The Council reported the election of J. Ramsey and George Atkinson as Associates.

Messrs. B. E. Walker, and R. W. Smith were elected Members.

Mr. A. F. Chamberlain, B.A., read a paper on "Deluge Myths of the Canadian Indians."

The writer compared the myths of several tribes of Canadian Indians as recorded by various authors, and as heard by him from the Mississaguas of Scugog. With some of the tribes the Deluge is localized, with others it seems to have a more general character, and with some, no doubt, is completely mythical. The Eskimo myth, as recorded by Petitot, is very simple ; no cause is assigned for the great flood, which covered the summits of the Rocky mountains. Some Eskimo tied their boats together so as to make a large raft, on which they floated safely over the huge waves. The flood was calmed by a juggler or magician throwing first his bow and then his earrings into the water.

Quite different to this short account are the legends of the Déné-dindjié. In the Loucheux version the Deluge is caused by Etroet-chokren (the Navigator) rocking his canoe upon the waters of the river. He saved himself by crawling into a huge hollow stalk of grass, encased in which he safely rode out the flood, which in subsiding stranded his ark of safety on a high mountain. With the aid of the crow, whom he first killed and then resuscitated, the "Navigator" repeopled the earth. He pierced the side of the pike, from which issued forth men, the crow pierced the side of the loach, from which came women, and the earth was replenished. The Dog-rib tradition is somewhat different. Tchapeioi (the Old One) is the Noah of this tribe. When the flood occurred he built a raft, on which he placed two of each species of animals. When all the land had completely disappeared he sent down the beaver and other amphibious animals to dive for earth. The muskrat only succeeded. He came to the top floating on his back, with a little clay in one of his paws. This bit of earth Tchapeioi threw into the water and continued to blow upon it until it assumed the proportions of the earth of former days. In a version of a neighbouring tribe the cause of the flood is this : A young man called to a whale to swallow him, which the fish did, but the youth found his stomach an uncomfortable residence, and hearing his sister lamenting on the shore he called to her and told her to take off her shoe, and throw it into the whale's mouth, but to keep hold of the string. This the girl did, and the whale soon had to disgorge the young man, who was landed safe and sound on the shore. But the angry whale lashed the sea so vigorously with his tail that the waves mountain-high overwhelmed the earth. Of all the inhabitants the young man and his sister alone escaped. The Hareskin legend, of which Kunyan is the hero, resembles the Dog-rib story, except that the beaver is the successful diver.

The Ojebways of Lake Superior and Lake Huron relate the myth in a similar way to the Hareskins and Dog-ribs, but the hero of it is the demi-god Nanabojou or Nanabush, who saves himself by climbing to the top of the tallest pine on the tallest mountain in the world. The work of restoration is similar to that of the Noahs of the Hareskins and Dog-ribs. With the Ojebways of Lake Huron, the cause of the Deluge is that Nanabojou killed the white lion who dwelt beneath an enchanted lake, whose water in anger after his death overwhelmed the whole earth. Nanabojou's refuge was a tall pine, which in response to his entreaties grew taller and taller as the flood rose higher. The Mississagua story is very similar to this; with both, the muskrat is the successful diver.

Mr. Charles Armstrong gave a statement of a remarkable experience of the influence of mesmerism attending the recent amputation of one of his fingers. The statement was as follows :—

It became necessary a short time since for me to have a finger amputated, so I applied to Dr. Emery to do it for me. In reply to a question, I told him that I objected to chloroform, and would not take it. We then made an appointment for next day, Friday, December 14th, at his office, and, on arriving, I was introduced to Prof. Seymour by the doctor, who asked me if I would object to the professor making an experiment to control the nerves so as to prevent pain. I consented, but did not think he would succeed. Everything being ready, the professor took my arm and passed his hand along it for the first time, and then said he was ready. I saw the doctor take up the knife, and, leaning my head back, looked up, determined to show no sign of pain if I could help it. I felt the knife touch and press into the flesh, but strange to say not the slightest pain. I looked at my hand, saw it red, and till the end of the operation saw everything, the incisions, the scissors clipping the tendons ; I also distinctly felt the resistance, but no pain even when the stitches were put in. The last stitch on the back of the hand having been put in, Prof. Seymour let go my arm, which he had held all this time, and my hand was turned over. It was then decided to put one more stitch in the palm, and that one I felt in all its intensity. While Prof. Seymour laid his hand on my arm I felt not the slightest pain, but as soon as he took his hand off the next stitch gave me acute pain.

NINTH MEETING.

Ninth Meeting, 12th January, 1889, the President in the chair.

Exchanges since last meeting, 108.

Mr. A. F. Chamberlain, B.A., read a "First Contribution to the Bibliography of the Archæology of Canada and Newfoundland."

In general archæology the name of Sir Daniel Wilson stands foremost, and the number of papers written by him at various times is very large. For our own Province of Canada, the most exhaustive work on the subject is the report of Mr. David Boyle, the curator of the museum of the Canadian Institute for the year 1887. Other writers upon the archæology of Ontario are Prof. H. Croft, Rev. C. Dade, Paul Kane, R. W. McLachlan, E. Van Cortlandt, T. C. Wallbridge, and Sir Daniel Wilson. The papers of these writers describe local archæology and are to be found in the Canadian Journal and the Proceedings of the Canadian Institute. To various reports of the Smithsonian Institution, Messrs. E. W. Guest and others have contributed papers relating to the archæology of Ontario. In the journal of the Anthropological Institute are to be found papers by Sir Daniel Wilson, Sir Duncan Gibb, Dr. Fairbanks, and others. The archæology of the Province of Quebec has been but little considered. Numerous notices are to be found in Sir Wm. Dawson's "Fossil Man," Mr. A. Sandham's "Ville Marie," and the pages of "Le Naturaliste Canadien" (by the Abbé Hevart and others). The best view of the state of our archæological knowledge of New Brunswick is in the sketch by Mr. L. W. Bailey, in the bulletins of the Natural History Society of New Brunswick for 1887. Other writers on New Brunswick archæology are Prof. S. Baird, who has written on its shell-mounds, Rev. Jas. Fowler, A. C. Smith, and G. F. Mayhew. Rev. G. Patterson has, in the Smithsonian report for 1881, given a summary of Nova Scotian archæology. In Manitoba, Rev. Prof. Bryce and Mr. Chas. N. Bell have dealt with archæology, chiefly treating of the mounds. Other writers on the archæology of the North-Western portion of Canada (and they are but few) are Donald Gunn, Jean L'Heureux, Rev. John McLean, J. G. Swan, and Sir Daniel Wilson. The advantages of a complete bibliography of the archæology of Canada are very great, and it is to be hoped that it will soon be completed. The best idea of the archæology of Newfoundland and Labrador is to be gained from the articles on this subject by Mr. F. G. B. Lloyd, in the Journal of the Anthropological Institute for 1875.

Mr. Chamberlain also read a paper on "The Archæology of Scugog Island."

He described the situation and contents of a number of graves on Noncon Island, a portion of Scugog Island. Some 15 graves had from time to time been found there, all containing skeletons, but only three containing relics. In one grave were found a hard stone chisel, some perfect and imperfect shuttle-stones, several fragments of deer's horn, some half-dozen flint arrow heads, a portion of a bear's jaw, a piece of plumbago, a bone spear point, a bone harpoon, a bone awl, and some other articles. Ploughed up in the field at various times were found heavy stone chisels, whetstones, shuttlestones, etc. A number of pieces of pottery were also found. Noncon Island appears to have been the site of a pottery factory ; it is probable also that flint arrow heads were made there. The graves were situated some distance north of where the pottery was found.

No traces of connection with European civilization were found in any of the graves. The interments are probably to be referred to the ancestors of the Mississaguas or Ojibways, and date back a considerable period, as these Indians have been acquainted with the island for over a century. The Indians now at Scugog cannot account for the presence of the remains, and have had nothing to do with them. Mr. Chamberlain presented the collection to the museum of the institute. The collection consisted of four large chisels or hoes, one long and one round whetstone, some half-dozen so-called shuttle-stones, seven arrow heads, a bone spear head, a bone awl, a bone harpoon point, several unfinished stone implements. Besides these there were several pieces of deer horns, a portion of bear's jaw, and other articles interred with the skeletons.

TENTH MEETING.

Tenth Meeting, 19th January, 1889, the President in the chair.

Exchanges since last meeting, 41.

Messrs. Adam Morrison, William James Nelson, and A. A. Dewdney were elected members.

Mr. J. M. Clark, M.A., read a paper on "The Luminiferous Ether."

He set forth the reasons which induce men of science to believe in the existence of the ether. He demonstrated not only that the ether exists but also that it pervades all interstellar, intermolecular, and interatomic space. The varied and important functions performed by the ether were described and its properties discussed. The ether was shown to be a form of matter—to be a highly-attenuated substance of enormous elasticity. The particles were shown to be exceedingly minute, but the velocities of the particles correspondingiy great. A calculation of the density of the ether was also given, and the mass of the ether in the solar system approximately estimated. The paper also contained a criticism of the undulatory theory of light, and pointed out the difficulties in the way of its final acceptance.

In answer to a remark from Mr. Richardson, Mr. Clark said, the ether being a cause sufficient to explain all the phenomena, and, there being no known facts inconsistent with it, there was therefore sufficient proof of its existence.

The President, in answer to a question respecting the impenetrability of atoms, said, he did not know of any proof that they were impenetrable. It had often occured to him that the different chemical forms of the same substance may be combinations of the same element with ether.

In reference to the opinion that the mass of the ether moved, he supposed that it was not improbable that the ether permeated the masses of bodies.

ELEVENTH MEETING.

Eleventh Meeting, 26th January, 1889, the President in the chair.

Donations and exchanges since last meeting, 42.

Dr. Otto Hahn and Dr. Hugo Toeppen were elected members.

A letter was read from the Secretary of the Philological Section announcing the resignation of Dr. McCurdy and the election in his stead of D. R. Keys, B.A., as Chairman of that Section.

A communication was read from the Royal Academy of Sciences of Turin offering a prize to the scientific author or inventor, whatever be his nationality, who before the end of December, 1890, shall, according to the judgment of that academy, have made the most important and useful discovery, or published the most valuable work in physical and experimental science, natural history, mathematics, chemistry, physiology, and pathology, as well as geology, history, geography, and statistics. The value of the prize amounts to 12,000 Italian lire, or about $2,400. The prize will in no case be given to any of the national members of the Academy of Turin, resident or non-resident.

A letter was read from Mr. J. Hickson, general manager of the Grand Trunk Railway, in reference to the adoption of the 24-hour system. Mr. Hickson stated that he would rather not attempt to introduce the proposed system on the Grand Trunk Railway until the public have become more familiar with it.

Mr. David Boyle, Ph.B., curator of the museum, presented his report for the past year, enumerating a very valuable collection of archæological specimens recently added to the museum.

Rev. John McLean, M.A., Ph.D , read a paper on " The Blackfoot Confederacy."

He dealt with the history of the Confederacy, the contemporaneous Indian tribes, the mode of hunting the buffalo, and the extinction of the vast herds of buffalo that formerly roamed over the illimitable prairies of the Far West. A disquisition was given on the mythology and traditions of these people. Wonderful was their native religious system, with its elaborate ceremonial, prayers, sacrifices, and animistic beliefs. The physical characteristics of the tribes present in general a people of greater stature than the Wood Crees and Assiniboines, with arms and legs not fully developed. They have marriage customs similar to the Algonkin family, and engage in many kinds of amusements, nearly all of which are used for gambling purposes. The tribal laws are still in existence. They have also a political organization, with secret societies, and a system of telegraphy. There is a medical priesthood with initiation ceremonies, and some of the medicine men are proficient in surgery, besides having a good knowledge of herbs. The language is Algonkin but has an admixture of words from some other Indian language. A valuable collection of articles in use among the Indians by which the paper was illustrated was presented to the museum of the Institute.

Mr. Arthur Harvey had lived among the Indians many years, and had found them honest, truthful people. Many of his happiest hours had been spent with them. A great difference existed between the Whites and Indians now, but if we went back to Homeric times we should find customs similar to those of the Indians of the present day. We would find the same intense religious feelings. Among the Indians we have the neolithic people. It seemed to be a necessity that the old civilization must pass away before the new. Now the Indians have become degraded, but they have become degraded by contact with the whites. We have only the residuum. All the best men have gone, and we have been the means of destroying them. He had listened to Mr. McLean with the deepest interest. He was glad to see that he had risen above all minor prejudices and recognized the common brotherhood of man.

Mr. Boyle enquired whether Mr. McLean had been keeping records of the myths found among these people, the relics of which exist in great number.

Mr. McLean had jotted them all down as he went through the camps.

Mr. Boyle was glad to learn that Mr. McLean had distinguished between myths that were pure, and those that had been impregnated with European ideas.

In answer to a question from Mr. Browning in regard to the mode of tracing relationships, Mr. McLean said there was a considerable mixture of customs in these matters. In the election of a chief no attention was paid to it.

TWELFTH MEETING.

Twelfth Meeting, 2nd February, 1889, the President in the chair.

Exchanges since last meeting, 46.

A communication was read from the Audubon Monument Committee, requesting the co-operation of the Institute in obtaining funds for the erection of a monument to John James Audubon.

Mr. W. A. Sherwocd read a paper on "Colour in Nature."

He based his principles on the Newtonian theory, accepting red, yellow, and blue as the primary colours in preference to the theories of Helmholz and Maxwell. Having treated of the influence of the primaries, secondaries, and tertiaries on each other through the prism and in nature, Mr. Sherwood discussed the cause of colour-blindness. This he ascribed to the constant use of black and white. The costumes of society are principally black and white, so is the bulk of our writing and nearly the whole of our reading. Mr. Sherwood asked, "Are we in these things acting in accordance with the design of nature?" He thought we were not, for in neglecting colour we were going in direct opposition to the lesson of the book of nature. As to the prevalence of colour-blindness, he cited the published results of the examinations of locomotive engineers, where men fully qualified in every other respect fail to secure the coveted posts owing to being unable to distinguish the coloured signals. Another illustration was derived from Philadelphia, that city of education and refinement, where one out of every five of the children was found to be colour-blind or compelled to wear glasses. The greatest painters the world has produced flourished in lands where colour is seen on every side. From these resources of nature the artists drew their inspiration, and not from shops of fashion. Colour-blindness is almost unknown in many countries, Japan, Spain, and Italy for example. Here we have unfortunately the reverse of this. Mr. Sherwood believed this accounted for the preference many persons have for steel engravings and prints to paintings. This is false to the principles and teachings of nature. Those who favour engravings do so honestly because of their training in black and white, to which from childhood they have become accustomed. The children of the Quaker City had seen the sombre attire of their parents and even worn the same themselves, their city surroundings show the white marble residences and the black roadway, their books and writing are all black and white. Nature punishes all infringements of her laws; in this, as in other cases, the old truth holds good, "Be sure your sin will find you out." Mr. Sherwood concluded his paper, which was amply illustrated with diagrams, by a glowing description of an August sunset. "The day," said he, "is rich in colour, and after night spreads her mantle o'er the scene other worlds take up the colour which for the time we have lost. What is more glorious than colour? It is God's handiwork, and, like himself, is perfect. The representations of heaven are full of colour, and with more of colour in our daily surroundings life would be more cheerful."

THIRTEENTH MEETING.

Thirteenth Meeting, 9th February, 1889, the President in the chair.

Donations and Exchanges since last meeting, 69.

Mr. Daniel Lamb was elected a member.

Dr. G. Sterling Ryerson, read a paper on "Colour-Blindness in its Relation to Railway Employés and the Public."

Dr. Ryerson said that students of colour-blindness adopted the Young-Helmholz theory of colour as the simplest to work with, though much light had been thrown upon the subject by Seebruck and Stilling, of Germany, Prof. Wilson, of Edinburgh, and others. The theory of Helmholz was that there were three optic nerves or fibres, one for red, one for green, and a third for violet. Colour-blindness arose from the complete or partial paralysis of one of the three. It was met with as total and partial inability to distinguish colours, the causes being congenital and hereditary defect; severe illness or injury, particularly to the spine or head; and excessive smoking and drinking. The action of light, in the normal individual, on the three nerves is to produce the sensation of white light, under which the various colours had their proper effect on the organs of perception, but a colour-blind person saw greens and reds as greys. All nations exhibited a certain percentage of colour-blindness, even the Indians, among whom some researches on this subject had recently been made. From 2 to 13 per cent. was the usual proportion. Colour-blindness generally existed side by side with a great keenness of perception as to light and shade, so that some engravers had been actually more capable owing to these personal conditions. As a rule colour-blind people were unconscious of their defective vision in this particular. Describing the tests for colour-blindness, Dr. Ryerson said that Dr. Stilling invented a method of working letters in worsted of various colours on a velvet ground. The simplest and best test was, perhaps, that of Dr. Thompson, of Philadelphia, which consisted of a row of different coloured skeins of worsted hanging from a rod, skeins of different colours being placed in the hands of the person suspected of colour-blindness, with the request to match them with those on the stick. It was most important that railway employés should be periodically and strictly examined with reference to this inability to see colour. They were frequently only able to judge of colour by intensity of light, and when this ability was interfered with by fog or steam the effects might be most disastrous. He thought reform was needed in the arrangements of the railway companies in this respect. A verdict of manslaughter should be returned against railway companies in case of accident through neglect in ascertaining whether their men could or could not judge of a danger signal; and he thought the Department of Railways and Canals ought to take the matter up. A proper system of examination for colour-blindness might be satisfactorily conducted by divisional superintendents. He was not seeking to put the companies in the hands of an army of doctors.

Discussion ensued, in the course of which the fact was brought out that researches in colour-blindness began about 100 years ago, the first explorer in the field being Dr. Dalton, who was himself colour-blind, and who was once the amusing victim of his disability. As a Quaker, he was of course anxious to maintain a discreet soberness of tint in his attire; but after the degree of doctor was conferred upon him at Oxford, he walked about the streets of that ancient city and of London attired in his scarlet gown, under the impression that it was a neat grey. Persons in dry goods stores who were colour-blind generally distinguished the colours by their perception of light and shade, and by making a judicious and helpful arrangement of their stock. It was also suggested that some of the mysteries of colour exhibited by certain artists, as pictures, arose from partial colour-blindness, which deprived them of the power of seeing their productions as others saw them. Colour-blindness was a considerable disadvantage to a medical man, particularly in the case of disorders which exhibited their effects upon the skin, in determining the line of demarcation in gangrene, etc.

FOURTEENTH MEETING.

Fourteenth Meeting, 16th February, 1889, Vice-President T. B. Browning, M.A., in the chair.

Donations and Exchanges since last meeting, 55.

The Council reported the Election as Associates of C. R. Dent, C. H. Harvey, and Wm. Blackburn.

Mr. Kivas Tully, C.E., was elected an Honorary Member.

Messrs. John Notman, and James Bain Jr., were elected Representatives of the Institute on the Industrial Exhibition Committee.

Dr. A. M. Rosebrugh, read a paper on "Prison Reform."

It was moved by Dr. Meredith, seconded by Dr. Cassidy, and carried, That the Institute concurs in the recommendation of the Prisoners' Aid Society, and deems it advisable that the Government appoint a commission to visit prisons and collect information for the guidance of the Government on the question of Prison Reform, and that the secretary send a copy of this resolution to the Government.

Dr. Meredith referred to the cheering fact that so many men of cultivated minds were devoting attention to the subject of Prison Reform. He thought that the consensus of opinion was with the conclusions at which Dr. Rosebrugh had arrived. He considered it as cruelty of the worst character to send young boys and girls to the County jails, where they would associate with the most hardened criminals. It was in truth sending them the high road to the gallows. He was of opinion that boys and girls under fourteen years of age should in no case be sent to the County jails. He thought that they should receive some corporal punishment before a special Magistrate and be dismissed.

Mr. Massie, Warden of the Central Prison, Toronto, said he fully agreed with Dr. Rosebrugh, in all his remarks. After eight years experience he was convinced that reform must commence with the County jails. It would take a long time to eradicate their evil influence. Some of the measures advocated by Dr. Rosebrugh may be considered as too radical, but he was convinced that they were in the right direction. He was glad to notice that crime had not increased in Canada. He referred to the too great severity of punishments at an earlier period, and mentioned his recollection of a circumstance that had occurred at the coronation of Queen Victoria, when a man who under circumstances of great want had stolen a sheet, was sent for ten years to Botany Bay. A very respectable woman who had reared a family of nine, had written to him about a boy of hers. He found the boy, who was very reluctant to see his mother. She had lost seven children, but she felt more trouble on account of the boy than for the loss of all the others. He enjoyed very much the reading of the paper and hoped that it would be published in the public journals.

Dr. Cassidy was much impressed with the statements he had heard. He had learned much from Dr. Rosebrugh's paper. Not having devoted much time and independent thought to the consideration of the subject, he would not venture any criticisms on it. He was strongly opposed however to the enforced idleness of prisoners, and considered it of importance that they should be kept usefully employed. Some better employment should be found for them than trundling around filled wheel-barrows. In the case of a drunkard who was sent to prison, the man's labour should go to the support of his wife and children.

Mr. Elvins coincided with the views of Dr. Cassidy in regard to making the labour of the imprisoned husband help to support his wife and children who were the greatest sufferers.

Mr. Browning considered it hard that the labour of the prisoner should come into competition with that of the free labourer. He thought that it would be well if the police officers were not so anxious to make arrests.

Mr. Armstrong said that one object of Prison Reform should be to bring a number of young offenders to the cultivation of the land. This would relieve the artisan from the competition of prison labour.

Dr. Meredith said that the great object of the Industrial School at Mimico, was to instruct the boys in farming. He decidedly objected to penal labour. The great object of Prison Reform was to render them honest. They should be taught to regard labour as a privilege and a boon.

Warden Massie thought that a man who committed a theft should be imprisoned until he earned a sum sufficient to refund what he had stolen. The average expenses of the prisoner amounted to forty-seven cents per day. What he earned above the amount required for his maintenance, should be passed over to his family.

FIFTEENTH MEETING.

Fifteenth Meeting, 23rd February, 1889, the President in the chair.

Donations and exchanges since last meeting, 29.

Prof. Ellis read a paper on "Milk Analysis and Milk Standards," in the course of which he said that in the year 1874, Wanklyn published "A Practical Treatise on Milk Analysis."

In this little work he described the method which he used for the analysis of milk, and published a number of analyses made by himself of milk supplied to the London workhouses, and ten analyses of milk known to be genuine; and he there asserted that cow's milk never contains less than 11.5 per cent. of solids, and seldom so little as 12 per cent. Of these solids, the fat was the most variable. The solids not fat were very constant, and never fell below 9.2 per cent. In the same year the Society of Public Analysts was organized, and adopted the following "limits" for milk:—"Milk shall not contain less than 9.0 per cent. of solids and fats, and not less than 2.5 per cent. of butter fat. The method of Wanklyn came into general use in England, but was not adopted by the Somerset House authorities, nor did they commit themselves to the Society's limits. In course of time improved methods of extracting the fat were introduced, and it became evident that Wanklyn's method failed to get out all the fat. The last method of fat extraction is Mr. Adam's paper method, which has been adopted by the Society of Public Analysts and by the Chemists of the United States Agricultural Department at Washington. In this method the milk is sucked up by blotting paper, dried and extracted by ether in a special apparatus contrived for the purpose by Saxblet. The use of asbestos instead of paper has been recommended by Mr. Macfarlane, the chief analyst at Ottawa, and has been adopted as an alternative method by the Washington authorities. The more complete extraction of fat by these methods lowers the percentage of solids not fat, and the Society of Public Analysts has now fixed their limit at 8.5 per cent. of solids, not fat. From the results of a number of analyses of the milk of herds of cows in Canada, undertaken by authority of the Government in the summer of 1887, by the public analysts, of which those from the Toronto district were made in duplicate by the chief analyst and myself with closely concurrent results, he using the asbestos and I the paper method, I am convinced that even this standard of 8.5 per cent. is too high. The average results for the whole Dominion were :— Solids, 12.48 per cent.; fat, 3.86 per cent.; solids not fat, 8.62 per cent. This average leaves but little margin for variation, and as a matter of fact, in many of the samples, the solids not fat fell below 8.5 per cent.

Dr. Cassidy asked what was considered a good percentage of fat.

Dr. Ellis answered 3.5 per cent. of fat. The minimum, he considered, to be about 1.5 per cent ; 2.5 per cent. is not uncommon. From a herd of cows the butter-fat may fall as low as 2.5 without there being any adulteration. He thought that a limit should be fixed by law at which milk should be sold He had recommended in his report that if the miikman protested against the analysis, the analysis should be made from the milk of the cow. The cow that gave the best milk belonged to a man who took a pride in grooming his cows, keeping everything very clean and giving them good fodder.

The President remarked on the importance of milk analysis. In his own family he found sickness was caused by the use of the milk. The cows had fed on the banks of the Don, and typhoid fever had resulted.

A paper was also read on the " Detection of Methyl Alcohol in Commercial Spirits," prepared by Drs. Ellis and Babington. The authors show that the admixture of methyl alcohol with ethyl alcohol may be readily ascertained by Victor Meyers' vapour density apparatus, and propose this method as test for the purity of commercial spirits.

SIXTEENTH MEETING.

Sixteenth Meeting, 2nd March, 1889, Vice-President Browning in the chair.

Exchanges since last meeting, 38.

Mr. E. G. Hanning, C.E, P.L.S., was elected a member.

The following resolution reported from the Geological and Mining Section, was adopted and a copy was ordered to be forwarded to the Ontario Government:

In view of the great variety and undoubted value of the mineral resources of Ontario, and the necessity to the capitalist, scientist and prospector of having a typical collection of minerals to refer to in the capital of this province, it is highly desirable that the Government of Ontario make arrangements as soon as possible for a mineral museum at the new Parliament Buildings, or elsewhere, in Toronto, and in the meantime that temporary arrangements be made for a mineral museum at some suitable place in the city.

The following resolution was also passed:

That the members of the Canadian Institute desire to record their sense of the loss they have sustained in the death of George Paxton Young, M.A., LL.D., Professor of Metaphysics and Ethics in University College, Toronto, one of the most distinguished life-members of the Institute, whose high character as a man, attainments as a scholar, and success as an educationalist, will cause his name to be long held in grateful remembrance by all who had the pleasure of his acquaintance. His numerous papers in Mathematics and Philosophy, read before the Institute, are among the most valuable contributions to its "Proceedings;" and we hereby desire to tender our respectful sympathy to his relatives and friends in their great affliction.

That a copy of the above resolution be sent to the nearest relative of Professor Young.

Mr. Alexander D. Black read a paper on "The Genesis of the Heaven and the Earth."

SEVENTEENTH MEETING.

Seventeenth Meeting, 9th March, 1889, the President in the chair.

Exchanges since last meeting, 39.

Mr. C. W. Nash was elected a member.

Mr. A. F. Chamberlain read a paper by Mr. William Kennedy, on the "Formation of Valleys," which chiefly related to "The central basin of Tennessee, a study of erosion."

In the structure and formation of valleys, it was contended, there were laws as fixed as those to be found in any other division of geology, and as clear and readily understood when rightly interpreted. Valleys had been formed, and were now in course of construction, in various ways. They could be classified into four different kinds. A very insignificant agency might be the cause of the formation of an immense gorge, with its narrow channel, precipitous sides, and its rushing turbulent torrent as the beginning of a broad fertile valley, extending over many miles. Thus were formed the Grand Cañon and other similar gorges found in Colorado. They were not due to any great convulsions of the earth, such as earthquakes or volcanic eruptions, but were solely the effects of quiet, persistent, never-ceasing erosion. The paper then gave a very elaborate description of the great central basin of Tennessee, its geological structure and geological history. Then followed an account of the Appalachian coal field. The paper concluded with a description of the process of erosion and the agents by which it was effected.

