence of 70°11′; and α calculated from this is found to be 1.4664.

The light reflected from the plate was extinguished with the Nicol at approximately 45°; I have not calculated the theoretical directions in which the vibrations would take place in this particular case, where light, travelling parallel to β in the crystal, emerges, at the critical angle, as two plane polarised beams, from a face of the rhombic prism; but they would obviously be in some oblique position.

The angle M:M for dawsonite being near 60°, a cleavage p should be well suited for a determination of its indices by the minii deviation method; but several which were tried failed to give sufficie luminous images, owing chiefly to the minute size of the faces. V it was found that the two higher indices, β and γ, could not easi determined by total reflection, other cleavage prisms were exam and finally one was found which gave good results. Using the clea angle 65° 51′, light travels along the acute bisectrix (α), and th dices β and γ are obtained. The prism actually used had an ang 65° 57′ and gave the following result for yellow light:—

2 D = 96° 13′ — light vibrating vertically = β.
= 109° 31′ — " " horizontally = γ.

whence, $\beta = 1.5414$ and $\gamma = 1.5968$.

A second determination, made at a different time, but using same prism, gave $\beta = 1.5424$, $\gamma = 1.5965$.

Another prism was subsequently found, which, while not admit of the same degree of accuracy, fully confirmed the above figures; therefore considered that the determination may be relied upon to third place of decimals, giving $\beta = 1.542$ and $\gamma = 1.596$.

Calculation of 2 V.

The true internal optic axial angle, for yellow light, was calcul as follows:—

(1). From β and the angle designated above as $2M^{oil,\ 1.558}_{Na}$ i.e apparent angle, where the optic axes emerge through faces of a p immersed in oil of $\mu = 1.558$. See fig. 4.

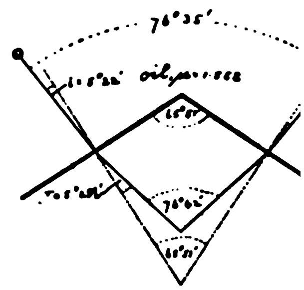


Fig. 4.

$2M = 76°35'$

$M : M = 65°51'$

$\overline{10°44'}$

$\therefore i = 5° 22'$.

$\sin r = \frac{1.558}{1.542} . \sin 5° 22'$.

and, $r = 5° 25\frac{1}{2}'$.

Whence, $2V = 2 (5° 25\frac{1}{2}') + 65°51'$
$= 76° 42'$.

(2). From β and $2M$ for oil of $\mu = 1.48$ (77° 23′).

The oil in this case has a lower index than the crystal, so $2V$ will be less than $2M$; by a calculation similar to the above found to be 76° 56′.

(3). From β and the angle $2M$ for air (82° 40′).

Here again *2M* is a larger angle than *2V*, for which, in this case, the calculated value is 76° 44′.

The values for the angle *2V* calculated in this manner from three independent sets of determinations are well within the limits of experimental error.

Knowing α, β, and γ, a further independent calculation of *2V* may be made by means of the usual formula,

$$\tan V = \frac{\gamma}{\alpha}\sqrt{\frac{\alpha^2 - \beta^2}{\beta^2 - \gamma^2}}, \text{ which gives } 2V = 76° 46'.$$

This value is the mean of those calculated by the previous method, and may be taken to be the true internal optic axial angle for dawsonite in yellow light. The fact that the value is the same, as calculated by the two methods, proves that α (determined by total reflection) is concordant with β and γ (by minimum deviation).

The following are the optical constants for yellow light:—

$\alpha = 1.466$, $\beta = 1.542$, $\gamma = 1.596$.
Birefringence, negative, very strong; $\gamma - \alpha = 0.130$.
$2V_a = 76° 46'$; $2E = 146° 27'$.

The single measurement in red (Li) light gives $2V = 76° 33'$, showing that there is only a very slight dispersion, in the sense $\rho < v$.

Chemical Composition.

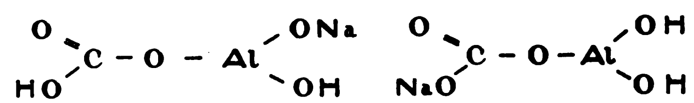
As explained at the outset, Harrington's analyses did not lead to any simple formula for the mineral, and always showed the presence of lime. Although in his first two analyses, given in columns I and II below, the percentage of the latter seemed to be constant, in others it varied considerably, and was sometimes as high as 16%. By assuming the lime to be present as admixed calcite, the recalculated analyses brought to light the fact that the ratio of the remaining constituents was always constant, and agreed well with the formula, $Al_2O_3.Na_2O.2CO_2.2H_2O$, which Friedel had calculated from his analyses of the Tuscan dawsonite.

I thought it advisable to make a new analysis of the Montreal crystals, with a view to determining whether carefully selected material would not be found to be free from lime; or, on the other hand, if this were not the case, to see whether some, at least, of the lime might not be isomorphously replacing an equivalent amount of soda—a fairly common replacement among minerals. About a quarter of a gram was carefully selected from several specimens, rejecting all material which was not perfectly transparent. The specific gravity determined with

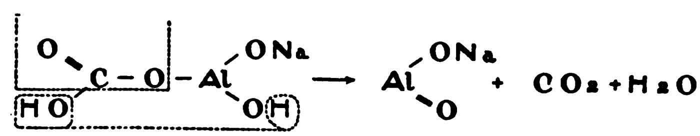
Friedel was the first to suggest a formula for the mineral, and Nos. 1 and 2 above are from his original paper; they are both given in many subsequent references to dawsonite, by other authors. They are not identical, however, and the second should apparently be $Al_2(CO_3Na)_2(OH)_4$. The other formulae have been adopted to try and account for the chemical behaviour of the mineral, and the only one which calls for comment is the last, which differs from the rest, although in this case the error may be due to a misprint for $NaAl(OH)_2CO_3$.

The formula $Al_2O_3.Na_2O.2CO_2.2H_2O$ accurately represents the chemical composition of dawsonite; a constitutional formula would have to account, among other things, for the fact that, as stated by Friedel, and also Curie and Flamand, the mineral loses neither water nor carbon dioxide at 140°C, and that long heating at a high temperature is necessary in order to bring about the complete expulsion of these constituents. In one experiment, I heated a weighed quantity, placed on a boat in a glass tube, for nearly half an hour over a full bunsen flame, and there was a loss of only 50% of the total carbon dioxide.

Several graphic formulæ might be constructed which would explain such a behaviour, but the two suggested seem to have many points in their favour:—



Either of these would account for the difficulty in expelling the water, since this is shown to be all chemically combined, and not present as water of crystallization. The first, perhaps, expresses the constitution more accurately than the other, since the sodium is here in direct combination with aluminium, which would be expected, the end product after ignition being sodium aluminate:—



If sodium aluminate is left after expelling all the carbon dioxide and water, it might at first sight appear that the residue should be completely soluble in water, whereas it is not. An experiment was made to test this point: a small quantity of the powdered mineral was strongly ignited over the blowpipe for 45 minutes, at the end of which period it appeared to be unaltered, as the mineral is infusible. The residue was lixiviated with water, and although it did not dissolve, it was yet quite evident that some action had taken place, for the powde changed into more or less flocculent particles, while the solu an alkaline reaction. This was filtered off, and it was fo ammonia gave quite a perceptible precipitate of aluminium hyd warming the solution and allowing to stand for some time. planation of the apparent insolubility of the residue left after appears to be that, although the sodium aluminate dissolves, mc aluminium is reprecipitated as hydrate as fast as it goes into the latter salt being soluble only when an excess of soda is The precipitate obtained on adding ammonia to the filtered due to the small amount of alumina which the soda is able tc solution.

The experiment has only a negative value, since even if th and aluminium are not in direct combination with each othe mineral, we would expect sodium aluminate to be formed a removal of the carbon dioxide and water by intense ignition.

Dawsonite and Nesquehonite: a comparison.

Although as regards their chemical composition, these two can scarcely be described as nearly related, yet, when we comp crystallographical properties, a very curious and striking sim seen to exist between them, as will be apparent from the followi

Dawsonite.	Nesquehonite.*
$Al_2O_3 . Na_2O . 2CO_2 . 2H_2O$.	$MgO . CO_2 . 3H_2O$.
Orthorhombic.	Orthorhombic.
$a : b : c = 0.6475 : 1 : 0.5339$	$a : b : c = 0.6445 : 1 : 0.$
M : M = 65° 51′.	M : M = 65° 36′.
Cleavage ∥ (110), perfect.	Cleavage ∥ (110), perfec
Birefringence,—ve, strong.	Birefringence,—ve, stro
Ax. Pl. ∥ (001); Ac. Bis. ⊥ (100).	Ax. Pl. ∥ 001); Ac. bis. ⊥ (
Dispersion, small, $\rho < v$	Dispersion, small, $\rho <$
$\alpha = 1.466, \beta = 1.542, \gamma = 1.596$	$\alpha = 1.495, \beta = 1.501, \gamma =$
$2V_y = 76° 46'$.	$2V_y = 53° 5'$.