Mr. Harvey thought that so far as the geology of the Middle States of the American Union was concerned, the paper just read was highly valuable, and it would be desirable to have it printed in the Proceedings. Passing over the geology of the Tennessee Basin, he wished to make some remarks on the erosion of valleys, especially on the erosion of the valley of the Don. He referred particularly to a creek he passed almost every day, called 2nd or 3rd creek or Cemetery Creek. Of this creek he proceeded to show the process of erosion. From Bloor Street all the drainage runs north, the creek was on an average, 50 feet below the level of Bloor Street. It was about 2½ miles long, and 300 feet wide. He had taken out one-eighth of an inch of sediment when dried from a gallon of water. During fifteen days, this creek flows down at the rate of four miles an hour, and every gallon of water carries down ⅛ of a solid inch of sediment. Calculating from these elements, it would take 70,000 years to carry down the contents of the valley. This would be the age of the valley of the Don. He had observed several of these Don creeks and concluded that the average erosion of the valley was about the same as it is now. He thought there was no difference in the erosion of a creek where there were trees and of one where there were no trees. All things considered he thought the erosion was the same now as when there was a primeval forest.

The President thought that on some days there might be fifty times the volume of water carried down that Mr. Harvey had mentioned. It would then remove a considerable portion of the bank. This would shorten the time considerably. He had known at one flood, in the course of a few days eight inches of sand deposited over several acres of the Don Valley.

Mr. Elvins said: Of course all these valleys were cut through the drift. The Don itself was cut through the drift. In undisturbed portions of the drift, but by no means at the bottom of it were found portions of trees of the same species, as those now existing. These fossil remains being the same as the present trees, it seemed to him impossible that time required for the erosion of the Don could have been so long as that given by Mr. Harvey. It was not likely that it exceeded 6,000 or 7,000 years.

Mr. Harvey thought that some valuable results may be arrived at, and, recommended the appointment of a committee to investigate the subject.

EIGHTEENTH MEETING.

Eighteenth Meeting, 16th March, 1889, the President in the chair.

Exchanges since last meeting, 66.

Messrs. Arthur Harvey and D. B. Dick were appointed Auditors for the current year.

A communication was read from " La Societa Siciliana per la Storia Patria," Palermo, announcing the death of its distinguished President, S. E. Vincenzo Fardella, Marchese di Torrearsa, Caveliere dell Ordine Supremo della SS Annunziata, ex-President of the Chamber of Deputies of Sicily, Senator of the Kingdom, and late President of the Senate of Italy. A resolution of condolence was adopted by the meeting, and ordered to be sent to the above mentioned society.

Dr. Otto Hahn read a paper on his trip through Canada in 1878, and the discovery of organisms in meteorities, with demonstrations by the microscope.

NINETEENTH MEETING.

Nineteenth Meeting, 23rd March, 1889, the Vice-President in the chair.

Donations and Exchanges since last meeting, 33.

Communicatians were Read from the Royal Society of Canada, respecting the Seventh Annual Meeting, and from

"La Societa Toscana di Scienze Naturali in Pisa" announcing the death of its President.

Mr. W. H. VanderSmissen, M.A., read a paper, prepared by Rev. Neil MacNish, LL.D., of Cornwall, on the authenticity of the "Sean Dana."

The paper contained a defence of the literary honesty of the Rev. Dr. John Smith, of Kilbrandon and Campbelltown, Argyleshire, against the strictures of Mr. J. F. Campbell, compiler of "Leabhar na Feinne." Dr. Smith published in 1780, twenty years after the appearance of Macpherson's Ossian, a work called "Gaelic Antiquities," containing "a collection of ancient poems translated from the Gaelic of Ossian," etc., and in 1787 his "Sean Dana," or ancient lays or poems, the original Gaelic of those translated in the first collection. Mr. Campbell casts doubt on the genuineness of these poems, and charges Dr. Smith with having given his own compositions to the world as those of Ossian. Against this charge Dr. MacNish's paper defends the author, on the ground partly of the high character he bore, as evidenced by the testimony of the Highland Society's report on the Ossian poems, but chiefly on the internal evidence of the poems themselves.

Mr. David Spence said that it was almost unnecessary to discuss the question. In his opinion the authenticity of the poem of the Sean Dana had been fully established. With regard to the authenticity of the poems of Ossian, Hector McLean one of the best Gaelic scholars, had come to the conclusion that the English poems which McPherson had collected were composed by McPherson himself. This did not agree with the opinion of certain German writers, but he (Mr. S.) had looked into the matter pretty closely and believed that McLean's theory was true. The Gaelic poems were genuine. He had read over the different arguments and had no doubt of their genuineness. He came to the conclusion that McPherson had found those poems in the Highlands. The manuscripts from which the poems were taken were found in McPherson's possession. Dr. McNish considered that a great change had come over the Highlands since McPherson's time. It should be noticed that the clergy had set their minds against the people learning those tales. This had prevented many people who had learned them from repeating them. He had met with an old man who recited at great length many of those tales.

Mr. VanderSmissen asked whether the poems of Ossian were in accordance with the folk-lore and traditions of the people.

Mr. Spence said they contained many fragments that were so, though no doubt much amplified.

Mr. T. R. Rosebrugh, B. A., exhibited and explained a "New Trigonometrical Scale."

The principle of the new method of solving triangles depends upon the facts (1) that the difference of the logarithms of a side and of the sine of its opposite angle is a constant quantity for every triangle. (2) That when the indexes of a "chord operator" and scale have assumed a relative displacement corresponding to this value, the graduation marks of the three pairs of opposite sides and angles are found respectively at three pairs of coincident points. (3) To secure this the observer need only see that the condition that the three angles of a triangle are together equal to two right angles is satisfied by the scale indications. The "three point problem" may be solved by the scale with great facility without using equations; the operation being one of simple inspection to determine the point at which a certain condition is satisfied. In the case of right-angled triangles, the solution may be combined in one operation with that of changing the denomination in which the sides are measured.

TWENTIETH MEETING.

Twentieth Meeting, 30th March, 1889, the President in the chair.

Donations and exchanges since last meeting, 39.

Mr. Frank L. Blake was elected a member.

A communication was read from the President of the Committee of Organization of the International Congress of Maritime Affairs, to be held in Paris in the month of October; also from the Geological and Mining Section requesting the Institute to appoint a committee to wait on the Government with reference to the establishment of a Mineral Museum; also from the Antiquarian and Numismatic Society of Montreal enclosing a petition to the Hon. Minister of Finance for the Dominion of Canada, praying that the present duty of 15 per cent. *ad valorem* on printed books be changed to a specific duty of six cents per pound weight avoirdupois. It was resolved that the petition be signed and transmitted to the Government.

Mr. T. B. Browning, M.A., read a paper on the "French Shore Question."

He began by saying that he adopted the above title not because it described the subject matter he was to speak of accurately, but because the name was well known to the public, and brought the chief portion of the international complication into clear relief. He would himself prefer the heading The French North American Fisheries. From 1629 to 1886 no less than 20 treaty conventions or declarations had been made regarding them; many of the older arrangements had been superseded, and certain of the later had never been ratified. Three ideas seemed to run through them all, to be granted on both sides and to form, as it were, the underlying basis of negotiations: (1) That the fisheries are one and not several; (2) that they are the national property of Britain: and (3) consist only of the codfish and such minor species as are used for bait. The latest treaty is that of November 20, 1815, which confirmed the settlement of the previous year, 30th May, 1814, Article XIII. of which specified the places where the French exercise the rights granted them by previous agreements. These places are:

(1) The gulf of St. Lawrence, at a distance of three leagues from the coast of continent and islands, 15 leagues from Cape Breton, and 30 from Nova Scotia.

(2) The banks of Newfoundland, including the Great Bank in the North Atlantic.

(3) The islands of St. Pierre, Miquelon, and Langley.

(4) The western shore of the main island from Cape Ray northwards to Cape Bauld, thence south-eastwardly to Cape John, a distance or coast line (not including indents) of 398 miles, commonly called the French shore.

Mr. Browning gave a description of these several fisheries, their extent, mode of pursuit, the bounties paid, and the value of the fisheries, which he estimated at $5,000,000 yearly. The ordinances of the French and English Governments were brought under review in their chief points, the former dating from Louis XIV., the latter from an order of the Star Chamber in the reign of Charles I., confirmed and amplified by statute 10 and 11, William III., c. 15. The result of both is to introduce and perpetuate a practical communism as regards land-holding, to prohibit settlement, the growth of private rights, and make this side of the Atlantic subservient to the interests of the other. Notwithstanding the stringent regulations imposed, a resident population and independent industries have sprung up, and now flourish both in Newfoundland and St. Peters. In regard to the French shore, Mr. Browning contended that the claim of France to exclusive right there received no countenance in the treaty of 1783, its declaration, in the statute passed in pursuance of it in 1788, the proclamation issued under that Act; nor from the prior treaties of 1763, 1713; and traced its growth to the French ordinances or regulations governing their own subjects. Under these the French shore is divided into "places" of the 1st, 2nd, and 3rd class, to correspond with the bounties given to vessels under the French laws. Within each class lots are cast as to which "place" any ship may have. This it holds with its fishing grounds or stages for five years, when another casting of lots is had, the practical outcome of which is an exclusive allotment for a term to individuals, and, as regards the nation, an exclusive use or enjoyment of the whole shore. The system is one of usurpation, amounts to national ownership, while the treaties affirm that at no time shall his most Christian Majesty or any of his subjects make any claim of right to Newfoundland, or any portion of it, and assert the sole ownership of Britain.

Mr. Browning enumerated particulars wherein the French had exceeded their treaty privileges, *e. g.*, (1) in parcelling out the shore, (2) exercising jurisdiction over British subjects, (3) prohibiting British sea fishing and prescribing conditions for it, (4) preventing the British from the river fishery and lobster fishery along shore. No magistrates were appointed in this district till 1878: no grants of lands or licenses for search for mines, till 1881; nor can the mines chiefly coal and copper, be worked, because the French forbid the use of the sea-board for shipping and other purposes.

Two conventions have been lately drawn to set at rest the questions raised—one in 1857, and the other in 1886, both of which were rejected by Newfoundland, the last on these among other grounds:—(1) The portions set aside for the exclusive use of France as "places," are the best harbours or fishing grounds. (2) The ignoring of Newfoundland magistrates and the appointment of a naval board of two commanders in the English or French navy for the decision of disputes either of whom could act in the absence of the other. Newfoundland has no confidence in the French navy or its commanders. (3) Chiefly because it guaranteed to the French the right to take and purchase bait within English bounds. That nation has lately raised its bounties on the exportation of fish so as to equal the value of the article, and is by this means, underselling Newfoundland in the neutral markets of Spain and Italy. The convention rejected, the Island Legislature passed a bait law by which she seeks to counteract the force of the French bounties and preserve the bait fishes for her own use. According to the latest accounts, the law is working well, is enforced by a special cruiser, and is receiving the active support of the Home Government. Mr. Browning looks for the settlement of these difficulties, not to any change in the attitude of Newfoundland but in that of France. Her object in bountying these fisheries, the development or providing of material for a navy, is not attained; the experience of two centuries and the advice of her naval commanders are against it, while the perpetuation of the fishery regulations is detrimental to the best interests of all parties, English and French, and is against the trend of civilization on both sides of the Atlantic.

TWENTY-FIRST MEETING.

Twenty-first Meeting, 6th April, 1889, the President in the chair.

Exchanges since last meeting, 37.

Mr. O. J. Klotz was elected a member.

The President nominated the following Committee in pursuance of the Resolution passed at last meeting :—The Council of the Institute and Messrs. T. R. Clougher, John Notman, R. W. Phipps, A. Harvey, A. Rankin, Andrew Elvins, A. F. Chamberlain, and Dr. P. H. Bryce.

Dr. W. Canniff read a paper on "The Value of Sanitation."

Mr. Levi. J. Clark read a paper on "The Sewage Problem in Toronto."

There are three plans at present before the citizens for the disposal of the city sewage. I shall describe them as : 1st, Messrs. McAlpin and Tully's ; 2nd, Mr. Sproatt's ; and 3rd, Messrs. Hering and Gray's. They all recommend two intercepting sewers, a high level one along the line of Gerrard street, and a low-level one along Front street, having a fall in each case from west to east, and extending from about Garrison Creek sewer to near the Don. Then Messrs. McAlpin and Tully recommend a connecting sewer joining Gerrard and Front at their eastern extremities, and continuing out into the lake to a distance of 4,100 feet, at a point east of the Eastern gap, to deep water, the discharge pipe to be a seven-foot steel pipe. The other two schemes recommend a continuation of the Gerrard street sewer across the Don and eastward to near Victoria park, where the sewage would be carried out into the lake through a six-foot pipe, by the second scheme 3,500 feet long, and by the third 2,000 feet long. In the second scheme the Don was to be crossed by a bridge 40 feet high, in the third the river was to be siphoned under. Both the latter schemes require the pumping up of the sewage from the lower level sewer into the high-level one. The first scheme requires no pumping, being a purely gravity scheme.

I have a strong objection to all these schemes with regard to the outlet pipes, being of the opinion that they would not operate satisfactorily, and also in case of the second and third schemes, with regard to pumping, which is nothing more nor less than a worthless, expensive nuisance. The outlet pipes lie under water, so that they flow always at the full, and knowing their size and the amount of sewage discharged through them, it can easily be told to the thousandth part of an inch what the velocity would be. I would call your attention to the following table, and challenge anybody to refute its accuracy. First through a seven-foot pipe :—

Gallons.	*Feet per Sec.*	*Miles per Hour.*
12,000,000	.577	.394
9,000,000	.433	.295
6,000,000	.288	.197
12,000,000 6 ft. pp.	·785	·534
8,000,000	·523	·356
4,000,000	.262	.178

We know that 12,000,000 gallons is the average amount of water that is pumped into the city per day, and allowing that it is all returned to the sewers, by reference to the above table it would only have a velocity of .577 ft. per second, less than seven inches, and in the six-foot pipe of about 9½ inches. But we know that much of the water pumped into the city never reaches the sewers : for instance, that which is used for watering lawns, sprinkling streets, building purposes, steam engines, etc., so that a safer calculation would be to take two-thirds or three-quarters of that amount. By reference to the table you will see that 9,000,000 gallons will only have a velocity of 5 1-5 inches per second, or less than 3-10 miles per hour.

Mr. Baldwin Latham, one of the most eminent English engineers, says in regard to self-cleansing sewers that, "In no case should the velocity be less than two feet per second, but in the generality of cases it should be much greater." Mr. N. Beardmore gives two and a-half as the least, Mr. Phillips gives the same rate, while Mr. John Neville says three feet per second is required. Now compare these rates with the actual facts as set forth by the table—velocity required two to three feet per second, actual velocity five to seven inches. We are told in the reports of these experts that the velocity in some parts of the system would be as high as five miles per hour, equal to 7½ feet per second, for instance on Gerrard street. Now what will be the inevitable result? The sediment and solids that are held in suspension while being rapidly whirled along Gerrard street at the rate of seven feet per second will immediately begin to subside when they reach the outlet pipe, and the velocity is reduced to five inches. The pipe will be choked and perfectly useless. What is needed is some means of keeping this outlet free and clear. I will explain my method for accomplishing this end, adopting the first scheme, namely: A high-level and a low-level sewer, and a connecting line down say Parliament street. I would have it, after passing Front street, turn to the east, pass under the bed of the Don (new mouth) to the angle formed by its bottom with the eastern bank, then follow this angle down as far as the river needs, dredging thence easterly and continue out to deep water. The object of this diversion is to interpose the waters of the Don between the discharge of sewage and the intake of water. This would give perfect security from contamination of the water supply. Along the line of the connecting sewer, somewhat to the south of King street, I would have a flushing tank situated, capable of holding say 400,000 gallons of sewage, arranged to discharge itself automatically wherever the sewage rose to a certain height. Now, estimating that one-half, 6,000,000 gallons, is collected in the high-level intercepting sewer, and passes out through the flushing tank, it would fill and discharge fifteen times in the twenty-four hours with a velocity of from 5 to 8 miles per hour, sufficient to sweep along whole bricks, stones, or cannon balls, and deliver them safely into deep water. Now considering that the entire system, as herein briefly described, can be constructed for about three-fourths of a million dollars, why should the people of Toronto throw away one and a half millions on a worthless scheme when they can get an efficient one for half the sum?

Mr. Kivas Tully thought that the Canadian Institute and the citizens of Toronto were much indebted to Mr. Clark for the clear way in which he had placed the subject before them. As to the difficulty in Tully and McAlpine's plan that Mr. Clark had referred to, he would see that it had been obviated. Mr. Tully showed how the difficulty was removed by an hydraulic slope. Any obstructions would be swept away into deep water. He highly approved of Mr. Clark's plan of an Automatic Flushing Tank. This would secure a regular periodical flushing, the outlet pipe could be cleaned by natural means, as by showers. Mr. Clark's plan secured the cleansing of it by artificial means. Mr. Tully then referred to Mr. Miller's method of deodorizing the sewers. From what he had seen of it he thought that it was very practicable. The substances required could be procured in Devonshire, England.

Dr. Canniff referred to the saying that Doctors always differ, but the differences among Engineers surpass any thing among doctors. He asked whether there was not great danger of the contamination of the water from the Sewage as it passes along.

Mr. Tully thought that on the whole the proposal before the people was the correct one, and hoped that the By-law would pass.

Mr. Macdougall gave an explanation of the system in use in England.

Mr. Harvey asked whether the separate system with steel pipes in use in Furope could not be introduced here.

Mr. Macdougall said the difficulty would be in the great cost of it.

TWENTY-SECOND MEETING.

Twenty-second Meeting, 13th April, 1889, the President in the chair.

Donations and Exchanges since last meeting, 58; including 3 pamphlets and a copper axe and spear found on the north bank of the Kaministiquia River, by Capt. Smith, of Fort William, for which thanks were voted.

On motion of Mr. Williams seconded by Mr. Macdougall, Messrs. J. H. Pearce, W. E. Middleton, W. Brodie, W. H. Merritt, A. Harvey, J. B. Williams, A. Macdougall and Prof. R. Ramsay Wright were appointed a committee to see the Government in regard to the Algonquin National Park for the preservation of wild animals and natural forests.

Mr. L. J. Clark was elected a member.

Mr. Arthur Harvey read a paper on "Outlines of the Geology of the North-west ol Lake Superior with special reference to the Silver District of Thunder Bay."

Mr. A. F. Chamberlain, B.A., read "A Second Contribution to the Bibliography of the Archæology of Canada."

The second "contribution" consists of about one hundred titles of papers, articles, and passages in works of various travellers and scientists referring to the archæology of the Dominion of Canada and Newfoundland, the first contribution containing about seventy such items. To the citations of titles are added brief notes of the contents and importance of the articles, etc. In the list of names figure very prominently Sir Daniel Wilson and Sir J. William Dawson; of the latter some eight and of the former some twenty articles are chronicled, besides their works "Fossil Men" and "Prehistoric Man," respectively.

The works of travellers afford many passages relating to archæology, etc., and when all have been examined the Bibliography will be approaching completeness. For the Eskimo we have the works of Ross, Parry, Richardson, Franklin, Hall, Schwatka, and many more, besides the recent investigators, Kumlein, Rink, Rae, Turner, Boas, etc. In Labrador we have the works of the Moravian missionaries, and Kohlmeister, Cartwright, Chappell, Dobbs, etc., besides the more recent explorers, Hind, Packard, Gordon and others. In Nova Scotia the labours of Rev. Geo. Patterson, whose collection of specimens is now in the museum of Dalhousie College, are especially valuable. In Montreal the results of the energy of Sir William Dawson are seen in the museum of McGill College. For Ontario, Mr. D. Boyle's report just issued is of highest importance, besides which the (as yet unpublished, but most valuable) material of Mr. A. F. Hunter and Dr. Tachè is to be mentioned. The Manitoban region has received attention at the hands of Rev. Prof. Bryce, Mr. Chas. N. Bell, and Lieut.-Gov. Schultz. Dr. Geo. M. Dawson's valuable contributions relating to the Indians of Queen Charlotte's Islands, his papers on Jade in the North-West of British North America are the most important of the articles dealing with the archæology of the British Columbian region; besides these we find much in the works of Grant, Mayne, Scouler, Wilson, Bogge, Sproat, etc., and the recent investigations of Krause, Deans, Boas, and others. The compiler of the bibliography will be especially grateful for references to the archæological articles in local papers.

Mr. H. R. Wood, B.A., presented a paper on "The Silver Belt of The Kaministiquia."

TWENTY-THIRD MEETING.

Twenty-third Meeting, 28th April, 1889, the President in the chair.

Exchanges since last meeting, 48.

Mr. D. B. Dick having declined to act as auditor, Mr. J. B. Williams was appointed in his place.

Mr. J. C. Hamilton, M.A., LL.B., read a paper on "The Mound Builders of America."

He first described a site of a mound builders' old city, now a beautiful park, in Richfield township, Ohio, visited by him. Having fortunately remained in the possession of owners of means and taste many of the old landmarks yet remain. He then discussed the subject at length, taking first the remains found in Ohio, which was the central home of the race and had not less than 10,000 places where these people left traces of their former occupancy, of which

1,500 are enclosed earthworks. In New York state there are 250 enclosures. In an area of 50 miles on the borders of Iowa and Illinois there are 2,500 mounds, besides earthen enclosures. He quoted from various authorities as to the extension of the remains of these people even into Manitoba, and by the Saskatchewan and other water courses to British Columbia. He described the great works at Fort Hill, Fort Ancient, Newark, Cahokia, and elsewhere. He dwelt on the happy results that have followed at Marietta, Ohio, and some few other places where the remains have been preserved as far as possible intact. He showed diagrams of several mound works in Ohio and Indiana which added to the interest. He discussed the state of civilization and customs of these predecessors of the Indians, and analysed the various theories propounded by Count de Nadaillac, Sir J. Lubbock, Col. Charles Whittlesey, Sir Daniel Wilson, and other writers. He spoke of their inner life, their government, religion, dress, ornaments, etc. He found no traces of Georgite theories among them, considered that the government was patriarchal and tribal. The religion was like that of the Aztecs, with sacrificial rites and sun worship. As to their origin, he considered them not by any means the first race of men on this continent, but that they were akin to the Toltecs and Aztecs of America, and to the present Japanese, and so of a clearly Asiatic type. Referring to Nadaillac, Sir Chas. Lyell, and other authorities, he considered these people as a great and widespread nation, which occupied this continent for perhaps 2,000 years, but that some 1,000 years ago their distinct nationality was lost in contests with the Indian races, chiefly Shawnees and Cherokees, in the Ohio regions, which then overran the continent, amalgamated to some extent with them, but that the greater part of the Mound Builder race was driven to the South and became lost in the great Nahua nations, of whom the Aztecs were one. He drew a picture of the life of the people, and referred to the art of the archæologist, which respects not the tombs of the Pharaohs nor the graves of the proud old Peruvians and Mexicans, but has gathered as mummies and skeletons many such remains to be stared at by the curious in museums from Bulak to Central Park. He lastly depicted what may be found as to Canadian civilization after another score of centuries have passed, when some pundit from the then "Dominion of United Africa" or the "Japanese Republic" shall drop down from his electric flying machine and inspect the remains of civilization of the Canadian Caucasian race.

A paper was then read by Ojijatekha on "Pagan Belief in Religion."

TWENTY-FOURTH MEETING.

Twenty-fourth meeting, 27th April, 1889, the President in the chair.

Exchanges since last meeting, 38.

The Council reported the election as Associates of H. C. Champ, Herbert C. Eddis, and Edmund Staunton.

W. H. Child and T. A. Staunton were elected members.

Capt. Stupart, R.N., read a paper on "The Flying Proas of the Ladrone Islands, and the Navigation of the natives of the Western Pacific."

FORTIETH ANNUAL MEETING.

Fortieth annual meeting, 4th May, 1889, the President in the chair.

Donations and exchanges since last meeting, 47.

George E. Lumsden was elected a member. Dr. Joseph Workman was elected an honorary member.

Sir Daniel Wilson announced that Mr. Sandford Fleming had authorized him to state that he had in 1853 insured his life for £1000 currency in favor of the Institute, and that he was making arrangements with the Insurance Company to have the amount paid over to the Institute at once. The cordial thanks of the Institute were tendered to Mr. Fleming and a Committee appointed to prepare an appropriate resolution, which Committee subsequently reported the following :—

The Canadian Institute recognizes in the gift now offered to it by Mr. Sandford Fleming a fresh and unexpected evidence of his kindly and generous heart, and of the deep interest he has always taken in the welfare of the Institute. A mere expression of thanks conveys but feebly the gratitude with which the Institute acknowledges its indebtedness to Mr. Fleming whose numerous contributions to its Proceedings have been crowned by the movement initiated by him before the Institute now leading to the adoption of a uniform system of time-reckoning over the whole world.

The Fortieth Annual Report was read and adopted, as follows :

The Council of the Canadian Institute has the honor to lay before its members its Fortieth Annual Report.

The Council has much pleasure and gratification in recording an increased interest in the work, and an extension in the influence and prestige of the Institute.

The movement for a universal system of time-reckoning, initiated by Mr. Sandford Fleming has spread far and wide. A deputation waited on His Excellency Lord Lansdowne in May of last year with regard to this subject, who was kind enough to bring the pamphlet on "Time-Reckoning" before the notice of the Secretary of State, through whom it was sent to all the colonial and foreign governments.

Cosmic or twenty-four hour time is being largely adopted on this continent; inquiries have lately been received from the government of Hong Kong on this subject. The very enterprising kingdom of Japan has adopted the system as the basis of its time reckoning.

A clock marking cosmic time, the present of an American firm, has been in the reading room of the Institute for over twelve months.

The government of our Province paid the institute the compliment of placing one of its members, Mr. W. Hamilton Merritt, on the Royal Commission to enquire into the Mineral and Mining Resources of the Province. The report is of great value and will largely extend the development of our mineral resources.

The interest in the work of the Institute has not flagged during the past year, there have been 24 ordinary meetings at which 31 papers were read, and 36 meetings of sections at which 39 papers were read, or a total of 69 papers for the session.

The range and character of these communications have been fully equal to the standard of former years, they have been well and fully discussed. The average attendance at the meetings is in advance of last year. The attendance of members in the reading room has also increased.

The Council desires to record its high appreciation of the generosity of the Government in again placing the sum of $1,000 at the disposal of the Institute, for the extension of archæological research. Through the indefatigable exertions of the curator many valuable additions have been made to the museum from the Province and from the United States. The admirable arrangement of the specimens in the various cases, has greatly assisted the study of this important branch of our national history. It is gratifying to report that the museum has been visited by a large number of ladies and gentlemen, from many of whom valuable donations have been received.

The appointment of Mr. David Boyle, as representative of the Provincial Government at the Cincinnati Exhibition last year has been productive of much good to the interests he represented there, and has been the means of many valuable gifts being presented to our museum. The archæological report for 1888 has already appeared as an appendix to the report of the Minister of Education for last year.

The thanks of the Institute are due to Mr. Sandford Fleming for his exertions in procuring an interesting and valuable present from the Grand Trunk Railway Company of a portion of the first sod of the Northern Railway, cut on the 15th October, 1851, by Her Excellency the Countess of Elgin and Kincardine, and the bottle used on 14th January, 1853, to christen Collingwood harbor, and an extract from the *Globe* of the 26th January, 1863, giving an account of these relics and other interesting matters.

The members of the Photographic Section, desiring to extend their work in a more practical manner, resolved to form a Photographic Society having wider scope than they believed would be offered by union with the Institute; they have in consequence withdrawn from the Institute. The Council regret this action.

The Biological and Natural History Section continues to make its influence felt, and deserves the thanks not only of the Institute but of the citizens at large for its recent successful remonstrances against the destruction of the purely natural beauties of High Park.

The list of donations and exchanges has increased; the library has received many valuable additions. This department is carefully attended to by our energetic librarian; over 300 volumes were bound this year; extra accommodation in the library is an urgent necessity.