We would have no hesitation in saying that two minerals these, whose properties are so closely allied as to be identical respects, were isomorphous, provided there was some similarity their chemical composition; and if we are to regard the geomet optical properties of crystals as being intimately connected structures of their molecules, whether physical or chemical, the forced to the conclusion that the molecule of dawsonite mu

* Genth and Penfield, Am. J. Sc., 39,121, 1890.

some way similar to that of nesquehonite. It seems impossible, however, to trace any connection between their formulæ which would suggest that the internal structures of the two molecules is at all comparable; but the intimate relations observed between the properties of the two minerals remain none the less interesting.

SUMMARY.

Dawsonite, $Na_2O \cdot Al_2O_3 \cdot 2CO_2 \cdot 2H_2O$.

Orthorhombic, $a : b : c = 0.6475 : 1 : 0.5339$.

White prismatic or needle-shaped crystals, striated vertically; also in tufts of radiated fibres.

Cleavage || (110), perfect, at 65° 51′ . H = 3 . G = 2.44. Lustre vitreous, fibrous varieties silky. Colourless or white. Streak uncoloured. Transparent.

Birefringence,—ve, very strong; $\gamma - \alpha = 0.130$.

Ax. pl. || C (001). Ac. Bis. ⊥ A (100). Dispersion, $\rho < v$, not marked.

$\alpha = 1.466$, $\beta = 1.542$, $\gamma = 1.596$, for yellow light.

$2V_y = 76° 46'$. $2V_r = 76° 33'$. $2E_y = 146° 27'$.

B.B. infusible. Loses neither water nor carbon dioxide at 140°C but both expelled at red heat. Easily soluble in acids with effervescence; residue after ignition also dissolves readily in acids.

X.—*Thoughts and Facts on Right and Left Handedness and an Attempt to Explain Why the Majority of Men are Right Handed.*

By G. PROUT GIRDWOOD, M.D., M.R.C.S. (Eng.), F.C.S., F.I.C., F.R.S.C., Emeritus Professor in Chemistry Medical Faculty of McGill University, late Assistant Surgeon Grenadier Guards.

(Read May 26, 1908.)

That the average man is right-handed is so well known, that it would appear hardly worth noting the fact, but left-handed men are so common that the question why are all men not right-handed must frequently have been asked, and up to the present date diligent search and enquiry by the writer has not resulted in finding that anyone has published a satisfactory reply; this is the excuse for bringing the subject before you again.

In the proceedings of this society are two able and exhaustive articles upon right handedness, by the late Sir Daniel Wilson.

In Section II, paper VII, page 119, Vol. No. 3, 1885, Sir Daniel writes on "Paleolithic Dexterity." In this beautiful and interesting article he goes over all the evidence of the stone implements of the paleolithic age and of the stone arrow heads and tools, knives and daggers, and the articles he has been able to obtain or reach an account of, and although finding some places where there seems to have been a larger number of left-handed workmen, he still comes to the conclusion that in those localities men at that period were as a rule right-handed, some were ambidextrous, and others were left-handed; as Sir Daniel himself was naturally left-handed, his opinion on the effect of education as a reason for right-handedness is especially valuable, and he says that "my "own experience as one originally left-handed is that in spite of very "persistent efforts on the part of teachers to suppress all use of the left "hand, I am now thoroughly ambidextrous, though still with the left "the more dextrous hand."

On page 130, Sir Daniel says, "But the entire number of left-"handed warriors of the tribe appears to have barely amounted to 2.7 "per cent. Out of 26,000 Benjamites, as we are told all warriors, "there were 700 chosen men of the tribe, every one of whom was left-"handed and could sling a stone at a hair's breadth and not miss. The "instinctively left-handed is more dexterous in the true sense of that "term. He is not only an exception to many right-handed men, he is "still more an exception to the large majority in whom the bias "slight and the dexterity so partial that their practice is little mor "a compliance with the usage of the majority."

Still more, the fact of the difficulty of overcoming by educatio natural predilection of some individuals to use the left hand inst the right, so far goes to destroy the theory that education is the why men are mostly right-handed, and points out that there is other reason why there is a natural inclination to use the right ha preference to the left.

Sir Daniel Wilson also quotes from Froude's Thos. Carlyle, "sad misfortune it was to lose the use of his right hand when h "reached the advanced age of 75. The period of life was all too l "turn with any hope of success to the unaccustomed and untraine "hand, and in his journal more than one entry refers to the irrep "loss." But one curious embodiment of the reflections suggested b privation is thus recorded in his journal upwards of a year aft perience had familiarized him with all that the loss involved: " "ous to consider the institution of the right hand among universal "kind; probably the very oldest human institution that exists, "pensable to all human co-operation whatsoever. He that has seen "mowers, one of whom is left handed, trying to mow together an "impossible it is, has witnessed the simplest form of an impossi "which but for the distinction of a right hand could have pervad "human things. Have often thought of all that, never saw so "as this morning, while out walking, unslept and dreary enough, "windy sunshine. How old? old! I wonder if there is any peopl "barous enough not to have this distinction of hands; no human c "possible to be even begun without it. Oldest Hebrews, etc., w "from right to left, are as familiar with the world-old institution "why that particular hand was chosen is a question not to be s "not worth asking except as a kind of riddle; probably arose in "ing; most important to protect your heart and its adjacencies "carry the shield on that hand."

It has been suggested that right-handedness is hereditary and certainly is, so also is left-handedness which runs in families[1]

The world is made up of right-handed men the majority handed men the minority, but between the two there are probably who use either hand indiscriminately. These would soon become

[1] Judges, 20 Chap., 16 verse.

handed by example and education and so throw their weight with the right-handed number.

It is also suggested that the lower animals, the apes and quadrupeds, do not exhibit any peculiarity of right and left-handedness, this statement is perhaps due to want of closer observation of the habits of the lower animals, the monkeys are quadrumanous animals, using their fore hands as feet as well as prehensible organs, and indifferently right or left as occasion may require. So quadrupeds use all four feet as medium of support and progression and there is apparently no reason why they should make use of one side more than the other. Yet as we shall see there are reasons why there is a possible difference of the two sides with them also.

In man, in very early childhood, the mother carries her infant on her left arm and thus the child's right arm is compressed against the mother's breast, this would leave the child's left hand and arm free to move and would give the child the earliest tendency to use its left hand most.

This habit pervades most civilized races who are more right-handed than the more uncivilized, the females of which latter races carry their babies slung over the shoulders in some way; and hence there is no special inducement for the child to use either hand more than the other.

The late Dr. Gilbert Finlay Girdwood, of London, the writer's father, and to whom the writer is indebted for many suggestions and thoughts on the habits and instincts of the lower animals, and to whom the writer now desires to give all credit for whatever of value may be in these thoughts and facts on this subject, and whose death in 1870 prevented his carrying out what he doubtless would have done far better than his son.

Amongst other things he observed, was the fact that in horses where there is one white leg it will probably be the near hind leg, if two, these will likely be the two hind legs, and if three, the two hind and near fore leg, this observation has been extended and an official list of 3,000 horses is appended which was obtained by writing to all the veterinary offices in the United States Army in cavalry regiments and horse artillery and to the veterinary officers of the Northwest Mounted Police, to all of whom the writer's indebtedness is here acknowledged and thanks returned, as well as to Dr. Higgins, Bacteriologist to the Veterinary Department at Ottawa.

N H	O H	B H	N F	O F	B F	B H & N F	B H & O F	B F & N H	B F & O H	N H & N F	N H & O F	O H & O F	O H & N F	A F	No. of Horses Examined	Authority
51	27	57	1	1	....	10	9	4	1	6	2	1	....	9	310	MacDougal, A., 11 Cavalry, U.S.A.
33	30	73	5	2	1	11	....	....	....	....	....	....	....	11	480	Peter, W. H., 14 Cavalry, U.S.A.
148	104	....	28	21	....	....	....	....	....	....	....	....	....	....	360	Willyoung, 40 of these have both legs white alike, 10 have left hind highest white 1 right hind, 1 left front, 1 right front.
6	3	8	....	....	....	3	1	....	....	....	....	....	....	....	21 }	† D. MacEachran.
1	9	16	....	....	....	....	....	....	....	....	....	....	....	....	26 }	
84	51	103	2	2	3	27	14	12	8	....	7	....	7	30	776	Hunter, Sidney D., 2 Field Artillery, U.S.A.
323	224	257	36	26	4	51	24	16	9	6	9	1	7	50	1093	
117	71	175	44	31	5	17	12	....	....	4	....	2	9	26	1020x	† Large number of cattle die every year from exposure on the ranches. Dr. MacEachran's letter, 90% of all the young cattle on ranch of Gordon & Ironsides were among the light coloured ones.
440	293	432	80	51	9	68	36	16	9	10	9	3	16	76	2993	