The treasurer's statement shows a satisfactory balance at the credit of the Institute, and the increased interest taken in the Institute by the comparatively small number of members in arrears.

The membership has been increased by 22 elections during the past session. The Council after much careful thought determined to make a thorough examination of the list of members and enforce the rules against members in arrears who refused to make any settlement. The list now submitted is more complete than any hitherto presented to the Institute, and represents truly the actual membership: the Council would urge on the Institute the importance of adhering to the step now taken, and enforcing the rules against members in arrears, as it is only by this means that membership in the Institute will become of value.

The Council endorses the remarks of the auditors that a proper valuation of the assets of the Institute should be made.

During the past year the Institute has lost by death two distinguished life members, the Rev. Walter Stennett, of Cobourg, and Prof. G. Paxton Young. Apart from his special attainments in the department of Mental and Moral Philosophy, Prof. Young was a mathematician of very high order; some of his later papers read before and published in the Proceedings of the Institute, placed him in the foremost ranks of mathematicians.

In recognition of his valuable services at the inception and in the early days of the Institute, as well as his honourable professional career, Mr. Kivas Tully, C.E., (who was our first Secretary) has been elected an honorary member.

Your Council is much gratified to announce that the invitation of the Institute to the American Association for the Advancement of Science to hold its next meeting in this city has been accepted, and there are bright prospects of a very successful meeting.

Following up the memorial of January 1888, meetings have been held with the Honourable Commissioner of Crown Lands with reference to setting aside a tract of land for the preservation of the forests and wild animals in this Province. At his suggestion a memorial with a sketch map showing an area which could be made available for such purposes is being prepared.

The reports of the various Sections are appended. They all report satisfactory progress in their several branches.

All of which is respectfully submitted.

CHARLES CARPMAEL,
President.

APPENDIX II.

MEMBERSHIP.

Number of Members at 1st April, 1888,—309.

Honorary Members	7	
Life Members	10	
	——	17
Ordinary Members :		
1. Who have paid their subscriptions to 31st December, 1889, including new members	141	
2. Who have paid their subscriptions to 31st December, 1888	65	
3. " " 31st December, 1887	14	
4. Who are two years and more in arrears	3	
	——	223
		240
5. Losses through death and withdrawals	36	
6. Names struck off the roll for non-payment of arrears	23	
7. Names placed on suspense list for non-payment of arrears	10	
	——	69
		309

Associates		32
8. Members elected during the present session who have paid their annual subscription	15	
9. Members elected during the present session who have not yet paid	7	
		22

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE FOR THE YEAR ENDING MARCH 31ST, 1889.

To Summary :—	
" Amount received from building fund	$ 110 11
" " " in Imperial Bank	163 56
" Cash on hand	9 20
" Annual subscriptions	809 75
" Rents	233 50
" Government Grant	1,000 00
" Journals sold	15 65
" Periodicals sold	9 49
" Biological Section	50 00
" Woodcuts	4 75
" For Conversazione of 1886	2 00
" Interest	60
	$2,408 61

By Summary :—	
" Salaries	$ 370 50
" Printing Journal	688 67
" " Miscellaneous	39 25
" Stationery	45 53
" Postage	129 26
" Freight and express charges	23 27
" Repairs	56 96
" Gas	32 88
" Water	24 00
" Periodicals	123 21
" Furniture	6 00
" House cleaning	99 30
" Fuel	78 25
" Taxes	9 36
" Phonographic Exhibition	15 00
" Architect	50 00

Customs charges and brokerage	3 00
" Advertising	7 75
" Sundries	19 35
" Interest	212 00
" Promissory note	200 00
" Balance in Imperial Bank	137 00
" Cash in hand	38 07
	$2,408 61

Examined and found correct.

(Signed) ARTHUR HARVEY, J. B. WILLIAMS, } Auditors.

JAMES BAIN, JR., IN ACCOUNT WITH ARCHÆOLOGICAL GRANT.

To Government Grant for 1888-89	$1,000 00
" Balance forward	35 45
	$1,035 45

By Purchase of specimens	$ 550 00
" " cases	91 65
" Engraving and printing of specimens for Report	102 50
" Travelling expenses and remuneration of Curator	285 67
" Bank charges	38
" Balance on hand	5 25
	$1,035 45

Examined and found correct.

(Signed) ARTHUR HARVEY, J. B. WILLIAMS } Auditors.

ASSETS AND LIABILITIES.

ASSETS.

Building	$11,500 00
Warehouse	720 00
Ground	3,000 00
Library	5,000 00
Specimens	2,000 00
Personal Property	1,000 00
	$23,220 00

LIABILITIES.

Mortgage No. 1, due 1892	$ 3,000 00
" " 2, "	1,000 00
Balance in favor of the Institute	19,220 00
	$23,220 00

The Auditors having carefully gone over the accounts and vouchers beg to report:

That the cash accounts kept by Mr. Young are in perfect order.

That the distribution into the various heads of income and expenditure, made by Mr. Bain, the treasurer, corresponds therewith.

Your Auditors think it would be wise to have a proper valuation made of the various assets of the Institute—Library, museum, and building, and to procure by this means a reliable statement of its Assets and Liabilities—and recommend the subject to the consideration of the Council.

(Signed) ARTHUR HARVEY, J. B. WILLIAMS, } *Auditors.*

Canadian Institute, Toronto,
April 25, 1889.

Classification of papers read, by subjects:—Anthropology, 1; Archæology, 3; Astronomy, 2; Chemistry, 2; Economics, 1; Geology, 3; History, 2; Mathematics, 1; Miscellaneous, 3; Philology, 3; Political Science, 1; Physics, 3; Physiology, 1; Sanitary Science, 2; Social Science, 1; Sociology, 2; total, 31 papers read at 24 meetings.

Read at the meetings of the Biological Section, 22 papers; Architectural Section, 3; Geological and Mining Section, 5; Philological Section, 9 papers; total, 39. Making in all 70 papers.

LIBRARIAN'S REPORT.

To the Council of the Canadian Institute :—

The statement for the Library for the year 1888-89 is as follows :

I.	Donations to the Library		85
II.	Exchanges :		
	1. Canada	138	
	2. Great Britain and Ireland	481	
	3. United States	569	
	4. Mexico and South America	43	
	5. Austro-Hungary	150	
	6. Belgium	54	
	7. Denmark	4	
	8. France and Algeria	396	
	9. Germany	106	
	10. Italy	146	
	11. Netherlands	25	
	12. Norway	30	
	13. Portugal	7	
	14. Russia	37	
	15. Spain	18	
	16. Sweden	18	
	17. Australia	31	
	18. British India and China	34	
	19. Japan and Java	20	
	Total		2,307
III.	New exchanges	39	
IV.	Total number of exchanges	435	
V.	Periodicals subscribed for, same as last year with the exception of Hardwicke's Science Gossip," which has been discontinued	31	
	Total amount of these		769
VI.	Number of volumes bound during the year		306
VII.	Number of publications taken from Reading Room and Library during the year		1,900

All of which is respectfully submitted.

GEO. E. SHAW,
Librarian.

REPORT OF THE BIOLOGICAL SECTION.

The Section has to report a year of progress and prosperity.

The regular fortnightly meetings have been held throughout the year, and the attendance has been satisfactory.

A schedule is attached shewing the papers read—22 in all.

As this section is to a large extent educational in its objects it is not required that the papers read should be the result of original research, and we would welcome the assistance of some of the many members of the Institute who are well qualified to give us much information that would both interest and instruct.

The microscope which our last report mentioned as having been purchased but not then arrived has been received and by its means many points in the papers read before the section are illustrated and the enthusiasm of those members engaged in the study of minute forms of life has been quickened. The microscopical curator will always be ready to attend meetings of the Institute, or other sections, when the use of the instrument is desired. A small collection of slides has already been secured for the Section's cabinet, and more are expected.

Two years ago when the Institute contemplated the completion of the museum upstairs this Section became responsible for two years for the interest on the mortgage of $1,000 which was given to raise the necessary funds, and we are glad to say that this has been paid, and the Section is now free from debt or liability.

Not much progress has been made in our department of the museum. We merely desire to draw attention to the fact that biological specimens cannot be mounted without money and that our Section has absolutely no source of income except grants from the Council of the Institute.

W. E. MIDDLETON,
Secretary of Biological Section.

The officers for next year are: James H. Pearce, President; W. E. Middleton, Secretary.

SCHEDULE OF PAPERS.

1	E. E. Thomson	*Canadian Birds.*
2	Rev. K. F. Junor	*Echini.*
3	J. H. Pearce	*Inaugural Address.*
4	M. Chamberlain	*Canadian Birds.*
5	J. Noble	*Mosses* (First Paper).
6	"	" (Second Paper).
7	Wm. Brodie	*Parasites of Potato Beetle.*
8	Wm. Brodie	*Lemothrips Graminæ.*
9	J. H. Pearce	*Flowers* (First Paper).
10	"	" (Second Paper).
11	W. E. Middleton	*Fresh Water Sponges.*
12	J. B. Williams	*Birds Observed in 1888.*
13	Wm. Brodie	*Snakes.*
14	W. E. Middleton	*Structure and Fructification of Ferns.*
15	C. Armstrong	*Canadian Ferns.*
16	Wm. Brodie	*Relation to Environment.*
17	E. E. Thompson	*Winter Birds of Toronto District.*
18	J. H. Pearce	*Moulds and Kindred Fungi.*
19	W. E. Middleton	*Microscopic Mounting.*
20	James Noble	*Plant Evolution.*
21	James Noble	*Plant Development.*
22	A. Elvins	*Volvox Globator.*

REPORT OF THE PHILOLOGICAL SECTION OF THE CANADIAN INSTITUTE, APRIL 6, 1889.

Gentlemen,—I have the honor to present for your consideration the Third Annual Report of the Philological Section, for the year ending March 31, 1889. During the session the Section has met regularly on the second and fourth Tuesdays of each month.

Following is a list of papers read at the various meetings :

(1) April 10, 1888—"A Chart of Elocutionary Drill." By T. B. Browning, M.A.

(2) April 24, 1888—"Volapük, the new World-Language. By D. R. Keys, B.A.

(3) April 24, 1888—"On some words of Indian origin in the French Canadian Dialect and Literature." By A. F. Chamberlain, B.A.

(4) November 13, 1888—"The language of the Mississaguas of Scugog, with special reference to Sematology." By A. F. Chamberlain, B.A.

(5) November 27, 1888 — "The Semitic Vowels." By Rev. Pro McCurdy, Ph.D.

(6) January 8, 1889—"The Origin and Development of Grammatical Gender." By A. F. Chamberlain, B.A.

(7) January 22, 1889—"Language Learning and Language Teaching." By William Houston, M.A.

(8) February 12, 1889—"The Gaelic Vowel System." By David Spence, Esq.

(9) " 26, 1889—"The Gaelic Consonants." " "

During the month of March the section continued the investigation of the Gaelic Language introduced by the papers of Mr. Spence, of whose valuable assistance it was enabled to avail itself. On the 8th January, 1889, the Rev. J. F. McCurdy, Ph.D., resigned the office of Chairman of the Section, to which position Mr. D. R. Keys, B.A., was duly elected.

The officers for the ensuing year are :—Chairman, D. R. Keys, B.A.; Vice-Chairman, Jno. Squair, B.A.; Secretary, A. F. Chamberlain, B A.

(Signed) A. F. CHAMBERLAIN,
Secretary Philo. Section, C. I.

The Council of the Canadian
Institute, Toronto.

REPORT OF THE GEOLOGICAL AND MINING SECTION OF THE CANADIAN INSTITUTE FOR 1888-9.

To the President and Council of the Canadian Institute:

Gentlemen,—Very much interest continues to be manifested by the members of this section in the study and discussion of those subjects which form the specialty of our organization.

At the various meetings which have been held during the year the attendance has been good.

At the first meeting of the sessional year communications were read from the Department of the Interior referring to measures taken by that Department for collecting and publishing statistics and other information on the mining and metallurgical interests of the Dominion, and enclosing a copy of an Order-in-Council on the same subject, approved by the Governor-General in Council; also referring to an interview had by the Chairman and Secretary of this Section with the Deputy Minister of the Interior on the subjects of (1) Prompt publication of the Survey's reports on mining affairs; (2) Coöperation of the Dominion and Provincial Governments in the collection of such information, and (3) Legislation making the furnishing of information compulsory.

In thus directing the attention of the authorities to an important subject, the section has been able to do good work, and recent publications of reports justify the action taken by this section.

A number of interesting papers have been read during the year, and the discussions arising therefrom have aided materially in familiarizing many with facts relative to the minerals and mineral resources of our Province.

The Section has also taken much interest in the project of establishing in this city a Provincial Mineralogical Museum, and trusts that its efforts in this direction may yet be crowned with success.

Officers have been elected as follows for the current year:

Chairman—W. Hamilton Merritt.

Vice-Chairman—Arthur Harvey.

Secretary and Curator—David Boyle.

Managing Committee—R. W. Phipps, A. F. Chamberlain, A. Elvins, John Notman, P. H. Bryce, M.D.

The present year is confidently regarded by the section as likely to prove more than usually profitable to the section in all that relates to the investigation and study of geology and mining in Ontario.

W HAMILTON MERRITT,
Chairman.

ARTHUR HARVEY,
Vice-President.

DAVID BOYLE,
Secretary.

PAPERS READ DURING THE SESSION.

Mr. Harvey—"On Certain Lacustrine Deposits;" "On the Synclinal Trough of Lake Superior."

Mr. Merritt—"The Iron Ranges of Northern Michigan and Minnesota;" "Laurentian Formation of New Jersey, with Relation to the Iron Mines therein."

Mr. Mills, of St. Ignace, Michigan—"Iron Smelting Furnaces."

REPORT OF THE ARCHITECTURAL SECTION FOR SESSION OF 1888-89.

Gentlemen:—The members of the Section have met fortnightly during the Session, the meetings being chiefly occupied by instructive and interesting discourses, theoretic and practical, delivered by some of the prominent Architects and Master Mechanics of this city, who commended and encouraged the objects and motives of the Section, promising and offering us their entire sympathy and support.

The following were among the papers read and debated upon, being subsequently published in the *Canadian Architect:*

"The responsibilities of Students to their Profession," by R. Gambier Bousfield, A.R.I.B.A.; "Subsoil Irrigation," by E. Burke, Architect; "A Discourse on Carpentry," by R. Wilson.

Besides the papers and addresses, competitions were engaged in in designing Bay windows, Oriel windows, Entrances, etc.

At the close of the Session the following officers were elected: Robert Dawson, Chairman; Chas. D. Lennox, Treasurer; J. Fras. Brown. Secretary.

Yours verily,

J. FRAS. BROWN, *Secretary.*

REPORT OF THE SOCIOLOGICAL COMMITTEE.

The Committee on Sociology begs leave to present its report for the year 1888-9.

1. Your Committee was constituted at the first meeting of Council this year and at once procured a circular, which appears in the last *Fasciculus* under the heading "Sociological Circular," to be drawn up, printed and distributed chiefly to the following classes of persons:

(1) Indian agents, farm instructors, inspectors, teachers in Indian school in Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward's Island, Manitoba, the North-West Territories and British Columbia.

(2) Magistrates, inspectors of North-West Mounted Police, registrars, clerks of the peace. members of Council in North-West.

(3) Missionaries of the leading churches: Church of England, Roman Catholic, Presbyterian, Wesleyan.

More than a thousand copies have been distributed, so that your Committee is of opinion that the circular has found its way to most persons in the Dominion who are interested in Indian questions.

2. Your Committee has received material assistance from the Hon. Edgar Dewdney, Superintendent-General of Indian Affairs for the Dominion, the Hon. A. S. Hardy and the Hon. G. W. Ross, Ministers respectively of Crown Lands and Education in Ontario; is deeply indebted to the newspapers, educational, religious and legal press of Canada for bringing the subject to the attention of the public, and for extended and favorable notices of the Committee's work; also to the following periodicals: Magazine of Western History, Popular Science Monthly, Journal of Anthropology of the United States, Historical Review and Law Quarterly of England.

3. At the request of your Committee the Canadian Pacific Railway has kindly consented to carry archæological, geological and natural history specimens free of charge for the Institute.

4. The publication of the Indian Treaties of Canada and the Provinces has engaged the attention of your Committee. The Council and Institute will, no doubt, be pleased to learn, from the accompanying

letter of Mr. Van Koughnet, that this important work is under way and will shortly be completed. The correspondence on the subject is herewith submitted. Copies of the Dominion Reports on Indian Affairs from 1875 up to and inclusive of 1888 have been received for the use of the Institute, for which your Committee has duly returned its thanks to the Superintendent-General.

5. In reply to the circular a number of letters and abstracts have been received, among them

(1) A short abstract from the Rev. T. S. Cole, B.A.

(2) An interesting letter from Inspector A. Bowden Perry of Prince Albert, North-West Teritories, which your Committee begs to submit to the Editorial Committee for publication, together with a detailed paper on

(3) "The Western Déné," by the Rev. A. G. Morrice, O.M.

A number of other papers are promised, principally by reverend gentlemen whose duties bring them into direct contact with the Indian population of Manitoba and the North-West.

6. Your Committee begs leave to reserve such remarks of a sociological nature as it may desire to make for the separate papers as they appear, suggests that the circular be re-issued with such alterations and additions as may seem proper, and entertains the hope that the success which has accompanied its efforts this year will be redoubled in the year to come to the common benefit of the Institute, its members and the country.

All which is respectfully submitted on behalf of the Committee.

T. B. BROWNING,
Chairman.

Toronto, May 3. 1889.

The election of Officers for the ensuing year resulted as follows:

President--Charles Carpmael, M.A.

Vice-President—T. B. Browning, M.A.

Treasurer—James Bain, Jr.

Editor—George Kennedy, M.A., LL.D.

Curator—David Boyle, Ph.B.

Secretary—Alan Macdougall, M. Inst. C.E.

Librarian—A. F. Chamberlain, B.A.

Members of Council—W. H. Ellis, M.A., M.B., Alex. Marling, LL.B., G. E. Shaw, B.A.

The following papers were presented and taken as read :

"The Western Dénés," by Rev. A. G. Morrice, O.M.

"The Indians of Canada," an introduction to the work of the Sociological Committee, by T. B. Browning, M.A.

It was resolved that the thanks of the Institute are due to the newspapers of the city of Toronto, especially to the *Mail* and *Empire* for the space which they have so freely given to its proceedings, and for the extended notices of the meetings which have so regularly appeared in their columns.

SOCIOLOGICAL CIRCULAR.

PART I.—SOCIOLOGY.

Sir,—The Canadian Institute is desirous of collecting and incorporating in its Proceedings reliable data respecting the political and social institutions, the customs, ceremonics, beliefs, pursuits, modes of living, habit, exchange, the devolution of property and office which obtain among the Indian peoples of the Dominion, and of enlisting your voluntary coöperation in the work. It feels that this department of research has not been so fully cultivated in Canada as its importance demands, fears that the opportunity of gathering and carefully testing the necessary facts may with the advancing tide of European civilization soon pass away, and is of opinion that much light may be cast upon the genesis and growth of government as well as upon legal, sociological and economic thought by an accurate study of our Indian tribes in their existing conditions and organizations.

The Institute, without desiring to contract the field of observation, begs leave to direct your attention to the following matters:—

(1.) The basis of family or tribal organization, *e.g*, whether it be purely personal, or partake to any extent of territorial attributes; the received mode of ranking and tracing relationships, paternal, maternal, or both; with a table of degrees, if possible, of agnates and cognates.

(2.) Adoption, its kinds, ceremonies and formulæ, the extent of its use, and the particulars in which it modifies the family, gens, tribe, etc.

(3.) The rules and practice which govern the contracting, maintaining and dissolving of marriage; the degrees of prohibition; exogamy and endogamy; the effect of marriage on the status of woman, her position upon divorce, etc.

(4.) Grades of persons of both sexes apart from office, free and slave; to what extent mature children of either sex are the subjects of rights; the age of enfranchisement, if any.

(5.) The character of parental power, paternal and maternal; its extent over persons and property in matters civil and criminal; exceptions to it.

(6.) Offices, their kinds, the powers annexed to them, the terms for which and on which they are held; the mode of succession, *e.g.*, general election, election by a few, election within a group, inheritance, etc.

(7.) Assemblies or councils and the questions treated at them; how and by whom they are summoned; in whom resides the right of debate and franchise in the several assemblies of the family, gens, band, tribe, or nation.

(8.) Property, its admitted classes inside the family and tribe; joint proprietorship how acquired, held, managed, aliened; whether common ownership is acknowledged, and in what respects it is distinguished from joint ownership; whether private property is allowed; if so, how acquired, enjoyed, transferred, or lost; whether succession to it is permitted; if so, within what degrees; if not, how it is disposed of, *e.g.*, buried with body on death of owner, burnt, or otherwise destroyed.

(9.) Division of labor and duty, civil and military, and how apportioned, *e.g.*, to chiefs, sub-chiefs, ordinary male members, ordinary female members, immature children; methods and extent of production, modes and measures of distribution, the means of support of family or tribe, the interior economy of family and gens or band; the modes of bargain and sale in use; by whom conducted; the use of gifts.

(10.) The settlement of disputes or conflicting claims as between *(a)* members of same sub-family, *(b)* family, *(c)* different families or sub-families, *(d)* bands, groups or gentes, *(e)* tribes, *(f)* nations; in whom resides the civil and in whom the criminal power, by tradition or custom; how and by whom dooms are pronounced and inflicted; whether punishments as between the tribes are corporate or individual; the compounding of crimes and offences, *e.g.*, murder, theft; to what extent the bond of blood-feud binds; ostracism, surrender of offender, death penalty; in what cases practised; the effect of vows upon the performance of contract.

(11.) The making of inter-family and inter-tribal arrangements, *e.g.*, treaties as to boundaries, peace and war, sale and purchase; the solemnities observed among larger and smaller groups.

(12.) The cultus and sacrifices which obtain in sub-families, families, totem, etc.; moral or religious code which accompanies them; the form and purpose of the different tribal or inter-tribal ceremonies in use, *e.g.*, dog-, sun-, thirst-dance, etc.

(13.) Death and birth rates; effects of miscegenation.

(14.) Practice in cases of burial, its rites.

(15.) Border civilization, its effect upon the beliefs and moral conduct of Indian peoples.

(16.) The influence of territorial reserves, outside jurisdiction, education and support upon the Canadian Indians.

PART II.—PHILOLOGY.

Lexical.

(a.) Vowel and consonant sounds, their classification, the predominance of vowels over consonants, or consonants over vowels; the variation of vowels or the gliding of one into another, *e.g.*, O into A, A into E; the transmutation of consonants *e.g.*, L into N or R, T into D,

D into TH, P into B, B into F or V, G into K, K into χ, or, inversely, aspirate into medial, medial into thin; at different periods or in cognate words of different dialects of the same language.

(b.) Are roots monosyllabic or polysyllabic; what part particles play in the formation of words and whether and to what extent reduplication is used as a means of compounding?

(c.) Whether the language is agglutinative or inflexive; if inflexive, how? Examples of formations.

GRAMMATICAL.

(d.) The parts of speech which admit of gender, number, case; their formation, kinds, (*e.g.* animate or inaminate) with examples or paradigms. Do non-verbal adjectives obtain; if so, do they admit of inflexions? The classes of pronouns in use. Are personal pronouns distinct from, infixed in, prefixed or suffixed to the verb?

(*e.*) Conjugations, forms (negative and affirmative) voices, moods, tenses, numbers, persons of the verb; the position which its radical, personal and modal elements take; the extent and purpose to and for which participles are used; adverbial forms how derived; whether the reduplicative, initiative and final elements of the verb are infixed in, prefixed or suffixed to it, separated from it or altogether absent.

SYNTACTIC AND GENERAL.

(f.) What regular place (if any) each word or part of speech occupies in a sentence?

(*g.*) Is the verb the predominant element in the language? Do nouns and verbs expressive of collectivity or abstract qualities obtain? Examples.

(*h.*) Do fine distinctions abound in the language or are they wanting? A list of idiomatic peculiarities.

(*i.*) A list of simple numerals, names of days, moons, feasts, common plants and vegetables, animals, articles in general use, the more evident planets, for comparative purposes in tracing the relationship of languages and migrations of peoples.

(*k.*) Contributions to the folk- or myth-lore of the Indian tribes.

(l.) Sign language and mode of telegraphing.

The Institute will be happy to receive and give its best attention to papers upon any and all the above, or such other subjects allied to them as may seem to you important.

It would appear from reports published in the newspapers that in the Province of Ontario, in the other Provinces and the Territories of the Dominion, a considerable quantity of valuable information concerning our Indian people is reduced to writing, but is not given to the world because no proper channel has been established for its dissemination. This Institute desires to draw these scattered rays to a focus for the benefit of students at home and abroad; and believes that investigators will find in its PROCEEDINGS (now circulating among members in Canada, 300, foreign societies and institutes, 400,) that avenue of communication of which they have been so long in need. Proprietary rights in the papers may be reserved.

For some years the Institute has given special attention to collecting and classifying specimens of natural history, geology, and Indian archæology which, according to the custom of the Institute, are duly inscribed with the names of the donors. Its museum includes many very rare and valuable specimens which are open for inspection and study every lawful day from 1 p.m. to 6 p.m. It is the desire of the Institute to increase its collection in all departments, enhance its public usefulness and render it worthy of the Dominion as a national institution. Through the liberality of the Canadian Pacific Railway Company, the Institute is enabled to make announcement to donors and intending donors that specimens for the museum will be carried over the Company's line free of charge in packages suitably packed for freight.

It is particularly requested that packages of specimens for transmission by rail, papers, abstracts, communications in or pertaining to the matters of this circular be directed to

The Chairman of
THE SOCIOLOGICAL COMMITTEE
Canadian Institute,
58 Richmond Street East,
Toronto, Ont.

On behalf of the Committee,

T. B. BROWNING M.A.
Chairman.

Toronto, August, 1889.

THE CENTRAL BASIN OF TENNESSEE.

A Study of Erosion by William Kennedy.

Valleys and their Formation.

How are valleys formed? Have they no rules guiding their structure? or are their architecture, their form, their outlines and position or even their existence merely matters of chance and governed by no fixed laws?

In their structure and formation there are laws as fixed as those to be found in any other division of geology and as clear and readily understood when they are rightly interpreted.

Valleys are depressions in the surface of the plane of the globe in much the same manner as mountains are prominences or elevations upon the same plane. Valley and mountain are complementary of each other, so to speak of the one implies the presence of the other. Only, that in some cases the mountain part of the two is of a particularly flat broad type; the flat top extending over a great many miles in every direction and in fact completely enclosing the valley. Then, however, the enclosed depression is called a Basin and the rules governing its construction are sometimes a little different from those affecting the formation of a valley.

Valleys have been formed and are now in course of construction in various ways. To enumerate all the modes in which old valleys have received their present forms and recent ones have started out to form themselves would probably be to enumerate nearly every known valley in the world. They may, however, be classified into various divisions according to the primary causes of their formation. For the purposes of such classification all valleys may be divided into four different kinds, each being due to the peculiar manner of the inception of the valley. This is obviously the proper manner in which such classification should be made as no valley exists, or at least none is known to exist, in which a great part of the size and form of such a valley cannot be traced to erosion or denudation. The effects of erosion are recognizable in numerous cases long after the traces of the original cause of the valley have ceased to exist.

Valleys may be due to the flexing of beds or to the breaking of them, the flexing producing one kind of valley and the breaking another. Although so much, with regard to the extent and form of all valleys, is due to erosion, yet it is doubtful whether this cause ever originated a valley.

"The examination of the geological structure of valleys plainly testifies that almost every great hydrographical basin has derived its form originally from some other agency although its outline may have been subsequently altered by the continued action of currents within it."—(*Chambers' Encycl. Vol. IV, Art. Erosion*).