N H near hind.
O H off hind.
B H both hind.
N F near fore.
O F off fore.

x Veterinary Staff Sergeant Ayer states that four white feet are rather washy horses, and that buckskin and roan are tougher with

The numbers obtained from this list although only just 3,000 horses, are a sufficient average to call for further attention. These numbers were obtained by direct application to the different veterinary officers in charge, and their personal examination and answers, it is a pity more answers were not forth-coming. A similar application to the forces in England and to the Royal College of Veterinary Surgeons received for answer no records of the kind were obtainable. It may be asked what has this observation to do with right and left-handedness in man, to those who would ask, the answer is, that as man gets older and the vital forces become lessened, the man becomes gray haired and if his life be continued he at last becomes quite white and the powers of life have become much weaker.

This is apparently the case, not only in animal, but in vegetable life. The fact that absence of pigment in life where pigment usually is seen is evidence of weakness.

There is a common saying about white-footed horses:

One white leg buy him,
Two white legs try him,
Three white legs deny him,
Four white legs, throw him to the dogs.

As the hind legs are those most commonly white the weakness is more observable in the fore legs than in the hind and the remarks made by the different veterinarians go to show that a tendency to navicular disease is common in the white fore-legged horses—that the white-legged horses are generally washy—that the roan coloured horses and the buff are constitutionally the strongest, with brown next.

Report comes this spring from the west communicated by Dr. McEachran, from which the following is quoted: "In the car this morning, I met Mr. D. N. Campbell, live stock agent, who asked me if I had noticed last winter and spring whether or not the greatest mortality among our range cattle was in the light coloured ones. He said, George Lane, of Gordon & Ironsides' U ranch, told him that with them 90 per cent of the dead cattle from the severity of the winter were white and light roan in colour."

Absence of pigment where pigment is usually found is an evidence of lessened vitality.

Potato shoots grown in the dark are thin, long and white, easily destroyed.

All plants grown in the dark are weakly and are deprived more or less of chlorophyl.

What are called variegated varieties in plants have less vitalit normal plants.

One variety of the Coleus is cultivated for the variety of col its leaves, and for the white patches on its leaves, a branch will be spotted more or less with white, brown, red, and and by making cuttings from the variegated branch, where whil dominates, for all branches are not equally coloured, the variety r made constant and this is carried out to obtain more white, till the leaves become almost white and the stem pink, then that plai gradually fade away and die.

It is impossible to obtain a specimen of this plant just no here is a dried specimen of the Phyllanthus Nivosus, a Euphorbi plant, in which the tendency to grow white leaves is a strongly n characteristic. The leaves are alternate and at the base of the sta green and of full size. They show their tendency to become whi creasing as they get nearer the end of the stalk, till they become or quite white and suddenly drop in size. In this specimen the become smaller as the white increases and at last, when quite whit are much smaller and die early and drop off, here are two leaves have dropped. In the branch on which the leaves become white, th at the same time assumes a pink colour.

As people get older there is usually a decreasing amount of pi in the hair, and the older the whiter the hair becomes. This whi may be the result of some sudden stay in vitality from shock, wh vitality is greatly suspended, so that whiteness, where pigment shou may be accepted as an evidence of slightly lessened vitality.

Information received from a lady who is a cat fancier is to the that white Persian cats are more or less deaf and that the lighter co breeds are less healthy than pigmented varieties, the hardiest the black.

If then white hair may be taken as an index of weakness, would appear that it is so, it would imply that the side on which hair is most frequent would be the weaker and the figures quoted would show a preponderance of strength on the right side.

In man it has been observed that deformities and arrest of de ment occur more frequently on the left side.

Notably, hare lip most frequent on left side. Here is a set of graphs showing deformity in both arms and legs. The young lad whose hands these two were made is a Russian Jew. On the lef there are only the two middle fingers which are complete to the b the metacarpal bones, the unciform bone is present and what a to be the cuneiform bone. There is but one bone to represent radius and ulnar and that is united to the humerus without any elbow joint, and there is a long, extended internal condyle to the humerus.

On the right arm the same arrangement for humerus, radius and ulnar is present, but the one bone representing radius and ulnar is somewhat longer than the left. There is a rudimentary scaphoid, a trapezoid, os magnum and unciform and a cuneiform, but the other carpal bones are absent. There are three metacarpal bones, to the one is attached a double phalanx made by the union of the proximal phalanx of thumb and index finger, and then there are thumb, index, middle and ring fingers but no little finger and no metacarpal bone of the thumb. In this case the greater deformity is on the left side.