Valleys may be divided into the following :

1. Synclinal Valleys.—These are due to the folding of the earth's crust and always run parallel to the folds, or mountains, upon either side of the valley. As a general rule the dips of the two opposing sides are toward the centre of the valley. While this may be a general rule regarding the dip of the sides of a synclinal valley it is by no means invariably the case. There are valleys which properly belong to this class in which the dips are parallel to each other. Among the folds of the Appalachians many of them were so folded back upon each other as to give under the action of denudation valleys which although true synclinal valleys have the dip of the strata on both sides parallel. Synclinal valleys never cross the ridges or folds among which they lie.

2. Monoclinal Valleys.—Valleys of this description always face an escarpment, and have for the other side an indefinitely long dip or slope. Such valleys may be due to the slipping of the upper beds upon the lower ; or to the unequal erosion of beds lying upon the same side of a fault with the same exposure, or they may be formed along a fault by the difference between the uplift on the one side and the down throw upon the other.

3. Valleys of Elevation.—Paradoxical although it may seem, we have a class of valleys which are higher than the hills. These run along the summit of anticlinals and are due to the fracturing of the beds at the point of flexure and the admission of water. The water erodes the under-lying beds to such an extent that in a short time, geologically speaking, a valley often of a considerable size is formed. There are several valleys of this description within the territory connected with the Central Basin of Tennessee. The Sequachee Valley in Eastern Tennessee belongs to this class. The Sequachee Valley is a long narrow valley pursuing a straight southwesterly course for about seventy miles, with an average width of about four miles, and enclosed between two escarpments of from 800 to 1000 feet in height. The head of the valley lies within the Cumberland Tableland, in fact Sequachee Valley breaks the Cumberland Tableland into two divisions; and the mouth may be said to debouch into the Valley of the Tennessee River, near where the boundary lines of Georgia and Alabama meet the Tennessee line. In going eastward from the margin of the Central Basin, the Sequachee fold is the first great fold met with. It forms the Crab Orchard Mountain at its north-eastern end, and by a continuation southwesterly it is exhibited in the Sequachee Valley which is simply the fold with the upper portion of the plications worn off owing to fracture, admission of water, and consequent erosion.

In the same line of folding there is a small basin "Grassy Cove" formed in a similar manner, but Grassy Cove is completely surrounded by hills.

Another good instance of a valley of elevation is to be found in the Jones and Roup's Valley in Alabama, and lying between the Coal Basin of Warrior on the west, and that of the Cahaba on the east. Dr. Smith (Geological Survey of Alabama, 1876, p. 14) says: "The rugged barren hills of the coal fields contrast strikingly with the rolling fertile lands of the valley, and we have presented here, as has been remarked by Professor Safford, the curious case of a valley which is higher than the mountain. The geological structure of the region is in general as follows: In the middle of the valley the strata belong to that sub-division of the Lower Silurian which I have called Quebec or Knox Dolomite; these rocks are found dipping generally towards the south-east, though in many places they dip both north-west and south-east. Crossing from the centre of the valley south-east towards the Cahaba coal fields, we go over the rocks of the Chazy and Trenton, the Niagara, the Black Shale, the Sub-carboniforous, the Millstone Grit and the shales and sandstones of the coal measures all lying conformably and dipping south-east. Going north-westward we find the same succession of strata up to the coal measures of the Warrior fields, the dip being sometimes north-west, though often south-east. Such in simplest terms is the geological structure, and there is no doubt but that the coal basins of the Warrior and Cahaba were once continuous; that at the time of the disturbances along the Appalachians, they together with the underlying formations down at least to the Quebec or Knox Dolomite were uplifted into a long anticlinal fold; that this fold was fractured along its axis or summit, thus affording a channel for denuding waters, and finally that the great mass of sandstones, coal beds, shales, and limestones, which constituted the fold has been broken down and removed by the action of running waters till nothing is left of it now except the low rim on each side adjacent to the coal measures." This valley is from six to eight miles from coal field to coal field.

These two valleys exhibit in many ways peculiarities similar to what are found in the district in Central Tennessee and Southern Kentucky and, as we shall see further on, may be looked upon as the resultants of similar causes.

In some cases valleys of elevation have been denominated as anticlinal valleys owing to the peculiarity of their formations. It might be better to give them that name as their existence is due to the presence of the anticlinal, while the valley has nothing to do with the elevation of the ridge.

4. Valleys of Erosion or Denudation.—A valley of erosion is one due to the eroding and denuding effect of water in some of its many forms, or to atmospheric or some other sub-aerial causes. It is asserted that erosion never was the primary cause of the production of a valley, but rather that denudation is only a secondary cause operating from some pre existing condition of things, and thereby forming a valley of denudation.

A very insignificant agency may be the cause of the formation of an immense gorge, with its narrow channel, precipitous inaccessible sides, and with its rushing turbulent torrent, or the beginning of a broad fertile valley, whose smiling fields, watered by a slowly flowing and meandering stream, extend over an area of many miles, to be surrounded on its margin by rounded hills gradually rising to the level out of which the valley had been formed.

The land emerging from the sea may have risen furrowed with ripple markings, small and scarcely perceptible, such as we often see upon the present shores. Or the newly made land may have been covered with gravel or shells. Any of these agencies would have been sufficient. In the case of the ripple-markings, these slight furrows may have been uneven ; a larger one than its neighbours attracting the drops of water falling upon the surface of the rock, either in the shape of rain or as spray from the ocean, or it may be the receding tidal waters of the sea : A little channel is formed, this draws other little rills to it, and in this way it goes along growing in size as it increases in length. This operation can be seen any and every day upon the sea shore wherever there may be a deposit of sand or clay. Every stage of the work passes before the observer's eye during the few hours the tide is absent—the wave-furrows, the trickling of the water along the furrow, its gathering in size and finally its miniature gorge where it passes through the bank of mud into the ocean. The land rises a little and fresh beds are laid bare. The streamlet becomes longer and deeper ; its branches increase in size and number and its drainage area grows greater. So the work goes on, the land rising, the stream becoming greater and stronger as its course lengthens until by successive elevations the land has become a continent in extent, and the stream a river hundreds of miles in length, gigantic in depth and width, and the small channels which joined it away back in the past ages are now mighty lateral gorges, or it may be that the whole system has broadened out into extensive valley plains, the site of cosy farm-houses or occupied by a populous city, while the tiny wave marking has become a great commercial highway for the nations of the world.

It was in some such simple manner as this that the Grand Cañon and other similar gorges found in Colorado, in what is known as the Grand Cañon District, described by Dutton, were formed. They are not due to any great convulsion of the earth, such as earthquakes or volcanic eruption, but are solely the effects of quiet persistent never ceasing erosion. The rivers running through these Cañons were formed when the Tertiary rocks first rose above the sea level. Some irregularity of the surface then determined their course and ever since that time they have kept persistently in that course until now the Grand River has cut a gorge 5,000 feet deep, straight down into the carboniferous formations. The rocks rose up in front of the river and were cut through.

It is clear that the structural deformations of the surface, the uplifts and the downthrows, had nothing to do with determining the present distribution of the plateau (Grand Cañon District) drainage. The rivers are where they are in spite of them. As irregularities rose up, the streams turned neither to the right nor to the left but cut their way through in the same old places. What then did determine the situations of the present drainage channels? The answer is that they were determined by the configuration of the surface existing at or very soon after the epoch of emergence. Soon afterwards that surface began to be deformed by unequal displacement but the rivers had fastened themselves to their places and have ever since refused to be diverted. (Dutton, Second Annual Report, U.S. Geol. Survey p. 62.)

The river having made a break in the surface there is room for denudation to go on laterally as well as vertically and by what Powell terms the "Recession of Cliffs" the narrow stream bed of the river is slowly but gradually widened into a great valley or basin, bounded on either side by a wall of the receeding cliffs, with its head lying away up at the source of the stream and its entrance at the place where the river enters the sea or joins some other and greater stream having a valley of its own.

There comes a time in the history of all streams in which their corrading power reaches a minimum—that is presuming there are no upheavals or no gradual elevation of the land within the course of the stream. This period of minimum corrasion is when what is termed the base level of erosion has been reached. The base level of erosion is reached when the channels have reached an altitude in which their declivities are so small, the velocity of the water so feeble, and their transporting power so much reduced that they can do no more than urge along the detritus brought into their troughs from high lands along their margins. Their transporting power is just equal to the load they have to carry, and there is no surplus left to wear away their bottoms. Under these conditions the slopes of their ravines are less rapid; their narrow bottoms widen and flatten until they grade into smooth bottomed meadows stretching from base to base of steeper ascents on either side. The widening of the bottoms is due to the low gradient which has been reached in the progress of excavations of the valleys. The running waters now cut but slightly on their bottoms because with the low slope at which they have arrived they are unable promptly to remove from their beds all the material which the steeper valleys at the head and the slopes on either side throw into them in times of freshets and heavy rains. In their struggles with this material they wander to and fro and widen their valleys more than they deepen them.

Surface valleys are valleys of erosion but cut out of surface accumulations, such as drift or lake beds which have not yet become solid rock. They are, in consequence, relatively wide and shallow. This class would be any where of more recent origin than the other classes. In drift regions many of these surface valleys are due to the uneven formation of the drift. The retreating ice sheet by its change of front, by its alternately advancing and retiring, and the streams which issued from underneath the ice caused an accumulation of debris at various places along its margin. This debris forming barriers between higher lands, enclosed basins which for want of an outlet became lakes which ultimately drying up either by evaporation or the erosion of a channel through the morainic barrier left broad valleys comparatively shallow when their wide extent is considered.

Another form of valley of erosion is that due to glacial action. These are known by their being differently shaped than those due altogether to the action of running water. Water cut valleys have mostly a sharp bottom with sloping V shaped sides with often a winding course, but valleys due to ice action of the glacier type have a rounded bottom and more perpendicular sides, giving such gorges a U shape. They also end in a glacial amphitheatre which is usually wanting in water cut channels. The original form is always more or less modified by other causes.

In the districts overlaid by the subcarboniferous Protean beds of Kentucky, Tennessee and Northern Alabama, there are numerous small basins or cavities known as sink holes. Some of them are dry, but others form small pools or lakes and afford water in otherwise dry districts. These sinkholes exhibit in a striking manner the eroding effect of rains and frosts. Some of the sinks are from forty to one hundred and ninety feet deep and cover an area of from five acres to two thousand acres. The rim of sandstone surrounding these depressions is generally nearly level, the out cropping rocks within, are also nearly horizontal. Near the centre there is an opening of from three to fifteen feet in diameter. Into this opening the water which has fallen within the margin of the basin has been drained since the day when the rocks exposed within were raised above the drainage of the country, and thus by the slow process of washing and weathering, the rocks which once filled these cavities have been worn and carried down into the subterranean drainage of the country. All this has evidently come to pass in the most quiet and regular manner. The size of the central opening is too small to admit extraordinary floods, nor is it possible with the level margin around to suppose that these cavities were worn by eddies in a current that swept the whole cavernous member of the subcarboniferous limestone of Western Kentucky, but the opinion is probable that the upheaving force which raised these beds to their present level, at the same time ruptured and cracked the beds in certain lines; that afterwards the rains were swallowed into openings on these fractures producing by denudation the basins of the sink-hole country and further enlarging the original fractures by flowing through them and thus forming a vast system of caverns which surround the western coalfield.—*Owen, Geol. Survey of Kentucky, Vol. IV, p. 511. 1861*).

This class of basins is not confined to the district included in Kentucky and Tennessee. Similar sink-hole basins were noticed by Dutton, in the Grand Cañon District, and which he says imply a system of subterranean rivulets, but it is not more wonderful than the endless caverns in Kentucky and Indiana, and it is probably not upon so large a scale nor so greatly ramified.

The great central Basin of Tennessee is a valley of erosion, due according to all existing evidences to simple aerial causes. This valley is of a somewhat irregularly formed oval shape having a broken into and fringed margin. Its long axis extending in a northeastern and southwestern direction is about one hundred and twenty miles in length—that is excluding the narrow gorge traversed by the Cumberland River at the northern end, and the Elk river valley at the southern extremity. The shorter axis or width of the basin measured in a northwesterly and southeasterly direction is from fifty to fifty-five miles, measured in the latitude of Nashville it is sixty miles in width. The area of this great basin has been computed at six thousand one hundred and ninety square miles. It is surrounded upon all sides by a high, almost precipitous, wall or escarpment surrounded by a broad flat top. The top, or broad plateau forming it, extends from the base of the Cumberland Mountains, or rather Cumberland Table land, on the east, to the shore of the old palæozoic Sea a few miles beyond the Tennessee River on the west, and from the State of Alabama in the south, it extends across Tennessee and covers the greater part of the southern and central portions of Kentucky. The area of this extensive plateau within the State of Tennessee and immediately surrounding the basin is computed by the State Commissioner of Agriculture, in his Report for 1887 (p. 156), to be eight thousand two hundred square miles. This wall and top with its broad extent has been called by Professor Safford the "Highland Rim," and the whole Basin and Highland Rim has been compared by him to a great broad rimmed flat bottomed dish slightly tilted to the northwest. This tilting to the northwest is due to a general dipping of the whole country in that direction and is altogether independent of any of the numerous directions of dip found locally.

From this it will be seen that the Central Basin is simply an erosion through the Highland Rim into the underlying formations.

This Highland Rim is almost continuous in its circumscribing the Basin. It is only broken by four narrow rocky gorges through which the Cumberland, Elk and Duck Rivers pass. At the northeastern corner the Cumberland enters the basin through a long narrow pass, and on the northwest again the same river passes out of the basin by a gateway somewhat similar to the one by which it enters. Upon the south, the Elk River leaves the basin by a narrow rugged channel, and upon the west another outlet of the same kind affords a passage for the waters of the Duck River. Of these outlets only those connected with the Cumberland River are navigable. The others are too narrow, rocky and shallow to be of any practical use.

Although these gorges are the only ones piercing the plateau of the Highland Rim, and finding an outlet through it, the margin of the Rim is broken into by numerous streams which have their sources somewhere upon its broad flat top. These streams have cut for themselves long narrow channels running back, sometimes several miles, into the plateau and finishing with a waterfall. In some of the channels, lateral ones, due to smaller streams flowing over the face to join the main stream, are cut into the hill for a considerable depth. These gorges, or channels, give the high wall surrounding the basin a serrated, or fringed appearance. This, however, is a peculiarity not confined to the margin of the Highland Rim but is also characteristic of the various formations occupying the lower levels within the centre of the basin.

On the eastern side the Caney Fork has cut into the Rim a very extensive valley running in a southeasterly direction about eighteen miles, with a width of between four and five miles. This is the most extensive gap along the eastern escarpment. The Duck River has also cut a gorge, and in the southeastern corner the Elk River is forming a pretty extensive valley.

The western escarpment is much more broken than the eastern. The Harpeth River has formed a channel of considerable width and length, while the Duck River before entering the gorge through which it escapes to join the Tennessee has formed a broad deep valley with several lateral gorges opening into it both from the north and the south.

Along the southern end of the basin there is a very much broken ridge of land having the same elevation as the Rim. This ridge, which is known as the Elk Ridge, passes through the counties of Moore, Marshall, Giles, and Lewis, and forms a division between the basin of the Elk River and the body of the main basin itself. It is, however, broken through in two places—the valley in Moore county in which Lynchburg is situated and the valley utilized by the Louisville and Nashville Railroad running south from Columbia.

Throughout the basin at several points the summit reaches the same elevation as that of the rim, and the structure of the exposed rock formations is the same. In addition to the Elk Ridge, the most noteworthy place in which these summits are found is a tract running along the eastern boundary through the Counties of Dekalb, Wilson, and Rutherford, where these hills form a line running nearly parallel to the axis of the valley for sixteen miles when the line turns, and for about twelve miles runs in a north-westerly and south-easterly direction.

The average elevation of the Highland Rim taken from the mean levels for Railroad purposes gives on the

	feet.	R. R. Survey.
Eastern and south-eastern sides....	1019	Mean of 13 Stations.
Northern side..................	816	" " 3 "
Western and South-western sides..	951	" " 6 "

or an average elevation of 942 for the whole Rim. The mean average elevation of the floor of the Basin above the same point and from the same authorities taken from twenty-nine stations is 567 feet. These measurements are above the level of mean tide in Mobile Bay. It will thus be seen that the average amount of erosion necessary to form this Basin would be a thickness of 375 feet extending over an area of 6190 square miles, and this after the surface of the country had reached the level of the summit of the escarpment. Nor was this the whole of the erosion that has evidently taken place in this region of the world as there are many circumstances pointing to the belief that denudation has removed an extent of sub-carboniferous and carboniferous rocks if not greater, at least as extensive as the whole of the Tennessee Coal field as at present existing.

The abruptness with which the escarpment rises from the level of the bottom of the Basin will be seen from the following figures taken from the alignments of the various Railroads crossing it.

Locality.	Foot of Ridge.	Top of Ridge.	Difference.	Dist'nce	Authority.
	Feet.	Feet.	Feet.	Miles.	Survey.
Near Edgefield Junction.	563	895	332	1·5	L. N. R. R.
" Gallatin	694	951	257	1·	"
" Tullahoma	814	1079	265	5·	"
On Tennessee and Alabama Railroad	702	1019	317	6·	R. R. Survey.
Near Pulaski..........	630	924	294	3·	C. S. R. R.
Nashville, Chattanooga and St. Louis R. R...	524	841	317	4·	R. R. Survey.

In addition to the serrated or rather fringed like appearance of the margin of the rim, or the escarpment, there is yet another peculiarity connected with it—that is, the absence of any terracing upon this escarpment. It has been assumed that the basin was at some former time the bed of a lake. In no place has it any terrace markings indicating that the basin was at any time the seat of an ancient lake. The northern and western divisions of the margin show appearances somewhat terrace-like, but these divisions are, as we shall afterwards see, due to the constitution of the rock formations and their unequal weathering qualities and not to any other cause. The long narrow neck of land extending between the Cumberland and the Harpeth Rivers in the southern part of Davidson County, does not show anything which might be attributed to the action of water in such a body as to terrace the sides of the hills forming the shores. The fringed appearance of the escarpment appears to indicate a slower and steadier but at the same time a no less equally powerful eroding agent as any power that waves might bring to bear upon it.

If by any means the Central Basin of Tennessee were formed into a lake it would occupy a space 110 square miles less than Lake Ontario, but would be about 40 feet deeper.

Geological Structure of the Highland Rim.

The geological structure of the Highland Rim presents us with an evidence that the position now occupied by the basin was at the close of the Lower Silurian Age, or during the period between the deposition of the last of the Nashville beds and the beginning of the Niagara, or the deposition of the Medina or lowest member of the Niagara group, elevated to a considerable height above the waters of the surrounding sea. The sections shown by the different sides of the basin enables us to trace with considerable accuracy the extent of territory laid dry about this time. A general section of the escarpment upon the eastern side shows the total absence of the beds of the Upper Silurian and Lower Devonian formations and the Black Shale of the Upper Devonian lying in contact with the beds of the Hudson River formation, or Nashville rocks. On the northwest, west, southwest and part of the south sides the Niagara including the Clinton and

Medina formations are to be found in position, but not in any thickness, and the Clinton and Medina represented generally by Professor Safford's beds of transition. They appear to be chiefly the thin feather edges or beveled wedge shaped ends and abut against the underlying Nashville series of rocks. That this is the case is seen by the fact that these beds increase in thickness as they go westwards, until they reach their heaviest development in the valley of the Tennessee River. The Lower Helderberg formation is also well developed in the Tennessee River valley, but thins out before it reaches the side of the basin, as none, or at least very doubtful, traces of it have been found in the western escarpment.

A general section of the eastern escarpment or margin of the basin from the gorge of the Cumberland on the north east to the valley of the Elk River in the south, and extending along the whole eastern side gives in descending order.

LOWER CARBONIFEROUS.

Siliceous, of which cherty limestones calcareo-siliceous rocks and heavy layers of solid chert are quite characteristic.

The Siliceous group includes two divisions—

b. The Lithostrotion or Coral bed consisting of cherty limestone, fossiliferous, often crinoidal, sometimes siliceous and argillaceous, and everywhere characterised by the Coral Lithostrotion Canadense. This bed is equivalent to the St. Louis limestone.

d. The lower or Protean bed, a series of strata, silico-calcareous in the main often limestone, often sky-blue silico-calcareous and sometimes argillaceous rock weathering into shale; the series containing as a characteristic feature heavy layers of chert ranging in thickness from one inch to two feet, alternating with the other rocks of the member. It often holds layers and locally heavy beds of crinoidal Limestones. The estimated thickness of the Siliceous group in Tennessee is from 300 to 500 feet.

With the exception of a small patch in Short Mountains in Cannon County the Lithostrotion beds do not appear in the escarpment upon any of the sides of the basin.

DEVONIAN.

Black Shale.—This shale which lies immediately under the lower division of the siliceous corresponds to the Genesee slates, or Hamilton group of the New York section and the Hamilton formation of western Canada. The charateristic mass of this formation is a nearly black bituminous, rather tough slate or shale. It contains very generally grains and nodules of Pyrite scattered through its mass. West of the Cumberland Table Land the Black Shale has at its top a thin layer of argillaceous very fetid concretionary bodies of round oval, kidney shaped and usually more or less flattened. They vary in size from that of a peachstone to masses two feet across, and occur packed with bluish shale in a layer from two to twelve inches thick. Below the shale there is generally a dark gray bituminous fetid sandstone which sometimes replaces the shale.

Estimated thickness in Middle Tennessee from 50 to 70 feet.

Nashville Group—(*Hudson River Group*).—The Nashville formation consists of bluish siliceous calcareous shales with beds of dark blue, highly fossiliferous, roughly bedded, impure limestones. The Orthis or lowest member of the group consists of blue siliceous and sandy limestones weathering into fine, thin earthy yellowish sandstones and shales. The upper beds weather into thin flaggy beds, the surfaces of which are often crowded with fossils.

Estimated thickness in Middle Tennessee about 500 feet.

Trenton.—The Trenton formation in Middle Tennessee is intimately connected with the Nashville series of the Basin and consists mostly of limestones of a light blue or dove colour, sometimes grey, arranged in groups of alternately thick and thin bedding—the thick bedding mostly cherty; the lower or "Central Limestone" being much more so than the upper beds.

Estimated thickness in Middle Tennessee about 500 feet.

The Trenton formation reaches the bottom of the Basin—the Central Limestone being the lowest bed exposed anywhere throughout the Basin.

These beds from the Siliceous to the Trenton are continuous across the ends of the Basin, and are also found in place upon its western side. The Trenton is continuous across the Basin and with the Nashville rocks forms its bottom.

If we now turn to the sections as exposed upon the north, west and southwest sides of the Basin we will find that while all the formations as exposed upon the east are to be found represented in these sections, with an equal regularity we have another set of beds to deal with which are not to be found anywhere along the eastern side of the Basin, and which owing to their interposition lie unconformably to those underneath. These are the Niagara, including the Clinton and Medina. They are interposed in their proper position in the geological scale between the Nashville or Hudson River formation and the Black Shale.

It is chiefly the uppermost part of the Niagara formation that is found in Middle Tennessee. The Meniscus limestone of Dr. Safford's Report consists of thick-bedded crystalline and fine-grained limestones more or less argillaceous and often weathering into shale. Most of the limestones are sparry and crinoidal; many contain green points. The series is divided into an upper or sponge-bearing bed and a lower or variegatad bed, and each about 100 feet in thickness. This lower bed is an alternation of grey, red and mottled layers, and much tends to crumble into shales. The limestones of the upper bed are light grey and light bluish grey, and much of the bed weathers into shaly matter.

Where this formation is first met with in the slope of the western side of the Basin it is not in very great force, but generally only in the shape of a feather edge, or running out, but increasing in thickness in a westerly direction, or towards the valley of the Tennessee River. This feather-edged Meniscus bed is first found in the northern side of the Basin in the western part of Macon County and upon the southern side of the Basin it first appears in Lincoln. From Lincoln it passes through the south-west part of Bedford County and through the Counties of Lawrence, Lewis, Maury, Williamson, Davidson and Sumner in a sort of semi-circular course until it reaches the place of its first northern appearance in Macon County.

From this line westward until the old shore line west of the Tennessee River is reached the Niagara formation is represented in the geological scale of the State of Tennessee.

It has already been noticed that nowhere along the escarpment or slope of the eastern side of the Basin is an outcrop of the Niagara to be found. Even the deep gorge made by the Caney Fork on the east does not show it, and it is not to be found in the valley of the Elk River in the southeast. Beds of the Niagara age, however, are found in East Tennessee, and these extend as far west as the Sequachee Valley on the Alabama State line and run in a northeasterly direction to the Kentucky boundary at the Cumberland Gap.

These lines of Niagara outcrops pass clear across the State into Alabama on the south and Kentucky upon the north. The nearest outcrop of Niagara beds in Kentucky is at Liberty, Casey County. —(*Proctor, Geological Map, 1887*). As they do not appear in the gorge of the Cumberland as far north as Port Burnside, we may safely suppose that the two lines of exposure in Tennessee unite somewhere in the district between Port Burnside and Liberty. The southern junction of the two takes place in the State of Alabama within a short distance south of the line between the two States.

With these two boundary lines it will be an easy matter to trace the extent of territory raised above water, or at least elevated sufficiently high to prevent the formation of rocks of the Niagara group, by the general disturbance following upon the close of the lower Silurian. It will be seen also that the greater part of the area now occupied by the Central Basin, being devoid of the Niagara formations, must have been above water at the time these rocks were being laid down.

Passing west toward the Tennessee River Valley another member of the Upper Silurian makes its appearance. It is doubtful whether the Lower Helderberg is to be found anywhere around the escarpment margin of the Basin. It is, however, found occupying a narrow strip of country along the Tennessee River in the western part of the State. It attains its maximum thickness in the river valley, and thins rapidly out on coming east. Lower Helderberg in Tennessee consists of a series of light blue limestones, often shaly, highly fossiliferous and frequently containing cherty layers, especially on its upper part. It has a maximum thickness of 70 feet, and is altogether confined to the western part of the State. It is not known in Eastern Tennessee.

From the distribution of the Lower Helderberg rocks it is apparent that the area under consideration was still dry land, and even had during the Niagara period been increasing in elevation. But while this elevation was in process there must also have been some denudation. The top of the Hudson River dome was exposed to the action of the waves as well as aerial conditions during the long period which was occupied in building the Niagara and Lower Helderberg formations and at least the whole of the Niagara and a great part of the Helderberg were built out of the debris of the Hudson River or Nashville rocks, forming the territory, part of which now forms the Central Basin.

West of the Tennessee, the palæozoic formations terminate in an abrupt and broken off manner, as if they had been subject to fracture and afterwards to an erosive action similar to that undergone by a rocky coast line under the influence of wave action. They form an escarpment against which the newer beds of the Cretaceous abut at a considerably high angle.

This breaking off or termination of the Palæozoic rocks follows approximately the course of the Tennessee River valley across the States of Tennessee and Kentucky, but with the exception of only a short distance of about 18 miles in Harding County, Tennessee, the old escarpment formed by the break is not coincident with the course of the river but passes along to the west; the Tennessee having cut a channel out of the older formations to the east.

This old shore line, for it is in reality a shore of very ancient origin and of long continuance, is broken in several places by long narrow bays. The length which these bays have obtained and the position in which they are placed indicate a long continued and at the same time great difference in the drainage system of the country, at the time the waves of the Silurian seas beat upon its beach or broke in spray against the cliffs from what we now find it. The course of the Tennessee River with its subordinate system of drainage has a northward flow, but the old gorges or stream channels disclosed in the palæozoic shore line indicate a southern or south-western course for the drainage of that time. In Benton County a narrow strip of cretaceous rock runs into the shore for nearly 10 miles. This represents a break in the older formations and is apparently an old river channel lying between the courses of the modern Tennessee and Big Sandy rivers. In Decatur County there is another old bay much broader than the Benton one but not so long. In both of these bays the head lies to the north-east and the opening into the ocean to the south-west. This is not the direction of the dip of the country which in this part of the State is to the north-west or almost at right angles to the course pursued by the streams which hewed out the old channels mentioned. Streams, however, do not always follow the dip of the beds through which they may have to cut their way, but in most instances they follow the general slope of the country. If then these channels indicate the general slope of the country during the Upper Silurian period, a combination of oscillations must have taken place to arrive at the present state of affairs.