Here is a similar deformity in a man of 55 years of age. On the left side he has both radius and ulna with an apparent tendency to fusion of humerus and ulna with lengthening of the internal condyle of humerus. At the wrist joint, there is a scaphoid bone and rudimentary trapezium, there is apparently an os magnum and unciform, the other bones of carpus rudimentary, three metacarpal bones for fore finger, middle and ring finger, none for thumb or little finger and the same arrangement as in the boy's fingers of right hand. In the man's right hand the radius and ulna are nearly perfect. There is a scaphoid, semilunar and cuneiform blended, a pisiform but no trapezium, there is a trapezoid os magnum and unciform, there is present a complete index, middle and ring finger with a rudimentary thumb, and the metacarpal bone of the little finger blended with the metacarpal bone of the ring finger.

The next is a club-foot on the left side and not on the right.

The next (No. 9) is a deformity of the left leg, the tibia and fibula end in expanded bony growths, and the bones of the foot are represented by rudimentary points of ossification, and here is a case (No. 10) of congenital absence of the left fibula.

Here is a picture of another abnormal left arm recorded by Dr. Jubb,[1] Glasgow Royal Infirmary. In this case the deformity is absence of radius in its greater extent and of the carpal and metacarpal bones of the thumb. This deformity is again on the left side.

When a student, in 1853, the writer had the opportunity of seeing a specimen of hermaphrodite organs as a preparation now in the museum of St. Mary's Hospital, London, in which there was a penis, a vagina

[1] Copied from the archives of the Roentgen Ray of London, Rebman & Co.

and uterus, with a testicle in the right vulvum and an ovary on the side. Again showing the left the weaker side.

These cases are too few in number to make any very strong s ment as to the difference of frequency of deformity on the left as ag the right, but they do tend to show a leaning to deformities more quent on the left side and to a greater extent on the left side than right.

Paralysis or hemiplegia is more frequent on the right side tha the left, and in this case the injury to the brain is on the left side, the effect is on the right side, due to the decussation of the fibres.

All these observations tend to the idea that the right side is a stronger than the left, and hence the use of the right hand more the left.

The carpenter and stonemason and blacksmith, like the majo are mostly right-handed men and they hold their chisels when they to direct the cut, in the left hand, and strike with the heavy mallet the right hand.

In his second article on this subject, Sir Daniel Wilson says, 3, section 2, papers for 1886: "The phenomenon to be explained is "merely why each individual uses one hand rather than another. "perience abundantly accounts for this. But if, as seems to be the "all nations, civilized and savage, appear from remotest times to "used the same hand, it is in vain to look for the origin of this a "acquired habit. Only by referring it to some anatomical cause ca "general prevalence among all races and in every age be satisfact "accounted for. Nevertheless, this simple phenomenon cognisant to "experience of all and brought under constant notice in our daily i "course with others, seems to baffle the physiologist in his search for "entirely satisfactory explanation."

He goes further into the habits of man in different countries into the various reasons assigned for the predominant condition of ri handedness, by physicians, anatomists and physiologists, some givin opinion as Sir C. Bell, that not only is man right-handed, but also ri footed, and that the right side is stronger than the left physically, ot stating that the blood supply is better to the right side than the again that it is due to the difference in the blood supply to the b and even to the difference in size of the two sides of the brain.

If the course of the blood be, starting from the apex of the ventricle through the ventricle into the aorta, and then a line be dr as it were through the left ventricle and the course of the ascen aorta, through the arch of the aorta, and down to the promentary of sacrum, it will be found to be represented thus, and if a plan were n looking down from above, it would be represented as a circle drawn from left to right, passing upwards and to the right in a curved manner, then still upwards and back at the same time passing gradually to the left side of the vertebral column, then down the left side of vertebral column, gradually passing to the centre thereof opposite the promontory of the sacrum, where it divides into the two common iliac arteries.

In this course the aorta gives off the two small branches to supply the heart, the coronaries, then it passes on and where it begins to turn back and to the right side it gives off the large arteria innominata which divides into the right common carotid and the subclavian, the carotid supplying the right side of the head and brain and the subclavian the right upper extremity. Passing on the arch of the aorta gives off from the upper side of the arch the left common carotid and a little further on the left subclavian, and then passing down the left side of the vertebral column gradually coming forwards from the left side of the column to the centre of the front of the column where it divides into the right and left common iliacs to supply the lower limbs, the trunk and internal organs being supplied by other branches on its way down. Now in this course it does seem that the blood supply to the right side through the larger conjoined vessel the arteria innominata does receive a more direct current and the two vessels being united and a little better positioned to receive the more direct current, than on the left side where the two vessels common carotid and subclavian are separate in their origin, and given off at an angle not quite so favourable to the supply in directness.