This old shore line indicates a continuance of oceanic conditions over all the area of the States of Tennessee and Kentucky, west of the Tennessee River up to as late a date as the Cretaceous period, and whatever changes the region east of this line may have undergone, none appear to have interrupted the continuity of the sea's occupation throughout Western Tennessee or the Mississippi Valley.

If we turn now to the eastern side of the basin we will find the Highland Rim existing as a broad tract of country extending from the edge of the escarpment back to the Cumberland Tableland, and occupied by rocks belonging to the lower or sub-carboniferous group, the Protean beds occupying the territory immediately adjacent to the basin, and the mountain limestone lying close to and passing under the carboniferous beds forming the tableland. The same sub-carboniferous beds form the surface rock of a great part of the State of Kentucky lying immediately to the north.

The elevation of the Highland Rim has already been given as between 950 and 1000 feet above sea level. From this plateau the Cumberland tableland rises almost precipitously to a vertical height of over 1000 feet or 2000 feet above the level of the sea in Mobile Bay.

Elevations of various points upon Cumberland tableland above sea level at Mobile Bay.

Locality.	Elevation.	Authority.
Cumberland Gap	1636	J. G. Newlee, R. R. Survey.
Pinnacle near "	2680	" "
Pine Mountain	2200	J. M. Safford, Geol. Tenn. '69, p. 73
Ben Lomond	1910	A. M. Lea, R. R. Survey.
Racoon Mountains at Whiteside.	1900	J. M. Safford, Supra.
Lookout Mountain............	2154	J. M. Safford, Geol. Tenn. '69. p.
Bon Air.....................	2029	A. M. Lea, R. R. Survey.
Tracy City	1847	Sewanee Mining Co. R. R.
Highest Ridge near Tracy City.	2161	"
Average of 18 points on R. R..	1846	"
Average Height..	2036	Cumberland Tableland.

Crab Orchard Mountain has an elevation of nearly 3,000 feet, or about 1,000 feet above the general level of the table land.

The two formations—the black shale and the overlying Protean beds of the sub-carboniferous—extend from the Cumberland tableland on the east; west, through Tennessee; north, through the southern and central portions of Kentucky, dividing the coal fields of that State into two divisions, and these beds also extend southward into Alabama. The dip of the underlying Nashville and Trenton beds does not conform to that of the overlying black shale.

Geological History.

From the data we have, the geological history of the district appears to have been thus :—

During the period in which the Lower Silurian formations were being laid down this part of the continent appears to have formed a division of the great inland sea, or rather branch of the Atlantic Ocean, which extended from the Gulf of Mexico, up through the Mississippi Valley, and covered the greater part of the centre of North America. The whole territory from the border of North Carolina was under water. In a comparatively shallow sea, and under varying conditions of alternately clear and muddy water, and after various oscillations of the sea bottom, the Owee conglomerates, Chilhowee sandstones, the Knox shales and dolomites, and the Trenton limestones, with the associated Nashville shales and limestones were laid down. This closed the Lower Silurian Age so far as this part of the continent was concerned.

At the close of the Nashville or Hudson River period there was a period of great disturbance which resulted in the upheaval of a long line of dome-like structures extending from Alabama in the south-west to Ohio in the north-east, and traversing the States of Tennessee and Kentucky. From South-western Ohio this same upheaval, known in Ohio as the Cincinnatti axis, takes a bend round to the north-west and passes into Indiana. The ridge thus thrown up rose higher in some parts than in others with the dip of the strata quaquaversal or radiating in every direction, but in general having a greater angle of dip south-easterly or north-westerly than in the other or longitudinal directions, the two dips in the region of the Basin being southeast and northwest for transverse, and for longitudinal directions northeast and southwest. It is due to this quaquaversal condition of the beds that the elevation is of a dome-like structure, and it is also due to the variations in the dip in the longitudinal section that the Niagara and Lower Helderberg rocks are to be found surrounding the various isolated portions of these ridges, or what may be better regarded as islands in the Lower Silurian sea.

The district now occupied by the Central Basin was the site of one of these domes, or islands with an area of over 150 miles in length, extending from the northern part of Alabama to the centre of Kentucky and from a few miles west of the Sequachee Valley to a circularly drawn line extending from Macon County on the north, to Lincoln County on the south, as its Western boundary. The centre of this Silurian island was according to Professor Safford a few miles to the south-east of Murfreesboro in Rutherford County, near the eastern escarpment and now almost the lowest spot in the whole basin.

The elevation of the summit of this dome was about 1300 feet above the water.

This island immediately upon its emergence from the bed of the ocean gave rise to wave action, and the work of erosion or denudation began. With increasing elevation the land kept ahead of the ocean, but around the base of the island the beds of the Niagara period were being formed out of the waste material. If this increase in the elevation had not taken place the whole island would soon have been reduced to a uniform level and the Niagara rocks the only ones formed at that point. Another slight increase in height and a portion of the newly formed Niagara beds was brought to the surface to be subjected to the tear and wear of the waves and to contribute toward the building of the Lower Helderberg formations in the same manner as the Nashville and Trenton beds have been levied upon to construct them. At the close of the Lower Helderberg the island now considerably increased in size but lower in elevation and more rounded off than when it first appeared seems to have received a little more elevation, and the Helderberg sea bottom became dry land. In this condition things appear to have remained stationary for a long period until the whole territory took a plunge into the ocean again preparatory to receiving the beds of Black shale and the subcarboniferous beds with which the greater part of the States of Kentucky, Tennessee and northern Alabama are overlaid.

These beds appearing again, the age of coal or the true carboniferous period began. Without discussing the origin of coal we may accept the fact that the state of affairs necessary for coal production existed long enough to form a body of material over 600 feet in thickness in the Cumberland Tableland.

This coal forms part of the great Appalachian coal-field which stretches all the way from Pennsylvania to Georgia and Alabama, and extends almost clear across the latter State to the boundary of Mississippi with an extension of subcarboniferous beds into that State. The whole of the western margin of this field is very much broken, and fringed with detached outliers scattered along its boundary. Many of such outliers exist in the State of Kentucky standing in the midst of subcarboniferous protean beds. In northwestern Kentucky there is an extensive area covered with coal-bearing rocks which have been placed among the subcarboniferous formations, and would, therefore, belong to a much older formation to any of the Pennsylvania or Ohia coals of which eastern Kentucky field is but an extension. The western Kentucky area unites with the coal-bearing strata of south eastern Indiana.

The geography of this part of America during the age in which the coal beds were being deposited appears to have been a long narrow neck of dry land from the region of Cincinnati southward across Kentucky and Tennessee owing to an elevation of the subcarboniferous limestones and shales leaving a depression filled with shallow water and marshes eastward as far as Western New York, and covering the territory now occupied by the Appalachian chain of mountains. To the west the great inland sea flowed along the old coast close to the present Tennessee River Valley.

The carboniforous period having closed and the Permian age begun, a series of disturbances took place which changed the appearance of things over the eastern portion of the North American continent, and resulted in the upheaval of the Appalachian Mountains.

The term Appalachian is the general one applied to the great mountain system which stretches from Maine to the borders of Alabama, its distance from the sea generally ranging from 100 miles in the north, and about 300 in the south. The chain consists of several ranges generally parallel to each other which along with the intermediate valleys form a belt 100 miles wide, of which the valleys occupy about two-thirds. The chief ridges forming the chain are, beginning from the north, in New Hampshire the White Mountains with Moosehillock and Washington respectively, 4,636 and 6,634 feet. In Vermont the Green Mountains attain in Killington Peak, a height of 3,924 feet, and immediately beyond the Hudson come the Catskill Mountains with Round Top and High Peak, attaining elevations of 3,800 and 3,718 feet. From the north of New Jersey as far as Virginia, the Kittatinnies and in the same parallels, but nearer the sea, the Blue Ridge run down to North Carolina. In Virginia there are the peaks of Otter, 4,000 feet, and in North Carolina the highest summit of the system Black Dome, 6,750 feet is found. Lastly, there lie more to the westward the Alleghanies proper in Pennsylvania and Virginia, and the Cumberland Mountains on the eastern border of Kentucky and Tennessee.

The Appalachian Mountains are composed of a series of parallel waves having a general direction similar to the coast line of the Atlantic Ocean. The line of maximum disturbance is on their eastern limits; consequently their folded flexures with the inversion of their steep sides are chiefly confined to the great Appalachian valley and the Atlantic slope south of it. The flexures of this type impart a prevailing south-east dip to the whole outcrop. The flexures of the second type which curve more rapidly on the one side than the other, prevail wherever the forces that disturbed the crust were neither excessively intense nor very feeble. It is the characteristic form everywhere between the great Appalachian valley and the Alleghany Mountains. Undulations of the first or symmetrical type occur beyond the Alleghany Mountains where two groups of them may be distinguished, the one set dividing the bituminous coal field into six successive basins, and the other composed of four equidistant and very straight undulations.

These Mountain ranges were apparently raised by an intense pressure exerted from the east.

The long narrow line of upheaval passing through Kentucky and Tennessee lying to the west of the Cumberland Mountains, had its summit crowned by the upper beds of the sub-carboniferous. These beds may have been fractured along the summit of upheaval, and in this way give origin to the denuding agents which planed down the area covered by the siliceous beds and ultimately hollowed out the basin of Central Tennessee.

Agents at Work in the Formation of the Central Basin of Tennessee.

The basin of Central Tennessee began to be formed as soon as the sub-carboniferous beds which formerly overlaid the whole district first emerged from the waters of the sub-carboniferous ocean, and its construction has been going on ever since. The work of erosion, and consequent degradation of the land, attacks the highest points first, and as soon as these rocks were laid bare by an elevation the work began. The elevation becoming greater, the work of erosion and degradation kept on until now. When we consider the enormous amount of denudation which had taken place before the excavation of the main basin began, we are apt to reason that no known cause at present existing could have acted in such a manner or had anything like a sufficient amount of power to do the work which has been done. When we consider that the beds belonging to the sub-carboniferous extending over an area embracing the greater part of the State of Kentucky, a large portion of the State of Tennessee, and a portion of Northern Alabama have been completely swept away to a depth of 700 feet, and that in addition to this a large tract of this territory was covered by carboniferous rocks which have also disappeared leaving nothing but isolated patches here and there along the eastern border of the district, or to make the statement more comprehensible we may put the area of denudation at 28,390 square miles being for

Kentucky	10,000	Square Miles.
Tennessee	14,390	"
Alabama	4,000	"

we are apt to give thought and credence to the belief that all this work must have been performed by some enormous force—something that is altogether abolished from among the forces of nature at the present time—that in those days there must have been forces at work which have long since ceased to operate. It is remarkable how readily we are prone to ascribe a supernatural cause or some extraordinary and almost miraculous reason for the performance of any work we do not clearly understand. However, in this case there is nothing supernatural, nor yet was there any work in operation or causes at play during the earlier days of this work than there are in operation at the present day. It has been suggested that the Appalachians were raised by successive uplifts, and the force of the water rushing through among the mountains caused the formation of the valleys and gorges in various parts of the mountain ranges. If these mountains rose by successive stages, and the streams had already formed their channels and taken up their positions permanently, then no such a tremendous rush of water could take place. That this was so we have plenty of proof in the gorges of the few rivers which have found their way to the Atlantic Ocean.

If we consider the length of time during which this erosion has been going on and compare the results arrived at with the results of the same cause (erosion) in other parts of the world, we will readily see that it is not in the least necessary for us to call in the aid of any enormous floods or anything of greater force than the powers at work during the present time. We will find in comparison with other districts that many of them have accomplished a much greater amount of work within a much shorter period of time, and with apparently more inadequate instruments.

The great factor, or at least one of the great factors, and probably the greatest, in the formation of the contour of the surface of the earth is *erosion*, or denudation, or degradation, or land sculpture. To complete the operation under whatever denomination we may place the work, two agents are required—the disintegrating agent and the transporting or removing agent—without the one the other would be comparatively harmless and have little or no effect. Without the transporting agent the disintegrating of the material could only be carried on to a small extent—the mass of disintegrated material would form a protective barrier to the underlying rock and thus prevent any further destruction, and the work of erosion would be retarded until the transportation of the already destroyed material. The removal of this is the work of the transporting agent. The protecting barrier of destroyed or disintegrated matter being removed, another surface is laid bare to the attack of the disintegrating agent. That again is removed, and another destroyed and removed, until the whole of the material has been worn away.

All this must be done by the assistance of the transporting agent, as the disintegrating or destroying agent has no power of removal, or at best an exceedingly limited power due to the action of gravity; its action is wholly confined to destruction.

The transporting agent has only a very limited power of destruction due altogether to mechanical causes chiefly corrasion. Transportation is chiefly carried on by running water. A small proportion is also performed by the wind, and a still smaller by ice.

The chief factors in erosion are rain, snow, ice, rivers, waves, and tides, and ocean currents. The air in the shape of wind or as a medium through which chemical action attacks the rock, is also to a slight degree a factor in the problem of erosion.

It is, however, with only two of these agents that we have to deal with regard to the formation of the central basin. The atmospheric effects doubtless had something to do with it, but to what extent we cannot at present estimate. The two more directly interested in the work are rain and running water. These two had most to do with formation of the basin of Tennessee. Ocean currents, it has been gravely asserted, hollowed out the basin. Of the action of ocean currents we have no positive observations. Although they are very powerful agents of transportation, there is a great probability that they have no power as eroding agents. Ocean currents flow for the most part of their course through water and having a bed of water between the current and the bottom, thereby protecting it from any corrading influence the current might have. Whatever planed off the sub-carboniferous and other beds to the level of the Highland rim, or hollowed out the basin, ocean currents had nothing to do with the work.

Transportation as we have already stated is chiefly carried on by running water. It is also carried on to a small extent by the aid of the wind and atmospheric currents. The latter is more or less confined to the sandy shores of the sea and arid sandy districts.

Disintegration is carried on by weathering and slightly, in a mechanical way, by running water. This action of running water has been called corrasion.

The chief agents in weathering are changes of temperature, rain as a solvent and as a mechanical agent, gravity and vegetation.

Sudden changes of temperature affect material of every sort. Frost following a saturated condition will by freezing fracture the hardest rock wherever water has been enabled to penetrate. Softer rocks are disintegrated by the freezing and expansion of the water percolating through their pores.

Rain is an agent of weathering in a two-fold capacity, the one as a solvent and the other from a mechanical point of view. As a mechanical agent, the effects of rain are confined to the power of disintegrating any loosely held or incoherent matter and detaching particles already loosened by frost. As an agent of solution, water is the great solvent, not only inherently whereby many matters are dissolved, but also as an agent whereby various chemical solvents are enabled to attack the different materials composing the rocks coming under its power. While some rocks are disintegrated by complete solution, many are only divided into grains by a partial solution, whilst fragmental rocks only lose their cementing materials.

Gravity as a factor in weathering is not a very great one. In cases where the various beds of rock are of different textures and hardness, and the harder bed may be overlying the softer, such as may be seen in the case of the Niagara limestones overlying the softer shales of the Clinton, the weathering of the soft underlying beds gradually undermines the hard overlying bed, and in time the action of gravity causes the projecting piece to break off and fall down to the bottom of the cliff. In this way also gravity acts as a transporting agent.

Vegetation.—It is not so easy to determine to what extent weathering is due to vegetation. The plants have a direct tendency to aid, while indirectly plant life has a tendency to retard, erosion. Directly, plants aid erosion by the penetration of the soil by their roots, thereby allowing the admission of moisture to the underlying rocks, and also by the penetration of the harder rocks and thereby in a mechanical way owing to the enlargement of their roots, as well as the admission of water causing fracture. On the other hand, a profuse vegetation has a tendency generally to retard erosion. It is true, disintegration by solution is, owing to the increased power of percolating water, increased, but the soil is protected from the mechanical erosion of the rain drops and rills ; transportation, owing to the grasping conservative action of the roots, is retarded and brought almost to a standstill ; the action of frost upon the underlying rocks is destroyed by the soil reaching beneath the limit of frost action and the effects of rain drops are spent upon the foliage. The power of the vegetation in any district of retarding erosion lies in the fact that it interferes with the transporting agent just at the place where that agent is weakest.

The power of erosion due to running water is called corrasion. Clear pure water corrades by solution, and mixed muddy water partly by solution but chiefly by mechanical action of attrition. Wherever the declivity is steep and the motion of the water rapid, the corrasion by solution is reduced to a minimum. The increased velocity of the stream due to the increased steepness of the bottom increases the transporting power of the water, and in that manner increases its power of corrasion. The moving power being the water of the stream and the tools the fragments of mineral, mud or sand held in the water, the more rapidly these tools move the greater the amount of work performed. This, of course, depends on the hardness, size and number of the fragments in transition and also upon the hardness of the rock forming the bottom of the stream. If the fragments be hard and the rock-bedding soft the maximum amount of corrosion is reached. Although the general tendency of corrasion is in a vertical direction, yet under varying circumstances it works in a lateral direction, in which case it forms a flood plain. "As an effect of momentum, the current is always swiftest along the outside of a curve of the channel, and it is there that the wearing is performed, while at the inner side of the curve the current is so slow that part of the load is deposited. In this way the width of the channel remains the same while its position is shifted and every part of the valley which it has crossed in its shiftings comes to be covered by a deposit which does not rise above the highest level of the water. The surface of this deposit is hence appropriately called the flood-plain of the stream. The deposit is of nearly uniform depth, descending no lower than the bottom of the water channel, and it rests upon a tolerably even surface of the rock or other material which is corraded by the stream. The process of carving away the rock so as to produce an even surface, and at the same time covering it with an alluvial deposit is the process of *planation.*"—(*Gilbert, Land Sculpture, Geol. of Henry Mt. p. 121*).

In the course of the Cumberland River through the Central Basin there are numerous portions of the bottom of the basin along the margins of the river that come under the denomination of flood plain. The Signal Service have three river stations at which are recorded the height and other particulars regarding the movements of the water. At these are also given the flood plains in the various districts.

Station.	Danger line feet.	Area overflowed.
Burnside, Ky........	50	2.5 Sq. miles.
Carthage, Tenn	40	90. "
Nashville, Tenn......	40	13. "

In the neighbourhood of Nashville but outside of the immediate area covered by the above 13 miles and lying within the great bends of the river there are large tracts of land which might be classified as flood plains. The material composing these plains is chiefly of clay and sand with a mixture of fine gravel scattered throughout the beds. This material is of a rusty yellow or orange color and is similar in texture to the low lying islands of sand and gravel formed at various places in the river; there is, however, no clay in the islands.

The outer margins of the river as it sweeps around these great bends are composed of beds of light blue rock of the Nashville group to the west of Nashville, and of the darker colored Trenton limestones to the east. Both form high embankments varying from 100 to 200 feet in height. Along the limits of the flood plains where it joins the high land the rock wherever visible shews a beveled cut off face and wherever exposed to the air the action of the stream has been greatly supplemented by the action of the atmosphere. The edges are rounded off and even marked in many places with small channels or waterways for the escape of rain, and the overlying soil has rill marks and rain channels corresponding to the marks in the rock.

The climatic conditions consisting of temperature and rainfall obtaining in the region occupied by the Central Basin together with the material of which the rock is composed and the general drainage system all tend to facilitate the work of erosion.

The direct influences of temperature are comparatively simple. Temperature affects erosion chiefly by its changes. When the range runs so low as to include the freezing point of water, frost contributes its aid to weathering. It is only under conditions in which the changes are great and sudden that rocks are fractured by unequal expansion or contraction.

The range of temperature within the basin includes the freezing point of water. The highest temperature recorded in Nashville between 1871 and 1887 was 104 in August, 1874, the next being 101 in July, 1881. Although it frequently touched the nineties and once reached as high as 99 it never passed the 100 except on these two occasions. In January, 1884, the lowest recorded temperature, —10, for the same period was reached. On two other occasions—December, 1876, and February, 1886, the recorded temperatures were —2 and —7 respectively. Throughout that period the mean of the highest temperatures was 68.3 and the lowest 50.7 with a mean daily range of 17.7 and a monthly mean of 47.2. The mean annual temperature at Nashville is 59.6° and for the seasons: spring, 59.3°; summer, 78.4°; autumn, 59.7°; winter, 41°.

A glance at the annexed table will show that the variations of temperature are not very great, but comparatively uniform and that in only one month in the year does the mean lowest temperature indicate frost. The mean lowest temperature is recorded as 30.1° for January with the next 33.2° for December.

The table II. shews the dates at which frosts made their first and last appearance and the average number of days free from frost within the basin.

I. Table shewing average temperatures at Nashville, Tennessee, (by months) from January, 1871, to December, 1887, inclusive; from observations made by U. S. Signal Service.

MONTH.	Highest and Year	Lowest and Year.	Mean Daily Range.	Mean of Highest.	Mean of Lowest.	Mean Monthly Range.	Mean.
January	74. in 1879	—10. '84	15.8	45.9	30.1	58.9	38.6
February......	75.0 in 1875	—7. '86	16.3	50.2	34.2	55.3	43.1
March	81.7 in 1882	11.0 '73	18.1	58.3	40.2	52.3	48.9
April	90.0 in 1872	25.5 '75	18.6	68.9	50.4	49.5	59.6
May	90.0 '74,'79	37.0 '77	18.9	79.2	59.7	44.7	69.4
June.........	99.0 in 1874	49.0 '77	17.6	85.1	67.6	37.8	77.
July.........	101.2 in 1881	56.3 '82	17.7	89.0	71.3	34.4	80.1
August.	104.0 in 1874	55.0 '79	18.1	86.9	69.3	35.6	78.2
September....	98.2 in 1881	41.0 '75	18.7	80.4	61.7	43.6	70.6
October	89.0 1879-81	28.0 '73	19.6	70.8	50.9	48.9	60.5
November	80.6 in 1882	13.0 '72	17.6	56.9	39.3	52.6	47.9
December	77.1 in 1873	—2.0 '76	15.7	48.4	33.2	54.	41.4
Average '71-'87	88.6	24.7	17.7	68.3	50.7	47.2	59.6

II. Table showing dates of first and last frosts from 1871 to 1888 inclusive.

Year.	Last frost in Spring.	First frost in Autumn.	No. of days free from frost.
1871	April 23	Nov. 12	202
1872	" 2	Oct. 11	192
1873	" 26	" 21	178
1874	" 30	" 14	167
1875	" 19	" 12	176
1876	" 6	" 7	184
1877	May 1	" 5	157
1878	Mar. 26	" 13	201
1879	April 18	" 24	189
1880	" 12	" 18	189
1881	" 14	" 20	189
1882	May 16	" 24	161
1883	" 24	Nov. 1	160
1884	April 25	Oct. 16	174
1885	May 10	" 22	165
1886	" 1	" 2	154
1887	April 19	Sept. 24	158
1888	" 21	" 24	
Average...	April 24	Oct. 18	176

The processes of erosion are affected directly by the amount of rainfall, and by its distribution throughout the year. A regular and uni form precipitation favors erosion in both its divisions of weathering and transporting, whereas an unevenly distributed supply, or where the amount is concentrated into a short period of time at the expense of the rest of the year, erosion is retarded. In the dry season weathering is greatly retarded for the lack of assistance from the transporting agent; and in the wet season, although transportation and corrasion are accelerated, weathering is retarded. Weathering is greatly facilitated by abundance of moisture, but it requires to be evenly distributed. If the rainfall be uniformly distributed a greater amount is absorbed by the soil, and by the perecolating of the water the rocks underneath are dissolved, or at least partially broken up into a condition fit to be removed as soon as the present overlying soil is taken off. In the case of a concentrated dash of rain coming all together more falls than can be absorbed and it consequently passes off to swell the power of the transporting agent without having done anything to aid in providing material to be transported.

The rainfall within the Central Basin—that is, taking the averages as observed at Nashville as being representative—for the years from 1871 to 1887, shews a remarkably uniform rate of precipitation. The average annual precipitation amounts to 51.88 inches distributed over the seasons as follows :—

Spring	14·09	inches.
Summer	13·47	"
Autumn	10·29	"
Winter	14·03	"

The average monthly precipitation for a period extending over the same length of time is 4.32 inches, August, September and October being the lowest with averages of 3·41 inches, 3·60 inches and 2·79 inches respectively.

Table III. shews the averages of the monthly and daily precipitation from 1871 to 1887.

Table IV. gives us a record of the excessive and heavy rainfalls at Nashville for seventeen years (1871—1887).

III. Table shewing the average monthly and daily rainfalls at Nashville, Tenn., from 1871 to 1887, as observed by U.S. Signal Service.

Month.	Average Monthly Inches.	Average Daily Inches.	Average No. of Rainy Days.	Average No. of Thunder Storms.
January	5.27	0 17	13	1
February	5.04	0.18	12	2
March	5.27	0.17	12	3
April	5.10	0.18	11	4
May	3.72	0.12	10	6
June	5.10	0.17	12	8
July	4 96	0.16	11	8
August	3.41	0.11	9	4
September	3.60	0.12	7	2
October	2.79	0.09	7	1
November	3.90	0.13	10	1
December	3.72	0.12	12	1
Average 1871–87	4.32	0.14	10.3	3.4

IV. Table showing the excessive and heavy rainfalls at Nashville, from 1871 to 1887.

YEAR.	AMOUNT IN INCHES.	DURATION IN HOURS, MINUTES.	DATE.
		H. M.	
1871	2·23	13—45	April 25-26.
1872	3·45	10—	April 8.
1873	1·90	5—15	December 2.
1874	2·78	8—10	February 10-21.
1875	2·55	10—35	March 15.
1876	2·65	2—15	August 24.
1877	2·93	12—55	September 17.
1878	2·99	3—06	July 8.
1879	5·09	11—36	July 24-25.
1880	5·20	15—45	February 13.
1881	4·21	20—02	September 15.
1882	3·46	19—41	March 8-9.
1883	5·04	16—21	April 21-22.
1884	2·33	4—47	March 25.
1885	2.25	11—08	July 4.
1886	2·01	1—06	June 2.
1887	3·85	12—30	September 17-18.

The nature of the underlying rock has a greater or less effect upon the rate of erosion. In the case of hard material the rate must necessarily be slow, but where the underlying rocks are soft or the material consists of clay or gravel, the operation of eroding a valley or basin will be comparatively rapid, and erosion will go on until an equilibrium has been established between the rate of weathering and the power of transporting. In other words, whenever the transporting agent becomes so that it is unable to carry off the amount of detritus provided by the disintegrating force, then weathering will accommodate itself to the transportation by the accumulation of detritus bringing the action of weathering to a balance. Whenever this equilibrium is established, erosion will proceed at a uniform rate depending entirely upon the nature of the material to be eroded.

The rocks forming the bottom of the Central Basin consist of the comparatively soft argillaceous thin bedded rocks of the Trenton and Nashville, easily weathering upon exposure to atmospheric agencies. In many places rounded knob-like hills rise up about 100 or 150 feet above the general level of the plain. These knobs consist of thin bedded light blue argillaceous limestones, and are in some cases absolutely devoid of any detritus ; in others there is a scanty partial covering of gravelly material. Generally though, these knobs have a somewhat slight covering of gravelly soil out of which a stunted growth of cedar is found growing.

Along the streams at the foot of the knob there is usually a small extent of bottom land varying with the size of the creek, but none of any very great extent except where the creeks flow into the river. Along the banks of the rivers, particularly the Cumberland, there are extensive tracts of this bottom land made up of the detritus brought down from the higher grounds by the action of the streams.

The beds of the various creeks flowing from the escarpment are generally composed of gravel of a rusty brown or orange color, and containing fragments of fossils belonging to the beds through which they have cut a passage. In every case the streams have worn and rounded the rock bedding in the sides and bottoms. Even the smallest seem to have a considerable effect.