In the supply to the lower extremities by the two common iliac vessels, the right iliac seems to get a little more direct supply than the left, not from difference in blood pressure in either case, for it has been found that there is no difference in the pressure on the two sides, as indeed, the physical law that liquids press equally in all directions would preclude a difference in pressure but simply in direction, and the difference in direction being more easy for the current is the only difference, but with the multiplication of 120 beats a minute the rate of pulse of the newly born and before birth would make a multiplication of the slight difference of 120 per minute,

60

7,200 per hour.

24

28800

14400

172,800 per 24 hours.

[1] Dr. Janeway, Blood Pressure.

and that continued for a few years would easily establish a little stro vitality on the right side over the left, and would fully account for difference previously noted.

The hind legs in the horse which are so commonly white as (pared with the number of fore legs white may be due to the greater tance from the heart, the centre of force of the supply.

The conclusion the writer comes to from the observations reco are that the right side of the bodies of man and the quadrupeds a trifle stronger than the left, that this difference is caused by the l difference in the directness of the blood supply.

And that this difference accounts for the preponderance of ri handed men over left-handed.

And that the habit once established by natural causes has beer creased in man by heredity and education.

But the cause of this determination of a slightly increased su of blood is still unexplained.

Still the question, Why? remains.

Reference and illustration has been made to plants and a weak shown to exist there when the normal colour is absent. If now w further we find the snail shell all rotating in the direction of the h of a watch, that is, from left to right, but if the snail be watched i egg during development it will be found to slowly rotate in the opp direction, the direction from right to left, the writer has often wat them under the microscope for hours before they escaped from the s

If now we take a hyacinth or an onion and strip off the leaves find the scars left on the flattened disk arranged so as to produce an pearance like the back of an engine turned watch with curves procee from the outside to the centre in the direction of the hands of a w The same appearance is found in the sunflower disk (Helian annui) when the flowers are fallen, and the seeds are ripened they be found to be arranged in similar lines. In these cases the ax growth instead of being elongated, is flattened down into a disk, the leaves in their normal places and with the buds in the axils of leaves, in the sunflower the seeds are largest at the outside of the c and get smaller as they go up to the top of the stem represented by centre of the disk further away from source of supply.

If the fine point of a young pine or larch tree be looked at from upper end towards the root the branches or leaves will be seen to ha similar spiral arrangement.

In the Bryophyllum Peltatum the leaves are thick and fleshy are deeply crenated on the edge and stay hanging on the plant till are quite old and then fall off. If the leaf happens to fall on a d place and is allowed to lie there, in a short time a root will be protruded from the angle of each of the deep crenations, and shortly a second and a third root find their way into the moisture and a bud will be protruded on the upper side which will grow up to become a new plant, hence the common name for this plant is the life plant. This same characteristic to a less degree is enjoyed by the begonia, the cholens and others.

In seed bearing plants, a flower is produced, the various parts or envelopes of the flower consist only of modified leaves, and it may be expected that they occasionally take on other functions than the simple flower duties, and flowers or clusters of flowers are seen, especially in the primulaceæ, in which the flower is converted into a new branch, hence the common appearance known as the hen and chickens; in this case the leaves which began as flower leaves have returned to their duties as ordinary leaves, but when the flower goes on to maturity we find the calyx or outside covering, the corolla, more or less gaudy, to attract insects, then comes a whorl or more of stamens; all these parts are leaves modified to perform their functions; lastly, in the centre, is the carpel or fruit or seed vessel; also a leaf, the fleshy part of which constitutes the fruit; this leaf is called the carpellary leaf or carpel, which has its midrib prolonged to form what is called the style, and terminated by the stigma. There may be one or more carpellary leaves constituting the fruit; in the plum one leaf only constitutes the fruit, and the inner surface of the plum stone represents the upper surface of the leaf, the outer skin of the plum represents the under surface, and the flesh of the plum, the cellular matter between the two layers of the leaf, upper and lower, the line down the one side of the plum represents the part where the edges of the carpellary leaf are joined, and inside the cavity is the seed or kernel.