In the various railroad cuttings the exposures of rock are weathered to a considerable extent. Near the southern end of the Cherry Street Station there is a cutting shewing three beds of thick, light blue (almost white) limestone. The top bed is weathered, long thin projections sticking out in various ways. The softer portions of the bed have been taken out, apparently by the rain beating against the face of the cutting.

Although for the most part the beds of the Basin are almost horizontal with only a slight dip to the northwest, there are many local dips of various angles and in different directions. This is due to the dissolving of the thin clayey seams found as partings between many of the beds. Wherever these dips are found forming a synclinal valley there is sure to be a small water channel down the bottom, dry mostly, but in wet weather full of muddy water of the same colour as the enclosing beds.

In transportation of the material destroyed by weathering the drainage of the country forms the great agent.

For drainage purposes the area of the Central Basin may be divided into three divisions and named after the three rivers flowing through it.

In the northern division we have the Cumberland River occupying with its tributaries, the Caney Fork, the Stones River and the Harpeth River, a drainage area of over half the body of the Basin. The Cumberland flows along the northern margin of the Basin within a few miles from the escarpment. No large streams join the river on that side, but it is the receptacle for numerous small creeks which flow over the escarpment. The Caney Fork joins the main river just as it enters the Basin, and the Harpeth not until after it has left it—the latter river having cut a channel for itself through the escarpment in a north-western direction to join the Cumberland. The Stones River lies altogether within the Basin. These are supplemented by numerous small creeks and channels forming a complete network of water-courses over the face of the country.

The course of the Cumberland is a very tortuous one. From Port Burnside in Kentucky at the head of navigation to the island below

Nashville the river with its numerous windings is 327 miles and a direct line drawn between the two places would not be longer than 150 miles.

The fall of the river from Port Burnside to Nashville is only 228 feet, or an average of about eight inches per mile for the whole distance. Of this fall, however, 99 feet is obtained in the first 130 miles from Port Burnside to the Tennessee State line, and 40 feet within the next 50 miles.

Slope of the Cumberland River from Port Burnside to Nashville, from a Survey made by the U.S. Engineer Corps.

	Dist'nce	Total Fall.	Fall per Mile.
	miles.	Feet.	
Port Burnside to State Line	130	99	9 inches.
State Line to Salt Lick Shoal	46	32	8 "
Salt Lick Shoal to Niagara Island.	8	10	1 foot 3 in.
Niagara Island to Double Island	88	59	8 inches.
Double Island to Mansker's Island	24	15	7½ "
Mansker's Island to Nashville	31	13	5 "
	327	228	8 inches.

The average depth of water is about 10.6 feet. The highest water during the last sixteen years was 54.6 feet in January 1882, and the lowest 0.4 below the zero gauge in October 1876. The highest average of depth is 21.3 feet for Febuary, and the month shewing the lowest is October with an average of 2.3 feet.

Average depths of Cumberland River at Nashville from 1871 to 1887.

Month.	Average Feet.	Highest and Year.		Lowest and year.	
		Feet.	Year.	Feet.	Year.
January	17.7	54.6	in 1882	2.0	in 1877
February	21.3	46.9	" 1884	3.5	" 1877
March	19.2	49.3	" 1884	3.5	" 1877
April	18.8	49.6	" 1874	5.1	" 1878
May	10.3	34.2	" 1875	2.8	" 1879
June	6.4	27.7	" 1885	0.8	" 1879
July	6.0	30.7	" 1880	0.1	" 1879
August	4.3	17.6	" 1874	0.1	" 1887
September	3.	17.5	" 1874	*0.3	" 1887
October	2.3	10.3	" 1875	*0.4	" 1878
November	6.3	27.	" 1885	*0.2	" 1887
December	11.6	35.4	" 1879	0.7	" 1884
	10.6	33.5		1.5	

The months of January, February, March and April shew the heaviest averages. During these months of 1888 the average mean velocity of the stream was for

January	5,019 miles.	Mean of	51	observations
February	4,194 "	"	65	"
March	5,907 "	"	116	"
April	5,208 "	"	82	"

The average discharge per second was for

January	49,224 cubic feet
February	32,299 "
March	105,474 "
April	70,528 "

These figures probably represent more than double the average discharge if taken for the whole year. The discharge in summer is estimated about 13,000 cubic feet.

None of the streams connected with the drainage of the basin have the drainage area of the Cumberland.

In the central division the Duck River forms the channel of outlet. This stream flows almost through the centre of its drainage area sending out small creeks to both sides. This area is limited to the south by the Elk Ridge, and on the north by a long narrow spur of Nashville rocks. The Duck River is a tributary of the Tennessee. As may be indicated by its drainage area it is less than half the size of the Cumberland, it is not navigable, and no reliable data have ever been kept regarding it.

The Third or Southern drainage division is that of the Elk River. It is divided from the Duck River area by the Elk Ridge, and is limited on the south by the escarpment forming the rim of the Basin along which it skirts very closely. The Elk is a tributary of the Tennessee River.

In Tennessee these streams drain the Highland Rim, and in Kentucky the chief drainage channel is the Ohio River with its tributaries. The whole of the State of Kentucky, with the exception of probably about 1,000 miles lies within the area belonging to the Ohio division of the Mississippi drainage basin which is estimated to be lowered by one foot in 5,000 yards.

The conclusions naturally arrived at from a consideration of all the facts connected with the geological structure of the country under consideration are these. That the territory now occupied by the sub-carboniferous beds was elevated at the close of the sub-carboniferous period ; that the greater part of it was above the level of the marshes in which the coal beds were formed ; that the Central Basin of Tennessee is a basin of erosion, and that the amount of denudation necessary to form the Highland Rim in its broadest extent and the Central Basin was the work of the present system of drainage.

The rivers and streams of Kentucky have a generally westerly and easterly course and all have cut for themselves deep channels. Some of them are remarkably crooked with a gentle fall, some of them having not more than three or four inches to the mile, and in places only a succession of pools united by gentle ripples.

The Cumberland River which drains more than half of the Central Basin has an average fall between Port Burnside and Nashville of about eight inches to the mile, but this is due to what might be called a succession of jumps of a foot and sometimes a foot and a half at the various shoals and ripples which occur throughout the course of the river and which, to a considerable extent, impede the navigation of the stream. In reality the current for long stretches of the river is almost altogether due to the impetus given by these ripples or steps.

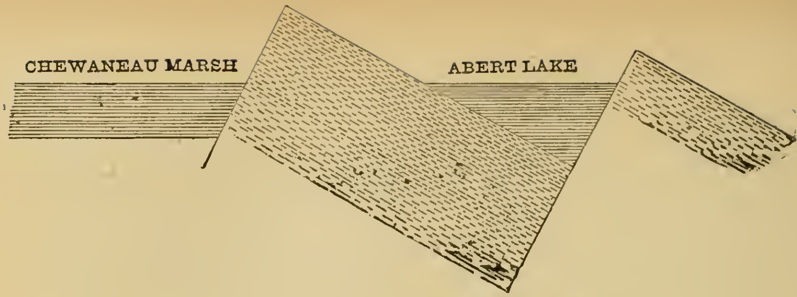
The area now covered by the Central Basin of the Tennessee was, at the close of the sub-carboniferous period, occupied by a dome-like structure, the apex of which was at least 1,500 feet higher than the floor of the Basin as it now appears. This dome was probably surrounded by smaller ones of the same description. A small dome of this nature and exhibiting the structure of the larger one is to be found in Stewart County. It is called by Professor Safford "Wells Creek Basin." On the principle or general law of erosion that the highest point is always attacked first, the apex of this central dome would be subjected to wear before the other portions of the region. There is every probability also that the harder beds lying upon the surface would be fractured and cracked in various places. These fractures would admit water and form an underground drainage which eroded the underlying soft beds forming the vast series of caverns such as are found underlying the sub-carboniferous rocks of Kentucky. The water falling upon the slopes of the dome would form the drainage which was eroding the overlying hard rocks. In course of time this erosion had so planed and denuded the top and the underground streams having formed a series of caverns connected with their channels that the Cumberland River, on passing through the barrier of less eroded rocks, entered the region of the Basin and found comparatively little resistance by the softer rocks where left standing by the underground waters, undermined the remaining upper beds and eventually removed them. The river, having reached its base level of erosion, its energies were expended in lateral erosion, and the result is that the Cumberland has wandered from side to side of its drainage area in great bends at each change of course entering a little deeper into its bed rock. At present it now forms great loops or bends, some returning so close upon the other as to make almost complete islands. The present position of the course of the river with regard to its drainage area within the Basin is by no means of a very high antiquity. This can be seen by a study of its channel and the bottom lands lying along it, when it will be seen that it has moved in various ways and shifted its position many times before it assumed its present course. Of course we cannot tell how often it has changed, but we can trace the limits of its latest movements since assuming its present level. During the rainy season the stream is highly charged with fine particles of matter which form a clayey sediment when allowed to settle. Part of this sediment is deposited along the bed and banks of the river in the shape of mud banks and in bars, and part of it is carried to the Ohio River where quite an extensive deposit has been formed within the last few years. This bankforming at the mouth of the Cumberland has rendered the town of Smithland, formerly a river port, quite inaccessible from the river for navigation purposes.

In the central district the Duck River has worked in the same manner as the Cumberland, but not upon such an extensive scale, as its drainage area is not quite so large. In the southern division the Elk River has not covered so much ground as either of the other two, but still its work has been in the same direction.

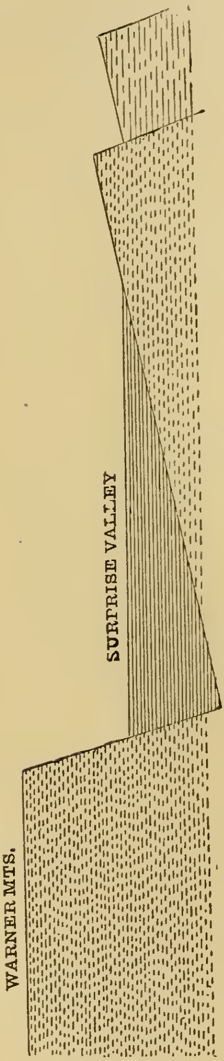
There can be no doubt but the movements of these streams have been the cause of the deepening of the Basin to its present condition, while the numerous smaller streams flowing over the escarpment have been the chief agents in former times, as they are at present, in the widening of the Basin.

Thus we see that the Central Basin of Tennessee was formed by simple causes operating through a great length of time, and that it is not at all necessary to call in the aid of any unknown factors in performing the operation. Any assumption that some gigantic unknown agency had anything to do with the case is purely gratuitous and unnecessary.

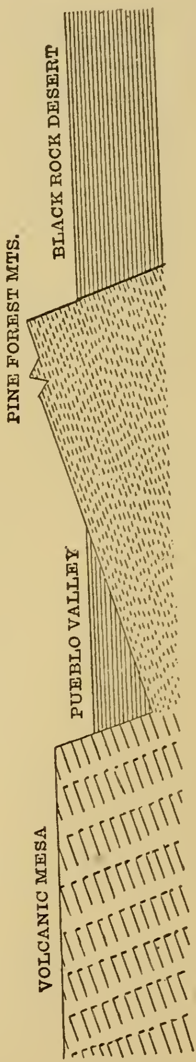
It may be argued that there has not existed a sufficient length of time in which to perform the work. To this it may be answered that much greater operations have been carried out in much shorter periods of time and with no more effective agents. Numerous instances might be given, but one will be sufficient. According to Powell and Dutton, over the whole Plateau region, an area of not less than 200,000 square miles, an average of 6,000 to 8,000 feet, and an extreme of 12,000 feet has been removed by erosion since the middle Tertiary. All this work has been performed in a little less than half the time consumed in digging out the area covered by the plains of the Highland Rim and the Central Basin of Tennessee.



IV.—Annual Report U. S. Geol. Survey, p. 448.



IV.—Annual Report, p. 450.

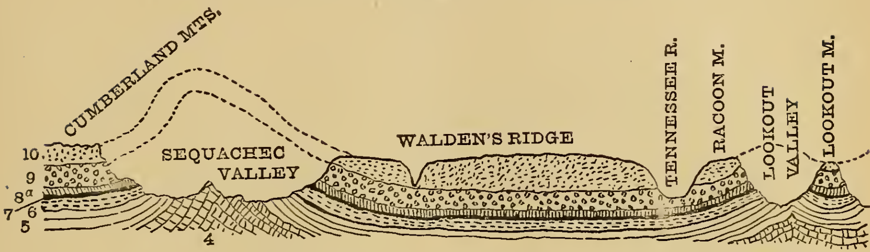


Page 444.

EXAMPLES OF MONOCLINAL VALLEYS.

From Fourth Annual Report, U. S. Geological Survey.

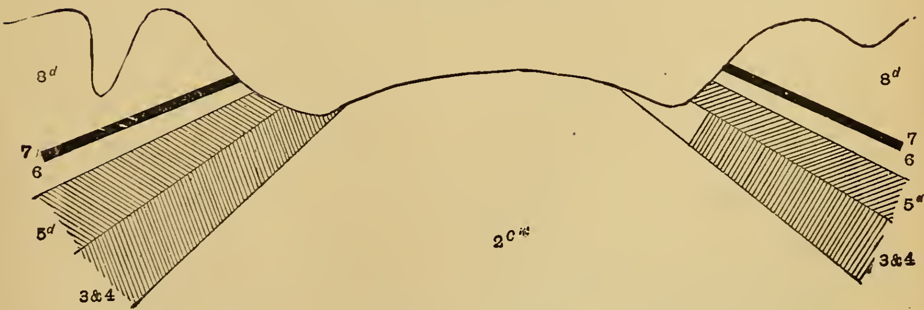
SECTION ACROSS SEQUACHEE VALLEY TO LOOKOUT MOUNTAIN.
From Safford.



4. Knox Dolomite ; 5. Trenton and Nashville ; 6. Dyestone (Niagara) ; 7. Black Shale ; 8. Siliceous ; 9. Mountain Limestone ; 10. Coal Measures.

EXAMPLE OF VALLEY OF ELEVATION.

WELLS CREEK BASIN.—*From Safford.*
Geology of Tennessee, page 147.



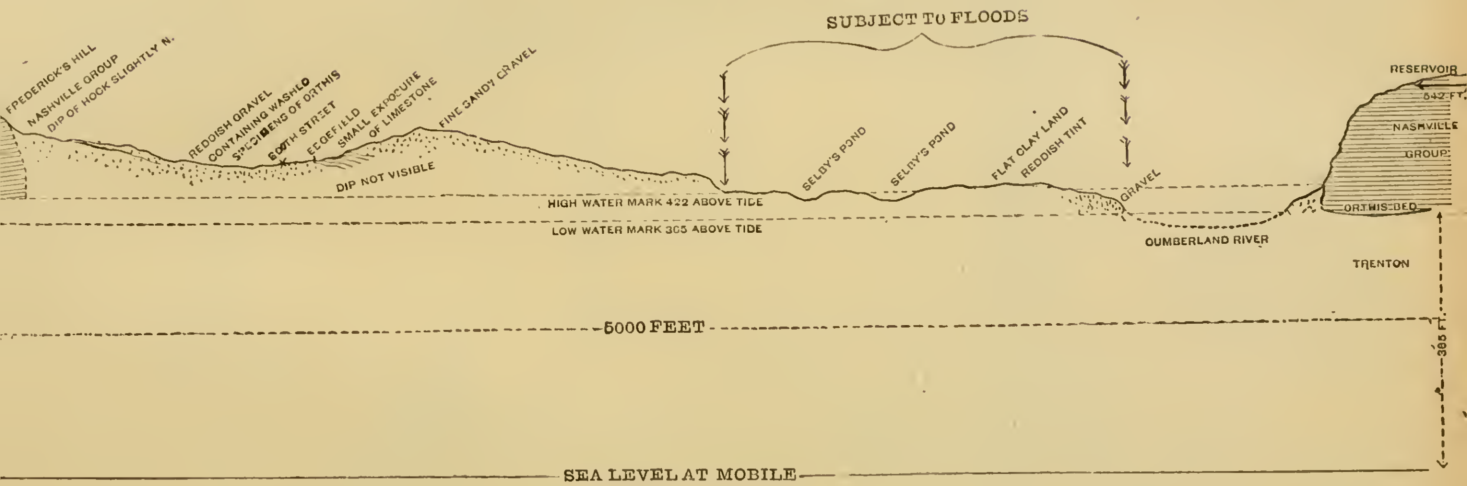
8a. Siliceous ; 7. Black Shale ; 6. Lower Helderberg ; 5d. Niagara, Meniscus Limestone ; 4. Nashville
3. Trenton ; 2c''' Knox Dolomite.

VALLEY OF ELEVATION.

SECTION ACROSS CUMBERLAND RIVER AT NASHVILLE, TENN., FROM OLD CITY RESERVOIR TO FREDERICKS HILL IN EDGEFIELD.

Scale { Horizontal 500 feet = 1 inch.
Vertical 200 feet = 1 inch.

29th Oct., 1888.



ERRATUM.—For "20th Street," read "Second Street."

THE WESTERN DÉNÉS—THEIR MANNERS AND CUSTOMS.

By the Rev. Father A. G. Morice, O.M.I., Stuart's Lake, B.C.

So far, very little and, to my knowledge, no reliable information has ever been published concerning the ethnology and sociology of the Indian tribes inhabiting that northern part of British Columbia originally known as New Caledonia. It is not because they have been altogether ignored by English-speaking ethnographers; but for one reason or another, whenever they are attended to in scientific papers, it has never been with satisfactory accuracy. No later than four years ago the Smithsonian Report contained a paper on Anthropology by Otis T. Mason, wherein I found[1] the following, purporting to be a classification of the "Tinneh or Athabaskan"[2] tribes, including the Western Dénés.

Western Tinneh.

Kai′-yūh-kho-ta′nā.
Ko-yu′kŭkh-o-tā′-nā.
Un′-ā-kho-tā′-na.

Kut-chin Tribes.

Ten′-an-kūt-chin′.
Tennŭth-kŭt-chin′.
Tat-sah′-kŭb-chin′.
Kŭt-chā-kŭt-chin′.
Nahsit′-kŭb-chin′.
Vunta′-kŭb-chin′.
Hai-ăn-kub-chin′.

[1]First part of the Report, etc., for 1885, page 832.

[2]At the risk of appearing unnecessarily fastidious may I be allowed to remark here that either term, Tinneh or Athabaskan, seems ill chosen to designate that vast family of aborigines they are made to represent? Athabascan is local and consequently should not be applied to the whole stock, whilst Tinneh, if anything, does not mean what it is intended for. Indian languages, especially that of the tribes in question, are exceedingly delicate, and a very light phonetic shade, which the uninitiated will often fail to perceive, always changes the sense of the word. Tinneh, which evidently stands here for Déné, "men" (the name most of the tribes call themselves by) would rather remind a Western Déné of the berry of what is vulgarly called "kinnikinik" (*Arctostaphylos uva-ursi*) than of the genus *homo*! Others give them the name of Tinné, calling them thereby "Four" (persons).

Eastern Tinneh.

K'nai-a-kho-tana.
Ah-tenā'.

Nehannees.

Abbā-to-tenāh.
Ȧcheto-tinneh.
Khŭn-um-āh.'

Carriers.

"Takŭlli."
Tsilkotinneh.

Now, I daresay the learned Professor has been misinformed, inasmuch as Dr. W. H. Dall's list, which he quotes and seems to adopt is incorrect and incomplete. It is incorrect because, among other things, it puts down the Tsilkotinneh (or more correctly Chilhχotins) as belonging to the Carriers (Taχelh, not "Takulli") from whom they are distinct. Moreover, those tribes noted under the title of "Western Tinneh" have no existence but on paper. As for the Nehannees, I suppose Dr. Dall means the Nah-anés; but I strongly suspect that the seven "Kut-chin" tribes, which he gives as specifically different, are only so many sub-divisions of the same tribe, all of whom speak the same dialect probably with local idiomatic peculiarities. Indeed, their very name, not to speak of reliable authorities, would lead me to form this opinion. "Kut-chin"[1] is a verbal suffix which, when in connection with a denominative name is expressive not of ethnological variety, but of topographical location. Its appearance at the end of certain words denotes that the aborigines who designate themselves thereby are philologically, and thereby ethnographically, so homogeneous as to preclude the possibility of their being classed as different tribes of the same stock.[2]

[1]The "toh" pronounced with a peculiar smacking of the tongue. To prevent typographical difficulties I shall avoid as much as possible the giving of aboriginal names in the course of this monograph. I am not acquainted with the system of Indian orthography suggested in a volume of the Smithsonian Miscellaneous Collections, and even should I have it ready for reference I doubt whether it would prove adequate to the accurate rendering of the multifarious sounds of the Déné languages.

[2]This suffix varies with the different tribes Its equivalents on this (west) side of the Rocky Mountains are *tingkwotin* in Chilhχotin, *ten* and *kwoten* in Carrier, *t-chene* and *kwo-tchene* in Sékenais.

On the other hand, Dr. Dall's classification is incomplete, since it omits the Tsékenné, a tribe whose habitat is on both sides of the Rocky Mountains, whilst, of eight clearly distinct eastern tribes, he notes only two and that under aboriginal names, the genuineness of which is to me of more than doubtful character.

Some ethnographers, for reasons known to themselves, regard the T'simpsians, who lately migrated from this (North Pacific) coast to an Alaskan Island, as an offshoot of the Déné or Athabaskan stock. But even a slight knowledge of their language and physical characteristics ought to convince any one of the fact that they are altogether heterogeneous thereto.

This being admitted, it remains with me to state which tribes are to the subject of this paper, and conformably with the Canadian Institute's Sociological Circular to give some account of their social condition, customs, ceremonies, etc. The subject is rather comprehensive, and even without attempting to treat it exhaustively I fear I will have to give its exposition perhaps unexpected extension.

I.

Let me, however, premise that I shall content myself with speaking of the Western Dénés, excluding from my subject those tribes which have their fishing grounds on the north coast of British Columbia and which form by themselves a group apart. Our Dénés belong to a race of aborigines occupying a vast territory. Without mentioning the Navajoes who, advanced sentinels of a delayed army, wait in New Mexico for their kinsmen of the north to rejoin them under more favored climes, one can hardly travel from Fort Macpherson within the Arctic Circle to the plains of the South Saskatchewan without meeting with representatives of that great family. On our (west) side of the Rockies they are divided into four tribes speaking as many dialects. They are :

1st. The Chilhχotins[1] actually about 460 in number, occupying the valley of the river called after them, and the bunch-grass covered plateaus that skirt it on either side between 51° 10′ and 52° 40′ north latitude, and from the western banks of the Fraser to the Coast Range of mountains.

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[1] "Inhabitants of Young Man's River."

2nd. The Carriers or Taχelh,[1] numbering 1,600 and whose territory borders on that of the Chilhχotins in the south, and extends as far up as 56° north latitude, leaving to a band of Sékanais part of the forest land intervening between said latitude and about 57° north where we find

3rd. The Nahanés,[2] who may number 700 and hunt over a territory, the northern limits of which (about 65°) are the southern frontiers of the Loucheux'[3] hunting grounds in the extreme North-west Territories. Lastly we have in our district a number of

4th. Tsekenné[4], more commonly called Sékanais who roam over the Rocky Mountains on either slope and the adjacent forests and plains from about 54° to 60°. north latitude. At present there are not more than 250 of them in British Columbia.

To these might be added the Beaver or Tsatens who trade at Hudson's Hope and Fort St. John's, Hudson's Bay Company's posts on Peace River, which, politically speaking, belong to our Province though east of the Rockies. But as (save a few individuals of that tribe) I have seen very little of the tribe, and to adhere to my resolution to speak only of what I have knowledge derived from personal intercourse, I shall refrain from alluding to them. Nevertheless, most of what shall be said of the Sékanais in the course of this monograph, may also be understood as largely applicable to that tribe.

All these tribes, especially the Chilhχotins and Carriers, were originally quite numerous. In fact, if we are to credit the old men among them, and even the Hudson's Bay Co.'s employées who were early in this country, it would be necessary to almost decuple the existing numbers in order to obtain an idea of the population as it stood at the time of the discovery of the country by Sir Alexander Mackenzie in 1793. Repeated domestic and foreign wars and contagious diseases, which have several times in this century played havoc among them, have greatly reduced their numbers.

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[1]This word Taχelh is exotic to the Carriers' language, and, although very often used by them, they contend it was unknown among them before the advent of the traders. It is untranslatable.

[2]" People of the Setting Sun or West," as named by the Eastern Dénés. The Carriers and Sékanais call them Tseloné—" People of the end of the Rocks," because the band which is best known to them inhabits a plain north of a spur of the Rocky Mountains, which our Indians believe to be the extremity of the whole range.

[3]The so-called "Tukudh" or " Kut-chins."

[4]" Inhabitants of the Rocks."

Before proceeding further, would it be presumptuous on my part to suggest as a partial corollary of the foregoing the following classification of all the Déné or Téné[1] tribes based on personal observation and the knowledge of two of their dialects, and, in so far as the Eastern tribes are concerned, on the works of Rev. E. Petitot, a learned ethnographer and philologist, who has passed twenty (1862-1882) years of assiduous study among them?

CLASSIFICATION OF THE DENE TRIBES.

Their Name.	Their Habitat.	Supposed Population.
	Western Dénés.	
Chilhχotins (tœni)[1]	Chilcotin River........	460
Carriers (tœné)....	Stuart's Lake, North and South	1,600
Nah-anés (téné)....	Stickeen River and East	700
	Intermediate Dénés.	
Sékanais toenè	Rocky Mountains	500
	Eastern Dénés.	
Chipewayans (déné)	Lake Athabasca, etc	3,000
Cariboo-eaters(déné)	East of Lake Athabasca..................	1,200
Beavers (dané)	Peace River	800
Yellowknives(déné)	North-east of Great Slave Lake	500
Dog-Ribs (duné)....	Between Great Slave and Great Bear Lakes.	1,000
Slaves (déné).	West of Great Slave Lake & Mackenzie Riv.	1,000
Bad People (diné)..	Old Fort Halkett	200
Hares (déné; adéné)	Mackenzie, Anderson & MacFarlane Rivers.	600
	Northern Dénés.	
Loucheux (dindjyé).	Mackenzie River, 67° northwards	400
" " ..	Alaska	4,000

[1]Œ in these and other Déné words corresponds to the French *e* of *je*, *me*, *te*, etc. *U* has the sound of the Italian *u* (oo).

The words within parentheses are the respective expressions used by the different tribes to say "Men," and thereby designate themselves when not referring to the country they inhabit. The remarkable homophony of these terms (which is easily explained by the fact that they are root words) is, however, somewhat misleading, inasmuch as it conveys an idea of philological similarity which is far from existing between the various dialects. Their lexical differ-

[1]D and t are interconvertible.

ences on the contrary are so wide that the Carriers and the Sèkanais, though geographically neighbours, can scarcely understand a word of each others' language unless they have previously learned it by personal intercourse.

Many of the remarks I am going to offer on the social status of the western tribes should be understood as applying to their original condition when no missionaries had as yet (20 years ago) endeavored to civilize and morally coërce them into giving up the most obnoxious of their customs. It would scarcely be to the point to speak of them as they are at present, since, being generally progressive in disposition, they are socially speaking pretty much as we have made them. However, the Sékanais and Nah'anés, owing to their nomadic mode of living and the consequent difficulty to produce permanent effects upon them, may be said to have to this day almost preserved their original social status.

II.

The American aboriginal type is too well known on this continent to require a description from me. Our Dénés, in spite of the characteristics which particularize them into various tribes, do not materially differ from it. Suffice it to say that whilst the Chilhχotins are generally of low stature, broad shouldered and not unlike the Chinese in their physical features; the Carriers are, as a rule, rather tall and stout without being corpulent, while most of them possess a fine physique. On the other hand, the Sékanais and Nah'anés, especially the former, are slender and bony, with hollow cheeks and almond shaped eyes shining with ophidian brightness.