In the apple there are usually five such carpellary leaves united to form the fruit and again the inside of the five cavities seen when the apple is cut across, looking somewhat like a five-pointed star, are the representatives of the upper surface of these five carpellary leaves,—the outside being the representative of the under surface of the leaves, and the outside points represent the mid-ribs of these five leaves, and the five inner points will be observed to be double and represent the edges of neighbouring carpellary leaves joined together on the edges of which little seeds begin to grow. These are only like the buds on the Bryophyllum leaf, but in this modified form they require impregnation; if that operation takes place they grow to be perfect seeds, but if not they waste away and dry up.

In (100) one hundred apples of the northern spy variety examined, there were five carpellary leaves in each apple, and on the margin o leaf there were either one or two occasionally three matured pip on each side of each leaf were little brown tubercles in number suf to make up (4) four pips in each cell, two on either side co mature seeds or rudimentary immature seeds.

One hundred apples with five carpels to each would give (50(hundred cells or carpellary leaves, and each leaf having four se pip mature or immature, would give a total of 2,000 pips that wo the proper full number of seeds; but the results of the examinatio only 972 mature seeds, of which number (556) five hundred and six were on the right side of the leaf, and 416 on the left, or 48 cent. of the total number grew to full maturity as seeds of these 57.09 per cent. were grown on the right side of the leaf, 42.8 pe nearly on the left.

These numbers are all too small to make a general average large a subject, but they are so striking as to call attention to the s and induce further observations in the same direction.

Now, if these pips be examined in the apple more closely, the be found attached: first, the lowest, on the right side of the car leaf, next a little higher on the left side, the third a little higher right side, and last, for there are seldom more than four, on the le and a little higher, as the numbers that come to maturity.

From these observations it seems then that there is somethi parently determining the why: these happenings are as they are, is the business of science to find out the why and wherefore for thing.

In the present instance there is no apparent reason why or should have the preference over the other, but if the cause be hidd more reason to search for it.

Suggestion or hypothesis might be made there are so many of arrangement, and motion, in the direction of the hands of a that thoughts are directed to some cosmic influence which app dominate both animal and vegetable growth, and possibly also n growth amongst crystalline substances.

Amongst such forces that appear on the surface the rotation earth itself, its alteration of heat and cold every (24) twenty-four by exposure to and absence of the heat of the sun's rays. The m zation of the atmospheric oxygen thereby, producing a diurnal va of the needle. There is the negative condition of the earth and th tive condition electrically speaking of the upper atmosphere keep a constant current of differing electrical conditions, and the effe sudden thunder storm destroying a whole sitting of eggs shows the influence of electrical phenomena on early life, and then there is the constant radiation from the earth's surface of radium, any of which might be sufficient cause. Or must we still go back to protoplasmic memory.

If the averages noted in these thoughts and observations are borne out and verified by other observers, the natural result would be to breed out white-legged horses, and in the meantime for governments to refuse to purchase them. In the selection of seeds for the propagation of plants, seek out those that have been grown earliest and on the right side of carpellary leaf.

The first evidence which may solve the riddle found in Crystalline bodies—it is well known that the asymmetric carbon atom in organic compounds determines whether the plane of polarized light be rotated to the right or to the left, or whether the amount of asymmetric right and left-handed rotation be equal we have an inactive compound which does not affect the plane of polarized light.

Starch and sugar are most plentifully present in the vegetable kingdom.

Starch has the formula, $C_6H_{10}O_5$
in endless varieties of plants.
Dextrin in varieties of plants, $C_6H_{10}O_5$
Inuline, Dahlias and artichokes, $C_6H_{10}O_5$
Moss starch.
Inuline, Dahlias and artichokes, $C_6H_{10}O_5$
Glycogen animal starch, $C_6H_{10}O_5$
Glycogen, being found in the mollusca—in the surroundings of the infant in embryo—and is leave notary.

Both converted into grape sugar by the action of acids, and as sugar turns the ray of polarized light to the left or right, according as it is dextrose or levulose, here is a connecting link between the animal and the vegetable, and from its action, as rotating the plane of polarized light, it might be the means of determining the growth to one side or the other. These are only hints, not even hypotheses.

No. 1.—See No. 1 at side of text (on sheet 3) for description.
No. 2.—Is the same arm, a different view.
No. 3.—Is the right arm of same iad.
No. 4.—Is another view of same right arm hand.
No. 5.—Left hand of man of 55.
No. 6.—Left radius and ulnar bones.

Nos. 7 and 8.—Right hand and arm of same man showing left side more deformed than right.
No. 9.—Absence of foot on left side replaced by spreading out of ends of tibia and fibula and a few occipi points.
No. 10.—Congenital absence of left fibula.
No. 11.—Club foot on left side and not on right.
No. 12.—Deformity of left hand and fore arm.