Of course, tattooing prevailed everywhere. The face was particularly the object of would-be ornaments in the shape of incrusted crosses or birds on the cheeks, the forehead or the temples. But more commonly they consisted of parallel stripes, more or less numerous, on the chin or the cheeks converging to the mouth corners. On exceptional occasions, such as dances or "potlatches" the Dénés had recourse to charcoal to render themselves apparently more redoubtable. And the young folks had vermilion to enhance their natural beauty, and it may safely be conjectured that they did not use it sparingly.

Everybody knows that one of the characteristics of the aboriginal facies is the almost total absence of beard. Nevertheless, our Dénés evidently thought that nature had provided them with too much of that appendage of manhood so much prized by the Aryan races. So, to correct its work, they assiduously picked off the few hairs that would grow on their chin and upper lip with small copper pincers, which they constantly wore suspended from their neck. In the same way, they used to trim their eyebrows, giving them the tiniest possible shape.

As for extraneous ornaments of every day wear, they consisted mainly of *haliotis* ear-rings and nose pendants often of enormous size, hanging from the perforated septum. These were common to both sexes. The wives and daughters of influential persons wore, also, bracelets hammered out of copper bartered from the coast Indians. A sub-tribe of the Carriers did not consider these "jewels" sufficient. Among them, to attain the *plus ultra* of feminine beauty and be reputed something in society circles, women added to the tattooing, ear-rings, nasal pendants and bracelets, a blunt wooden peg or tabret passed through the lower lip, thereby preventing its contact with the teeth so as to give it the utmost possible prominence, somewhat after the fashion of the Papuans of New Guinea. This circumstance led to their being called "Babines," or "Lippy" in corrupted French, by the early French-Canadians in the North-West Company's employ, which name they have retained to this day.

In common with the Nazarenes of old, men and women parted their hair in the middle and wore it at full length (except when in mourning), the men letting it fall on their back tied together in a knot when in repose, and rolled up like that of the Chinese when travelling, while women had it resting on the forepart of their shoulders in two skilfully plaited tresses adorned with a species of small, elongated shell, (*Dentalium Indianorum*) which was highly prized among the natives, and which they obtained from the coast Indians[1]. On grand festival occasions, persons of rank and influence wore wigs made of plaited human hair in its natural length, inter-

[1]The Nestorian Bishop of Samarkand, writing to the Catholics of Bagdad, says of the Tartar Kéraites: "They do not wash their faces, nor cut their hair; but plait and tie it together at the top of their heads."—*Vide, Aboutfarage Chron: Syr. in Assemani.* Volume III, part 2, chapter ix, page 488.

laced with quantities of Dentalium or Hyaqua shells. Sometimes these ceremonial wigs were ornamented with stout bristles taken from the sea lion's whiskers, trimmed so as to look like horns worn on the forehead.

As for their wearing apparel, without being strictly uniform, it may be said that in no case was it of a very complicated pattern. Besides the 'pagne" or breech cloth which was seldom removed, they wore a sort of tunic or loose vestment of beaver, lynx or marmot skin, with the fur next to the body. The outside was painted in variegated designs in vermilion and adorned with numerous fringes to conceal the seams and bands of dentalium or dyed porcupine quills. A pair of leggings reaching to the thigh, together with mocass ns, which, in the case of the poor were of salmon skin, completed their costume. Unlike their kinsmen of the Great Mackenzie Basin, they had no hood attached to their coat or tunic; but instead, wore a head-dress made of a small ground-hog skin and fashioned somewhat like a Scotch bonnet.

The women's wearing apparel differed only from that of the men by the length of their tunic, which was ordinarily covered with a skin cloak or a woven rabbit skin robe falling to their feet.

Washing may be said to be a European custom introduced among them. They clean their hands only, which they wash by filling their mouths with water and then squirting it over them in intermittent streams[1].

III.

Considered in their social condition and daily pursuits, a portion of the Western Dénés are nomadic and part may be described as semi-sedentary. To the first class belong the Sékanais and Eastern Nah'anés, the Chilhχotins, Carriers and Western Nah'anés forming the second. Thus, whilst their mode of living prevents the Sékanais from dwelling in houses and congregating together in villages, our Carriers pass the winter in lodges accommodating several families, and

[1] This reminds the comparative Sociologist of a similar custom prevailing among the Tartars or Moguls of the Middle Ages. William of Rubruck, (St. Louis' envoy to the great Khan, 1253) says that "They never wash their clothes. Cleanliness is in no more favor with "the men than with their ladies, and their mode of washing their faces and hands is by filling "their mouths with water and squirting it over them."—*Relation des Voyages en Tartarie. Bergeron.*

are also gathered in regular villages. And here I must remark that our tribes have scarcely any national economic policy; but have generally copied, wholly or in part, from the alien tribes with whom they have been in contact. Until a short time ago, the Chilhχotins, like the Shushwaps their eastern neighbours, used to pass the cold season in semi-subterranean huts rotund in form. An aperture in the centre of the mud covered roof to which an Indian ladder (a log chopped off every foot or so for steps) led, served the double purpose of a door and chimney. Imitating the Atnas or coast Indians with whom they had commercial relations, the Carriers lived in houses or lodges formed of slender poles, low in height and covered with spruce bark. These had an entrance at both gable ends, the fire place being in the centre to which corresponded an opening in the roof to let the smoke out. Salmon skins sewn together made a good substitute for boards and were used as doors[1]. Generally, they kept the spoils of their heraldic animals, fowl or rodent, nailed to the wall in the inside. whilst in the case of leading members of the tribe, they had their totem carved in wood and exhibited on the outside summit of the gable. (See figure 1.) The Sékanais were less pretentious. Even to this day, they content themselves with circular coniferous branch huts or lodges which they construct and abandon at a moment's notice, whenever their incessant peregrinations after food and peltries call therefor.

Unlike the Esquimaux[2] who sleep in a state of absolute nakedness, our Dénés roll themselves in their blankets, their feet to the fire, with almost all their clothes on. Making due allowance for their particular ideas of propriety, they are generally modest in depo tment and chaste in privacy, despite the fact that several

[1] Compare these with the nomadic Moguls' "rolling habitations": "The houses they inhabit "are placed upon wheels and constructed of a kind of wooden latticed work with an opening "at the top that serves for a chimney. . . Before the entrance there is suspended a piece of felt."—*Rubrick's Narrative in Abbé Huc's Christianity in China, Tartary, etc*, Volume i, page 178.

[2] In a letter from the Rev. Mr. Morice, dated July 28th, 1889, occur the following words: "Concerning the passage in my paper which refers to the Esquimaux as sleeping naked, I have not in view the Labrador Esquimaux, who if I mistake not, have been semi-civilized by the Moravian brethern, but the Tchigh't or Esquimaux of the Anderson and Mackenzie Rivers, who are still in their primitive state. Now, I take the liberty tô refer you, by permission, to Mr. McFarlane who passed part of his life as an H. B. Co's. officer among said aborigines, and who, but yesterday, assured me that both in winter and summer time, men, women and children of either se, sleep stark naked."—*Ch. S. Cm.*

couples live together under the same roof and without partitions in the house.

Should I have to sketch rapidly our Dénés' moral features, I think I could, by ignoring some necessary exceptions, give them credit for relative morality, great honesty, intense fondness of their offspring and a general gentleness of disposition, not excluding, however, occasional freaks of irascibility. But to qualify these lines and give their true portrait, I should immediately add that they are prone to lying, addicted to gambling[1], naturally selfish, cowardly, and at times very lazy, especially the stronger sex.

Besides were I required to particularize in two words the ethic peculiarities of each tribe, I would state that the Chilhχotins are the most violent and manly of the whole group; the Carriers, the proudest and most accessible to progressive ideas; the Sékanais, the most superstitious and naive. As for the Nah'anés, though speaking a language different from, but allied to, that of the Sékanais, they are considered by our Carriers so closely similar to the latter in their physical and moral characteristics, as to receive in common with them the name of Lhtaten (Inhabitants of Beaver dams,) by allusion to their chief occupation, trapping and hunting.

IV.

With the view of having the family and tribal organization obtaining among the Western Dénés properly understood, I must refer at once to the clans or gentes into which, like the Iroquois and most of the American Aborigines, nearly all of them are divided. These to the number of five, form a kind of very strict relationship, to which, to the present time, they have held very tenaciously. Each of these clans has one or several particular heraldic emblems or totems, the toad, grouse, crow, beaver, salmon, etc.; the image of which formerly received special consideration. This organisation outsteps the village limits, and members of the same clan are to be found in localities very wide apart. But however remote their respective places, they still claim mutual kinship.

Now, from time immemorial, a fundamental law in their social constitution has been for individuals of the same clan never to inter-

[1]This of course, must be understood of those who are still out of the reach of missionary influence.

marry. So it is that endogamy is looked upon with horror among them. Indeed, I think I am warranted in affirming that marriage with a consanguine, unless a very close one, was preferred to matrimonial union with a co-clansman. As it is, agnation and consanguinity in the direct or collateral line on the paternal side were considered powerful barriers to sexual relations, males and females descended from the same stock being always regarded as brothers and sisters. But at what particular point the offspring of a common or collateral[1] branch would be deemed sufficiently distant to admit of matrimonial union is more than I can say, none among the natives themselves being able to satisfactorily solve that question. All I can say is that as long as the common ancestors of two individuals were remembered, the latter were easily dissuaded from contracting marriage together, even to the fourth and perhaps the fifth degree of consanguinity, especially if in the direct line. I do not mean to say that there never were tacitly allowed deviations from this law, nor absolutely any intermarriage in the same clan. But the repugnance which such unions inspired only goes to show that in this case, as in others, the exception confirms or proves the rule.

Such was not the case, however, with consanguinity in collateral lines by the mother's side, cousins of that class, even as near as the first degree, being by a time honored custom, almost bound to intermarry. And here it is as well to state at once that, in common with nearly all the primitive people, mother-right is the supreme law regulating succession among nearly all of the Western Dénés, and I may add that here[2] it admits of no exception whatever. On the other hand, another ordinance of their social code forbids titles as well as landed property to pass by heredity into a different clan. Therefore children of a notable among them belonging to their mother's clan, could never inherit from their father. But if the latter had nephews by a sister, one of them was *de jure* his successor, this nephew belonging through his mother to his uncle's clan. Now, by way of compensation, and to permit the notable's children who could not otherwise inherit from him, to enjoy at least, as much as was lawful of their father's succession, one of his daughters would be united in marriage with her inheriting maternal first cousin.

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[1] On the father's side.

[2] At Stuart's Lake.—*Ch. S. Cm.*

As for affinity consequent upon either lawful or unlawful sexual relations, it was simply ignored. Nay, I should say that it was rather considered a powerful incentive to marriage, except when the regulations of the clan organization interfered so as to make the two relatives fellow clansmen. Thus it was, that in the case of a deceased brother's wife, the Dénés treated her conformably with the directions of the Jewish law, and the nephew considered himself in duty bound to espouse her.

It would be difficult to give here a complete table of agnates and cognates as named and ranked by the four Tribes under review, some of whom receive different names according as they are called by a male or female, or relatively to their comparative age. I shall, however, confine myself to a few remarks embodying the more characteristic peculiarities in their mode of reckoning kindred relationship.

1° A large proportion of our Dénés never go beyond the second degree in computing their progenitors or offspring, whether in a direct or collateral line, and in no instance do they go beyond the third degree—more distant relatives in either line being then called respectively grand-father and grand-mother if ascendants, or grand-children if descendants.

2° Grand-uncles and grand-aunts both maternal and paternal are also called grand-father and grand-mother.

3° Although they possess and sometimes use words meaning brother or sister without any reference to their relative age, they more generally designate them elder brother and elder sister, or younger brother and younger sister.

4° A son is called *syé* by his father and *syaz* by his mother who also calls her daughter *syatsé*, while her father when referring to her[1] always uses *stsé*.

5° Both nephews and nieces are called *stsû* by their maternal uncle and *skwaz* by their maternal aunt, while either paternal uncle or aunt will call their nephew younger brother and their niece younger sister.

[1] These and the following Aboriginal terms are in the Carrier dialect. This not being a philological paper, I have deemed it superfluous to have them accompanied with their Chilhχotin and Sékanais etc., equivalents.

6° *Sthi·* stands for paternal uncle and *spizyan* for paternal aunt; *s ez'é* meaning my maternal uncle and *sake*, my maternal aunt.

7° Maternal cousins of both sexes are *szit* to their co-relative male cousin and *sunté* if male or *szit* if female to their co-relative female cousin, whilst paternal cousins are always called brother or sister in the indefinite mood.

8° *Schi·* does duty for grand-children of any sex and also for the other offspring alluded to in the first remark. In the same way, brother-in-law and sister-in-law receive the common appellation of *sre*.

The clan organisation obtains also among the Western Nah'anés, who have frequent intercourse with the Coast Indians from whom it is derived; but it is unknown among the Sékanais and Eastern Nah'anés, who owing to the geographical position of their territory, have adhered to their primitive usages and kept aloof from foreign practices. As a consequence father-right is the only law which regulates succession among them.

V.

Marriage in the Christian sense of the term, is rather a misnomer when intended to designate native unions such as were contracted before the advent of the Missionaries in the Country. Co-habitation would better answer the purpose. In fact, it is the corresponding expression they employ themselves when referring to a man married to such and such a woman. They say *yerœsta*, "he stays with her." For as there was no valid contract and no intention on either side to consider their union as a permanent connection, divorce resulted as a matter of course whenever one of the partners was tired of the other. In that case, the ci-devant husband would take back anything he had bestowed upon his so called wife, and both of them would try life with a new partner. Naturally the man, especially if in easy circumstances, would have a better chance of success than his former wife. Supposing children had been born to them, divorce was more difficult, but by no means impossible. In that event, the father would ordinarily take possession of the offspring. For among the Indians, as among many of their civilized brethren "might is right," and as they are exceedingly fond of their children, the late husband would rather see them temporarily in a stranger's hands than entrust them to their own mother's custody.

Except among the Carriers, early marriages are in favor among the Dénés, oftentimes the female being barely pubescent when mated. Among the Sékanais nothing was simpler or more expeditious than the contraction of marriage. Whenever a young hunter had made up his mind on mating a fair child of the forest, with scarcely any previous courting, he would in the day time simply ask the girl of his choice: "*Will you pack my beaver snares for me?*" To which, if she refused him, she would make answer: "No, there are plenty of women, ask another one." But if agreeable to the maid, she would at once answer without any conventional blushes: "Perhaps, ask my mother." Upon which the lad would not ask her mother, but the girl would immediately tell her about it. Then, following her parent's advice, she would hasten to erect a branch lodge alongside their own primitive habitation,[1] and in the evening, the affianced youth (such was he after the proposee's answer) would on entering it hand her his "beaver snares." Without further ceremony, they were man and wife. Supposing the woman proposed to was the former wife of the man's deceased brother, there was no declining his offer, she was bound to accept his "beaver snares."

The preliminaries, if not more complicated, were at least more difficult and tedious among the Carriers. According to their etiquette, the intended wife had absolutely nothing to say for or against the projected union. Whenever a youth of a different clan had singled her out to be his future wife, he would not exchange a word with her, even when proposing, but installing himself at her father's home, he would begin to work for him, not failing to present him or the girl's most influential relative with anything of value which might come into his possession, either by hunting or otherwise. Meantime he would never tell them the reason of such unwonted liberality, neither would they ask him, but they easily guessed it. When after one or two years wooing to . . . . . . his intended wife's parents, he thought a well deserved "Yes" was likely to reward his efforts; he would demand her from her father or guardian through the instrumentality of an obliging friend. If agreeable, the suitor was thereby

[1] A Sékanais will never dwell under the same roof as his married children!

married. If not, then the recipient of his favors was bound to return an equivalent in kind.

Naturally enough, after having won his wife at such a cost, the young husband was not ready to reject her without sufficient provocation, and it may easily be conjectured that the prospect of having to recommence anew a protracted courtship, must have tended not a little to render the matrimonial tie, if not sacred, at least more durable among the Carriers than it was among the Sékanais. However, it must be said that in case the wooing party was well connected, the procedure previous to acceptance was somewhat curtailed, and frequently almost entirely dispensed with.

Polygamy flourished to a great extent among all of the tribes. The more exalted the man's rank, the more numerous would be his wives. The father of the present chief of this place (Fort St. James, Stuart's Lake) had as many as six wives at one time. Nevertheless, there was always one, not necessarily the first in priority of co-habitation, who was regarded as superior to the others whom she then called her younger sisters, receiving in return the title of elder sister from them. Even polyandry was in honour conjointly with polygamy among the Sékanais; but remained unknown to the Carriers.

A peculiarity perhaps worthy of notice is that an Indian woman will never say "my husband" when referring to her mate; but will invariably say "he" or "this child's father." Even men are quite as prudish and will seldom be caught saying "my wife" in speaking of their partner. Likewise both men and women feel a great reluctance to tell their names and will generally rather use a round about description than the appropriate vocative.

VI.

I need hardly say that among the Dénés the status of woman after marriage was seldom preferable to her previous condition. For I take it to be granted that among most of the non-Christian peoples of the day, as well as the various nations of antiquity, woman, under one form or another, is, and has ever been, very little short of her lord and master's slave. While still a girl, she had of course, to render her mother such menial assistance as lay in her power; but then she was generally taken good care of, well fed and well clothed, so as to command a higher price in the bachelor's market. Now that her fate is sealed, she must be the real factotum of the household.

And well might she consider herself enjoying a holiday life, even though very busy, when at her new home; but it is chiefly when travelling that life must become rather burdensome to her. Then her lot is to pack all the family impedimenta, while her husband, gun in hand, gaily precedes her on the way trying to have an occasional shot at game to diversify the menu of the evening meal. However, let us not pity her beyond measure, for as she never knew or even dreamt of a better fate she does not murmur herself, neither does she ever complain of her husband's ungallant conduct. Besides, her ability for this kind of labor has been developed from childhood, since among the natives even the little ones are trained to carry some of the family goods and chattels.

Her capacity for carrying heavy burdens lies in her ability to preserve an accurate balancing of the load rather than in any great muscular strength. The pack rests on the back, between the shoulders, supported by a leather line which passes in a broad band across the forehead and is secured by the ends of the line being tied across the chest.

It would however, be wrong to conclude that her daily toil is over when at dusk the couple stop for the purpose of camping. Then all the work in the way of gathering firewood, erecting the temporary lodge, cooking, etc., must be attended to by her, the man's duties and attributes among the Dénés, when in their primitive state, being restricted to hunting, eating and sleeping

One must not however, infer from this that her lot was such that she had absolutely no influence either in the family or the village circles. Oftentimes the woman did exercise much influence, but then it was not owing to her position as wife or mother, but generally on account of her birth and her father's rank. Her marriage conferred no right or privileges upon her, nor did it give her any claim to her husband's personal or landed property. Man and wife were never regarded as a moral unit, as customary among us; but just in the same way as during their union, they continued to have their respective names, even so did the property of each ever remain distinctly personal.

This, among the Dénés, is twofold: private and personal, as clothes, canoes, dogs, etc., and real or permanent as are the hereditary estates. For to the rank of Tœnezoi or notable are attached hunting grounds, the limits of which are very clearly defined. These are, by right, held in proprietorship by the titular only; but by a sort of tacit concession, other heads of families of the same clan as the legitimate proprietor share the usufruct thereof during his good pleasure. In fact, they may be said to be, though of inferior rank, his co-associates, hunting with and for him and receiving of the spoils only what he is pleased to let them retain. As already stated, a woman by the fact of her marriage, obtains no claim whatever to these lands, since they could not be alienated or made over to a different clan, but, upon their owner's death, they pass regularly into his nephew's possession, failing whom, then to one of the previous titular's brothers, or, if there is none living, to his sister or any fellow clansman before designated by him.

As for the private property of the deceased notable, until quite recently his widow could not inherit even the least fraction thereof, nor could she hold her own personal chattels, dress or working implements; they would be ruthlessly snatched away from her, nolens volens, by her late husband's relatives, who would also claim and divide among themselves all of the deceased's goods, even though his orphaned children might thereby suffer. To be exact, however, I must add that in case the deceased was the wife, her former husband, unless he were a notable, would hardly be better treated. Even in these exceptional cases, the survivor would be expected, if only for decency's sake, to make presents to his former wife's relatives.

Adoption is practised among the Dénés; but without any ceremonial formalities, and does not involve the right to succession and heredity thereby usual among most civilized people. Supposing the dead notable to have left no brother or nephew, any other acceptable member of his clan, even his sister would succeed him rather than his adopted son, and then owing to the latter being regarded as belonging to his adopting mother's clan. In this case however, he could claim the right to joint use of the hunting grounds together with the heir who had inherited their real proprietorship.

Landed property is unknown among the Sékanais and Eastern Nah'anes who are governed by father-right. Among them the eldest son, or failing him, a surviving brother succeeds the deceased father of a family as leader of the band while engaged in hunting. On the other hand, although groups of related families ordinarily hunt in the same mountains, streams or lakes as their ancestors, they do not regard them as their exclusive property and will never contest the right of others to hunt or trap thereon.

VII.

As previously stated our Dénés and, as a rule, all races of Aborigines I may say, are very fond of their little ones and. as a consequence, Infanticide has been exceedingly rare among them. Nevertheless, a native custom now happily discontinued, required an exception in cases of twins, one of whom had to be disposed of, as two children at one birth were thought portentous of ill and not much less than a natural monstrosity.

When the period of confinement arrived, the mother would be delivered of her child without the help of a midwife, in any place and under any circumstances—in her lodge or even while travelling, and apparently without any pain. This was the almost invariable experience in former times; but truth obliges me to add that among the Carriers, the most civilized of the four tribes, women have not gained much by the change in their diet and mode of living, inasmuch as painful accouchements and even death, at childbirth, are becoming unhappily of too frequent occurence; still-born children are also more numerous than formerly.

Circumcision is unknown among the Western Dénés, and I have never heard of any practice in favour among any tribe which could be construed as a remnant thereof.

Formerly children were named a short time after their birth by their parents or any person who was believed to have received, while dreaming, supernatural communication as to the name they should be known by. This was usually, except in the case of girls, indicative of some peculiarity, the recalling of which was supposed to bring good luck in hunting. When the child's parents were of rank or influence, he was, at the occasion of one of their ceremonial banquets, held up in the midst of the crowd by his or her maternal grandmother and given a name previously borne by a maternal ancestor.

It is a well known fact, that among the Aborigines of both North and South America, mothers never carry their infants in their arms, but uniformly pack them on their back. Our Dénés are no exception to this rule. The Chilhχotin mothers manufacture as receptacles for their babes, pretty little osier baskets or cradles generally placed in closely fitting deer hide coverings, wherein the infant is tightly laced, much as a little mummy. A birch bark conduit leading to an orifice in the narrow end of the cradle prevents its contents from remaining in an unhealthy condition. In this respect they are decidedly ahead of the Carriers who only use swaddling clothes firmly secured around the infant.

Parental authority, either maternal or paternal, may be correctly qualified as nil or thereabouts, except among the Carriers and Chilhχotins, when it is a question of marriage. The parents are under any circumstances very averse to inflicting punishments on their offspring when young, and cannot well expect to be able to control them when they become full grown.

"Fecund-like an Irishwoman," the female Déné would soon glory in a numerous family were she only to take proper hygienic precautions and wean her child after a reasonable period of suckling. But, even at the present time, unless physically unable to do so, she will nurse it as long as three and four years, sometimes longer! However, were it not for periodical visitations of contagious diseases formerly unknown, the native population would soon increase in a fair ratio, as will be seen by the following table of the births and deaths of this place for the last years. The population was exactly 140 by the last (31st December 1888) census.

TABLE OF THE BIRTHS AND DEATHS AT NAKAZTLI (STUART LAKE).[1]

YEAR.	DEATHS.	BIRTHS.	EXCESS OF DEATHS.	EXCESS OF BIRTHS.
1885.	3	8	0	5
1886.	3	4	0	1
1887.	1	4	0	3
1888.	5	6	0	1
TOTAL.	12	22	0	10

Even more satisfactory data could be recorded of other Carrier villages whose population are in conditions more favorable to natural increase. But I regret to be unable to furnish the reader with vital statistics of the four tribes or any whole tribe. However, I think the above a fair specimen of the average variations in the native population as far as the Carriers are concerned. As for the Chilhχ-otins, it must be admitted that they do not keep abreast of the Carriers in natural increase, whilst it is certain that the Sékanais who used to hunt on this side of the Rocky Mountains have, for the last few years, been declining in numbers at a rather disquieting rate.

VIII.

The staple food of the Western Dénés before the introduction of civilization and its concomitants, may be described under three heads: Fish, Meat and Berries, to which correspond the co-relative pursuits of Fishing, Hunting and Collecting.

Salmon is to the Carrier and Chilhχotin what seal is to the Esquimaux, rice to the Chinaman and wheat to the white man. Give them a large run of salmon, and abundance with its logical associates, rejoicing, feasting and dancing reign in the camp; cut off the supply, and there will be famine and desolation, silence in the village and melancholy in all hearts.

Only two species of salmon are believed to come up as far as Stuart's Lake through the Fraser and its affluents; they are the red

[1] Children who died in the year of their birth are not counted in the above table. It is also but proper to note that, though last year an aggravated form of measles attacked all the children of this village below, and some above, the age of 15, yet, thanks chiefly to the adoption and enforcement of stringent and prudential measures, only two of them who were at the time away with their parents in the woods succumbed to the disease.

fleshed salmon (*Salmo Quinnat*) or suck eye and the large white fleshed salmon (*Salmo proteus* . . .) called *Kes* by the natives. The first species is to them the fish par excellence, and so they call it *thallo*, the water-fish. To catch it, the river is staked across in its whole width, as is practised by the Kamtschadals, and the fish are driven into hurdle corrals terminating in long bottle-shaped baskets from which escape is impossible. To preserve them they also follow the Kamtschadals' method. After having cut the fish open and extracted the spine and vertebræ with the flesh adherent thereto, they dry it beneath a rough pine covered shed, by the action of the sun and air largely aided by the fire and smoke underneath.

In some places where the stream contracts to an insignificant width and in escaping from its rocky embankment produces a fall deep enough to temporarily impede the salmon's course upwards, the Carriers simply bridge the fall over and with bark ropes, suspend therefrom a sort of lattice, seven or eight feet wide, the lower extremity of which is curved up like a pot-hanger. When the fish attempts to jump over the fall, he strikes the lattice barrier and drops back into the basket-like bottom.

To get the *Kes* or white fleshed salmon which is not so gregarious, the Carriers use a bone harpoon of a somewhat unique pattern of which figure I will give a correct idea. Standing on rocks or light scaffolding projecting in the river—they spy the fish as it winds its way up stream and spear it with said harpoon fastened for the purpose to a shaft 12 or 15 feet long. In shallow streams, they cautiously wade in the water and dexterously launch their weapon at the fish, thereby securing for it increased velocity and additional length of reach. Instead of the harpoon the Chilhχotins employ a double dart made of mountain sheep's horn (figure 3.) which, when it fastens in the flesh of the salmon, detaches itself from the forked shaft to which it is securely tied by a plaited raw-hide line.

They also obtain small fish, such as trout, white fish, carp, késœl (a small species of salmonidæ), etc., by means of nets which, when thoroughly of aboriginal manufacture, are made of the spun fibre of nettle, red willow bark or of a semiligneous plant they call hwonœth'a, the *Epilobium angusti florium* of Botanists.

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When engaged in the salmon fishing they ordinarily congregate at the most suitable place near their respective villages in order to make and repair in common the barriere or wood pole staking across the stream while the "*kuntzi*" or cylindrical baskets are individually set by heads of families in the place assigned them by traditional right. In the same way when trout fishing is conducted on a large scale, as is usual when in the fall of the year, they gather their winter supply, each family or aggregate of homogeneous families, has its own particular shot in the rivers or in the vicinity of islands in the lakes from which they are not at liberty to wander in search of a better position.

Fishing in the winter is a rather uncomfortable occupation. Having previously cut a hole in the ice of about one foot in diameter[1] our Déné stretches himself thereover on the frozen surface. He then holds up with the left hand a small stick to which is suspended bone imitations of fry (figure 4.) which he gently oscillates in the water, so as to give them a life like appearance. He will patiently wait well wrapped up in his blanket for the larger fish to bite, even though it may be 30° or more below zero of Fahrenheit. If fortune favours him, he speedily spears his fish with the bone harpoon already spoken of, which in this case is only four times larger than that of figure 2, and fixed in a short handle.

A more interesting mode of fishing is when, during the cool spring nights, the Carriers lazily glide over their country lakes carrying in their canoes flaming pine torches which have the effect of attracting fish of every description, and by dazzling and, as it were, charming them, render them an easy prey to the harpoon.

The Sékanais disdain fish of any kind and regard fishing as a degrading occupation unworthy of a hunter. They live almost entirely on moose, cariboo, bear, marmot or beaver meat with lynx and rabbits in their season.

IX.

Before the North West Company's advent in the country, there was very little fur-hunting done save what was indispensable to the family's subsistence and clothing, and even then among the two

[1] Formerly this was done by means of heated stones.

most southern tribes, it was done only in summer time. For, strange as it may appear, before Sir Alexander MacKenzie's discovery of New Caledonia in 1793, snow shoes were unknown except among the Sékanais and Nah'anés. Locomotion among the Western Dénés is ordinarily by walking in very narrow paths though the Chilhχotins and Southern Carriers now travel not unfrequently on horseback. More commonly however, the Carriers utilize as public high-ways the numerous lakes which dot their country, whether it be summer or winter time. They use "dug-out" canoes made of the hollowed out trunk of a large cotton-wood tree (*Abies subalpina*). There is no artistic merit in their design, which is of a rather rough description, for we must not forget that "dug-outs" are among them a recent importation from the East.[1] In the beginning of this century they used only birch bark canoes.

Another mode of travelling, proper to the cold season, is by means of light toboggans or sleds drawn by three or four dogs trotting along in Indian file. These animals (which are now of different breeds) are very serviceable to the natives; for, even during the summer, when families are en route for their hunting grounds, their canine companions are compelled to assist the women in packing part of their master's baggage, firmly secured with lines to their sides.

The chief object of our Dénés' pursuit when hunting is beaver. Since they have learned the commercial value of fur, they have waged such a constant war on this valuable animal that he is practically and rapidly verging towards ultimate extinction. It is during the winter months, as well as after the opening of the spring, that beaver hunting is practised on the most extensive scale. Once they have found his lodge, an indispensable preliminary to secure his capture is to discover the exact location of his path or trail under ice. It appears that he follows well marked routes when swimming from, or returning to, his winter quarters. These our Dénés easily find out by sounding the ice in different directions with cariboo horns. Their well exercised ears readily discover by a peculiar resonance of the ice where the rodent's usual path lies. So, at a given point, they cut a

1 Some sixty or seventy years ago, a party of Iroquois having crossed the Rocky Mountains reached Lake Tatlh'a in two wooden canoes which at once excited the curiosity and covetousness of a band of Carriers who killed the strangers for the sake of their canoes. These having been brought here (Stuart's Lake) served as models for the building of the first home made "dug-outs.

hole wherein they set their babiche beaver net, taking care to attach thereto a switch—the chief end of which, issuing from the water, is provided with several small bells.[1] Then the hunter (should I not say the fisher?) proceeds to demolish the beaver's lodge, in order to drive him off. Should the game not be found there, the same operation is repeated at his adjoining provision store. When the undulations of the water tell of his presence therein, he is frightened away to where the net is set. Supposing that the beaver is swifter than his hunter and reaches the net before the latter, the efforts he will make to extricate himself therefrom will agitate the small bells before mentioned, and the hunter will immediately make for the hole and draw him out before he has time to cut himself clear of the net.

In the spring—besides occasional shooting—spearing and trapping are the two modes adopted in catching the beaver. To spear him, they employ a bone barbed harpoon, such as that delineated in figure 5 which, being securely fastened to a long shaft, is launched at the game from a distance to ensure greater speed and impetus to the weapon.

When trapping they resort to no remarkable device save that, with the object of attracting the beaver, they dilute the mud contiguous to the steel trap in one of the beaver's favorite haunts, with pulverized castorum which they keep in decanter-like birch bark bottles, figure 6.

More nomadic game such as lynx, martens, fishers, etc., are captured by means of snares in their most beaten paths.[2] The larger game—bears, moose and cariboo, etc., are usually chased with dogs, often for a full day at a time before they are brought to bay and shot. Bears are also frequently taken in snares.

The Sékanais, owing to the peculiar topography of their country, hunt cariboo on a larger scale, and with more satisfactory results. They previously set in a continuous line 40 or 50 moose hide snares in suitable defiles or passes in the mountains frequented by the animals. Two of the most active hunters are then deputed to watch at either end of the line, after which the hunters, who usually number

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1 These have replaced the beaver nails and pebbles of former times.

2 The larger proportion, however, of fishers and martens are taken by means of wooden fall traps.

fifteen or more, drive the band of deer or cariboo to where the snares are set and, by loud shouting and firing of guns, they scare and thereby force the reluctant game to pass through the noose which at once contracts around their necks. The deer immediately scamper away with the moveable sticks, to which the snares are attached, and which, being soon caught among fallen or standing trees or other obstacles, cause the caught animal to stop suddenly with the result of being strangled to death in a short time.

Besides the aforesaid game, which is indigenous to the country occupied by the four tribes in question, every recurring spring and fall bring the Carriers large numbers of geese and many varieties of ducks to diversify their daily diet. For a couple of weeks or more, there is shooting in almost every point of the compass and generally not without effect. As for grebes which every spring gather in very large numbers at the outlet of the lakes and more particularly of this (Stuart's) lake, a more economic plan is acted on to effect their capture. Taking advantage of the fact that these water fowl are very gregarious and will seldom migrate northwards before the lake is free from ice, the natives set common fish nets on the surface of the water and, manning eight to ten canoes at a time, they surround and drive them into the nets. This is a very exciting exercise and at the same time prolific of good results, as a catch of a hundred head at a single drawing of the net is not deemed very marvellous.

The grebes having been stripped of their feathers, their fat is extracted when raw and converted into cakes of more or less consistency, part of which is called in requisition from time to time to do duty as "*piment*" to season their preserved berries.

X.

The Dénés find a valuable resource in the various species of berries which yearly ripen in profusion in almost every part of their immense forests. Conspicuous among them, either by its abundance or its property of long keeping, and its consequent value as an addition to the native stores of winter supplies, is the service-berry (*Amelauchier alnifolia*). Indeed the Carriers often designate it by the simple appellation of *mi*, that is the fruit. Every fall, the women gather large quantities of them in birch bark baskets. These berries are preserved either sun-dried or compressed into thin cakes somewhat resembling large flat plugs of tobacco. This is done by a process which, if primitive, is not the less complicated. When the fruit has been collected in sufficient quantities, they build on the ground a sort of large boiling vessel with spruce bark supported by sticks driven into the soil. This being filled with service-berries, they throw in heated stones which in a few moments, will have the double effect of boiling and pressing down the fruit whose juice escapes through a narrow conduit at the bottom side of the boiler into an adjoining flat vessel also made of the same material. When the liquid is thus all extracted, the residue of the larger vessel is thoroughly kneaded; after which it is spread out in thin layers on willow hurdles previously covered with *epilobium* leaves and then exposed to the action of the sun and air. By frequently sprinkling the residue with the juice of the berry it coagulates into large cakes of almost uniform thickness. These when thoroughly prepared will keep for years, and when sprinkled over with a little sugar, it is of tempting succulency even to others than Indians.

They also treat in about the same way the *yenthœmi* (*Vaccinium uliginosum*, bog bill-berry), a species of small blue-berry, very sweet and juicy when fresh; but these they boil in common kettles and spread the jam on small hurdles without having previously extracted the juice. Several other species of berries which it is not necessary to enumerate are also preserved in a similar manner.

Another welcome addition to the Dénés' larder is the *Kœnnih* or *cambium* layer of the scrub pine (*P. contorta*). This they get at by barking the tree with a cariboo horn or shoot thereof (figure 7.) and then scraping off the cambium in thin ribbon like shavings which, after undergoing the usual drying process, will retain for quite a time much of its original freshness, although indubitably savouring of gum, or perhaps owing to that flavour, it is considered very wholesome. They also eat the growing shoots of the willow herb, (*Epilobium heracleum*) and other plants indigenous to their country.

Besides the above mentioned berries and economic plants, many roots containing more or less starch, were formerly, and are still to a great extent, sought after, dried and stowed away. The Chilhχotins and Southern Carriers have two species of potato-like tubers, identical in nature and taste, though differing in shape and name. One (*esrouh* in Chilhχotin) is elongated and closely resembles a diminutive "lady-finger" potato. The other is spheroidal and called *suntî* by the Chilhχotins. Both kinds are dug out by the women with T shaped sticks and dried in large quantities. These edible roots are not found in the Sékanais' nor in the greater part of the Carriers' territory. But the latter possess a substitute in the root of a species of fern not so plentiful, but of a larger size. They call it *'ah*. It is not dried but eaten fresh and baked *à l'étouffée* in this wise: The natives dig out a hole about three feet in diameter in the ground, pave its bottom with heated stones over which they strew chips of alder bark, and then fill it up with the roots. The whole is then covered with earth and the roots will be ready for the table (or rather the mat) ten or twelve hours later, that is, when entirely cooled down. They claim that this root when thus prepared is really most excellent and it is greatly relished. They also eat the esculent bulb of a kind of reddish lily (*Tsachœn*[1]).

It is almost needless to mention the fact that none of the Déné tribes originally cultivated the soil. Of late years, however, the Chilhχotins and Carriers have made laudable efforts to raise potatoes and a few vegetable roots wherever practicable. The former, whose land and climate are more adaptable to agriculture, now reap tolerably good wheat crops. They also possess large bands of cayouse horses which graze annually on the famous bunch grass of their extensive table-lands. As for the Nah'anés and Sékanais as a rule, they know horses only by name (*Chicho*, big dog) and have never yet grown a single potato.

XI.

A paper, however imperfect, on the Sociology of Indian tribes would hardly be complete without at least a reference to their arts and industries. As these were not of a multifarious nature among our Dénés, I shall be rather short on that head. Besides, I have already, in several instances, touched upon some of their industries,

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1 This is the *Erythronium Esculentum* which, according to Lapèrouse and other travellers, the Kamtschadals and the Yenissei Tartars so greatly relish.

and here I take the liberty to refer the reader to what I have said of their costumes, their habitations, the implements they use in hunting and fishing, and their divers methods of preserving berries and edible roots.

The Carriers who, since the advent of the whites, have proved to be the most amenable to civilization, of the four tribes treated of may be said to have been formerly the least industrious. Among them we find no trace of basket work of any kind, and they formerly imported from the coast some of the most useful of their working implements such as axes and adzes. Owing to the absence of mountain goat in their country, they also depended upon the Sékanais and the Atnas for their supply of spoons and other household utensils which, among the Aborigines, are usually manufactured from the horns of that animal.

Birch bark was substituted among them for willow basket work. They employed it in making vessels or dishes of any size and shape; the fibrous roots of spruce split in four parts was used in lieu of thread. One kind of these vessels, remarkable by the absence of any seam (the bark being simply folded up on its four corners and so retained by a split encircling switch) did service as a kettle or boiler. Therein they boiled meat or roots as they now do in tin and copper kettles, but with the difference that they had to keep it away from the flames. They are still loud in their praise of its usefulness as a rapid boiler. On grand occasions, they were replaced by large spruce bark vessels built on the ground or square wooden boxes imported from among the Atnas wherein, when filled with water and meat, heated stones were repeatedly thrown until the meat was boiled.

Instead of bark vessels, the Chilhχotins use spruce root for making neat and sometimes elaborately ornamented baskets and other vessels which are impermeable to water. Indeed one kind, which may contain eight or nine gallons, serves to keep water for household purposes. I regret to be unable to minutely describe their method of weaving the spruce splints, not having any of these baskets in my collection of Indian curiosities, and having neglected to watch their mode of working when stationed among them in years past. I had ample opportunities to do so. However, I am strongly inclined to believe that they are coiled or woven according to the method described and illustrated by Professor O. Mason in the Smithsonian Report for 1884,[1] but with this difference that all those I have seen among the Chilh-χotins are broad-mouthed and wallet-like instead of having the shape of a jar characteristic of the specimen illustrated by the learned Professor.

Another industry more diffused among the Western Dénés is the weaving or knitting of rabbit skins into robes or blankets. They begin the process by cutting each skin with the hair on in one single narrow strip which they knit or rather twist and weave on wooden frames of the required size.

Their mocassins, gloves and mittens are of cariboo or deer skin dressed in this wise: After having subjected the skin when fresh to a slight drying process, they scrape off any particle of flesh or fat adherent thereto with a bear bone chisel-like tool such as that illustrated by figure 8. Then, the hair is removed with a scraper formed of the tibia of a cariboo (figure 9.) after which it is thoroughly rubbed with the brain of the animal and put aside until needed for immediate use. In that event, after having passed a night soaked in cold water, it is subjected to several rinsings in warm water alternating with repeated scrapings until, being quite dry, soft and pliable, it is given the form of a bag and placed over a fire or rather the smoke of vegetable detritus started in a hole in the ground. When it has been thus thoroughly smoked on both sides, it is ready for use.

The same process is followed when tanning or dressing moose skins except that owing to the peculiar tenacity of the hair, a short curved knife is used instead of the bone scraper. Out of these skins they make the bear and cariboo snares mentioned in a previous paragraph. These snares consist simply of babiche-like ropes twisted together into a line which is outwardly protected from moisture by the inner bark of the red willow wrapped around it. The Chilhχotins plait, instead of twisting these lines and thus obtain very neat and strong ropes.

As if conscious of their inferiority as workmen, the Western Dénés made but few attempts at carving. Yet, in some of their

1 Annual Report, etc. Part ii., p. 294. Plate v.

ceremonies they used wooden masks and castanets or rattles which were not devoid of merit as works of art. I have none of these in my possession, and will simply refer the Sociologist to the specimens drawn in Plates vi. and ix. illustrating Mr. G. M. Dawson's monograph of the Kaidah Indians.[1] The masks of our Dénés, minus the ears, were identical in shape with those of the aforesaid Plates, whilst their rattles were only somewhat plainer in design than those used by the Kaidahs.

The Déné knives were ordinarily made of the common arrow-head flint, but those made of beaver teeth were more esteemed.

As already hinted, axes were not home-made, at least among the Carriers, and the few cutting tools then in use among them were in the possession of the notables alone. The *commune vulgus* had recourse to fire in order to cut their firewood and the few slender poles or logs required for the erection of their lodges. With the exception of the Chilhχotins, they did not even know of the elongated stone hammer, formerly so common among other American aborigines.

As for copper they obtained it by barter with Indians from the coast; but its use among them was restricted to the manufacture of trinkets, bracelets and hair-pincers. *Apropos* of copper, the Carriers of some localities have the following legend respecting its discovery and introduction among them. They contend that in times not very remote, all the Indians (themselves among the rest) congregated at a certain point of the sea coast around a tower-like copper mountain, emerging from the midst of the water. Their object was to decide which tribe should become the possessor thereof. When all had united in shouting, the mountain, after a time, began gradually to totter and the Kaidahs who are blessed with big heads and strong voices, caused it to fall on their side. "Thus it was," they add, "that those Indians won or secured the copper mountain, and we have ever since been obliged to have recourse to them for what we require of that metal to make bracelets for our wives and daughters."

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1 Geological Survey of Canada, Reports for 1878-79. Appendix A.

XII.

The only pursuit for which our Déné may be said to have been amply provided with home-made implements was war and its allied occupation, hunting. The offensive weapons in use among them were arrows, spears, lances and *casse-têtes.*

Their arrows were of two kinds: bone and flint. The first were made of the front teeth of the beaver reduced by scraping to the required shape. They were reputed the most effective. Figure 10 represents flint arrow heads of different sizes, forms and material. They are produced here for the sake of comparison with those used by the mound-builders of Illinois and other States of the American Union with which they will be found identical in shape and material, though a distance of at least two thousand miles separates the aborigines who made them. These arrow points are all drawn to the natural size and they are therefore somewhat smaller than those of the mound-builders. The two marked A and B may be described as the typical arrow-heads of the Western Dénés and are of the blackish resonant flint generally used in the fabrication of aboriginal weapons. C and D are composed of a semi-translucent bluish variety of siliceous stone not so common and consequently more prized than the ordinary arrow flint. E represents the most beautiful of all the Déné arrow-heads in my possession. It has been ingeniously chipped from a hard crystalline species of flint, and its form and finish display evidences of, I should say, exceptionally good workmanship. Some are also formed of a whitish siliceous pebble; but the points made therewith are, as a rule, of a rather rough description.

The Dénés likewise used another sort of offensive weapon which they called *Lhthiladinla*, that is, "fixed at the end of the bow." Its name explains its nature. It was of common flint chipped to the shape of figure 11 and sometimes of figure 12. They brought it into requisition when too closely pressed by the enemy to shoot, and used it as a spear. Besides, they possessed also the regular spear or lance of which figure 12 is a reduced representation.

All these weapons were obtained by chipping the flint with a moose molar tooth without any previous blocking. As a rule, these aborigines used only loose pieces of the flint, which were collected for or by the notables, and then handed to the village arrow-smith for reduction to the required size and shape, and, as a finishing process, the edges were generally sharpened by friction on a hard stone.

However, the only really polished stone implement of Déné manufacture was the *ealh* or "*casse tête*" of which figure 13 will give an idea. The specimen thereby illustrated is of a hard granite stone. A variety of that weapon, similar in form, but more elongated (being at least twice as long) was usually made of cariboo horn.

Apart from the common arrows, the Carriers made use of two other varieties of missiles of Sékanais origin. Both kinds were made from Cariboo horns. The first of these called *kachœnkwœlh* (cut arrow) by the Carriers, was awl-like in form and not less than six inches in length. The broader extremity thereof was hollowed out to receive a wooden shaft which served to dart it off from the bow like a common arrow, with this difference however that, when in motion, the horn point detached itself from the shaft. This projectile was deadly and intended only for use against an enemy or for killing large game. To shoot smaller game such as grouse, rabbits, etc., they had recourse to a curiously wrought triple arrow fastened to the shaft similar to that delineated in figure 14.

As defensive weapons they used two kinds of armours and a shield. The latter was oval in form like the Roman clypeus and generally made of closely interwoven branches of *Amelauchier alnifolia*. They gave it the name of *kelathœn* (that which is held with the hand).

While on the war-path, they also wore a kind of armour or cuirass consisting of dried sticks of the same kind of wood, arranged in parallel order and kept together with babiche lines interlaced in several places. This was common to the Kaidahs and other coast Indians. Another sort of armour, indigenous to the Déné nation, was the *pecesta* (wherein one sits). This had the form of a sleeveless tunic falling to the knees so that it afforded protection to the whole body save the head :—in hard fights the Dénés invariably shot kneeling. The armour or cuirass was of moose skin which, when sewn according to the proper pattern, was soaked in water, then repeatedly rubbed on the sandy shores of a stream or lake and dried with the sand and small pebbles adhering thereto, after which it was thoroughly coated with a species of very tenacious glue, the principal ingredient of which was boiled isinglass obtained from the sturgeon. Being again before drying subjected to a thorough rubbing over sand, it received a new coating of the aforesaid glue. When this process had been repeated three or four times, it formed an armour perfectly invulnerable to arrows over the parts which were thus protected.

All these weapons and armours were in use among the Western Dénés, immediately prior, and even for some time subsequent, to the discovery of their country by Sir Alexander MacKenzie's party.[1]

XIII.

It would scarcely be proper to speak of war as an institution obtaining among the pre-historic Western Dénés. Although the various tribes despised and mistrusted each other, general fights were rare enough, and as surprises constituted the main part of their system of warfare, it followed that success was, as a rule, on the side of the assailants. Sometimes the whole population of a village would be massacred in a single night. In that event, the victors would chant their hymn of victory, generally improvised on the spot and composed of the last words uttered by their victims. After their return from the fray, they would also repeat it dancing for several nights in succession. In no instance was scalping resorted to, at least, on this side of the Rockies.

Such general massacres, however, were not of very frequent occur-

1 Abbé E. Petitot in his "*Appendice relatif aux armes de pierre des Indiens arctiques*" presented in 1875 to the Paris Geographical Society states that the Dénés of the Great MacKenzie Basin know only by tradition some of the above described war weapons, as well as the wooden masks spoken of in the previous paragraph. The two most northern tribes of the whole nation, the Loucheux or Kut-chins and the Hares contend, he says, that they formerly dwelt among a powerful nation which oppressed them and whose warriors wore the *peœsta* which he graphically describes without knowing that it was used here but a comparatively short time ago. Would not this be evidence tending to prove that the aforesaid Dénés migrations might have been North-Eastwards instead of Southward as, I think, is commonly believed? The learned Abbé is evidently mistaken when he affirms that none of these defensive weapons were used by the Dénés since their probable arrival on this continent. Because Samuel Hearne and MacKenzie who travelled in time of peace did not actually observe any of these weapons and cuirasses among the natives they visited, it does not follow that they were not used by them when on the war path. Indeed, many of the present older inhabitants of this lake, have seen in actual use all of the arms, offensive or defensive which I have endeavoured to describe.

rence. More commonly (and I should say quite often), the brothers and near relatives of a man whose death was attributed to the secret machinations of a *Tœyén* or medicine-man of a different village, would go armed cap-a-pie and kill the supposed author of their relative's death. As a natural consequence, his co-clansmen would come *en masse* to avenge his murder and then a regular battle would take place, inasmuch as both sides would be prepared for the occasion. The logical result of this was that security was rather precarious and friendly intercourse, even between neighbouring villages, was not as frequent as the short distance separating some of them would lead one to expect.

In no case was a whole tribe found united and, *a fortiori* two allied tribes confederated, against a common enemy. And this leads me to enter upon the subject of the Dénés' social institutions.

I may as well state at once that no form of government, in the strict sense of the term, nor any political organisation of any kind ever existed among them. Not only were the various tribes of the same stock entirely independent of one another, but even no tie of any sort ever connected the different villages of the Carriers, Chilhχ-otins and Western Nah'anés. The clans or gentes outstepped indeed the village limits; but they were social rather than political. For, though a member of anyone of them could claim recognition from any person of the same clan, however distant his village, he owed allegiance to no constituted head thereof.

Authority was represented in each locality by the college of *Tœnezas* or notables which, *mutatis mutandis*, may be compared to the nobility of European nations. Their rank was strictly hereditary and was shared in by their children who were called *œzkezas*. The possible successor to the position however, was only the *tœneza's* eldest maternal nephew, whom he would generally bring up and educate himself in view of his future position. Should he have no such nephew, a younger brother, or failing him, even a maternal niece would regularly succeed him.

The notables were the sole proprietors of the tribe's hunting grounds, and as their name indicates ("the only men" is the nearest equivalent therefor), they were regarded as the only men entitled to be heard upon any topic of interest to the tribe. Theirs was the privilege to use a hereditary name, to which was attached a particular song handed down from generation to generation; to dance first to the tune of said chant; and the privilege also of wearing insignia distinctive of their rank; to be assigned an honorable place in the ceremonial "pot-latches;" and, lastly, the right to pacify belligerents, settle disputes and otherwise exercise some authority in their respective villages.

By "authority" however, I should not be understood as meaning the strict right or power to command with the implicit co-relative of absolute and instantaneous obedience—except when it was a question of territorial rights. As there was scarcely any sanction to their injunctions, and no definite punishment for disregard of the same, it follows that the power of the notables was more persuasive than obligatory. Nevertheless, some instances are related of notables who shot dead fellow villagers, who were unmindful of their orders, without having had to answer "tooth for tooth" for the blood they shed. On the other hand, it was very seldom that their orders were despised. especially if seconded by some influential person—the natives instinctively submit to properly supported authority.

There were more than one of these notables belonging to the same clan and village and they were all of the same rank. It frequently happened indeed that one of them exercised prominent authority in the village, more generally than otherwise on account of his reputed wealth and liberality—but even such notable was more *prior inter pares* than the possessor of the titles and attributes distinctive of the modern chiefs.

This organization was common to all the Western Dénés except the Sékanais and Eastern Nah'anés who pass their lives in incessant peregrinations, at the command of their natural leaders, the eldest among the fathers of the families ordinarily concerting with the whole band.

XIV.

The Dénés of the old stock were generally long lived. As a proof of this, I need only to adduce the fact that last year there died at this place a man who remembered the arrival in this country of Sir Alexander MacKenzie in 1793. Many of the diseases which have since proved so fatal to the aborigines were then unknown. Those which sometimes visited them, had in the vegetable kingdom their known antidotes, the quintessence of which may be comprised in the word "purgative." They possessed also valued astringents in the castorum pods of the beaver and in the roots of heracleum, etc.

When these remedies, joined to the incantations of the "medicine-man" failed and death seemed imminent, the moribund's relatives were hastily summoned around his death bed. Supposing he was a *tœneza* the above mentioned hereditary family song was struck up by some person outside of his clan and was continued by exo-clansmen till he expired, while his relatives would then rend the air with many doleful wailings. As soon as he had passed away, two young men also of a different clan, were deputed to announce the news to the neighbouring villages. All of the people of these places that were fellow-clansmen of the departed notable were then expected to make presents to the messengers as a compensation for their trouble, after which the whole population would turn out in a body and come forward to mourn the defunct *tœneza* around the remains and at the same time console his relatives. To this end, while the deceased co-clansmen were lamenting their loss, a man of another clan would rise from the crowd and commence to dance to the tune of an improvised song. This was intended as a diversion to the mourners' feelings, and, as the strictest point of the Carriers' moral law is "nothing for nothing," the latter would immediately throw at the dancer any object he might intentionally mention in his chant and which thus became his property. This dance and giving away being repeated several times on several consecutive nights, the strangers would, if in winter-time (or even during the summer, if the mourners were not prepared for the occasion) return to their respective villages, and the remains would be provisionally placed at some distance from the habitations under a bark roof-like "shelter" by the side of which the widow would erect for herself and children a small hut of similar form and material.

Thenceforth hers was a miserable lot indeed. From the very moment of her husband's decease to the time (two or three years later) of the final giving away of property in his honor, she was the slave of her brothers-in-law and sisters-in-law, one of whom would at once cut her hair to the roots and take care to renew the operation whenever needed as a badge of the abject condition of her widowhood She was also obliged to wear ragged clothes, and in case she was young and likely to re-marry when the period of mourning ceased, decency constrained her to pollute her face with gum lest her guardians (so they were called) should suspect her of desires unsuited to her condition. Meantime, she would be her master's real factotum and the women especially would endeavour to render her life as unbearable as possible, leaving her no other "privilege" (!) than that of nightly bewailing in as loud tones as she could for her departed husband.

Men who had lost their wives were obliged to undergo the same ordeal, though treated somewhat more humanely than the weaker sex.

When the future successor of the dead notable had succeeded in gathering a goodly amount of dressed moose and other skins and provisions, the inhabitants of all the surrounding villages were invited to witness the cremation of the corpse (such was the way the Carriers and Western Nah'anés disposed of their dead). The funeral pile being kindled in the outskirt of the village by men not belonging to the deceased's clan (who were paid on the spot by the latter's relatives) the widow was obliged by custom to embrace the remains of her late husband even though surrounded by the flames, amidst the howlings and wailings of his fellow-clansmen. When momentarily withdrawn by the bystanders, etiquette demanded from her repeated endeavours to burn herself along with the remains. Supposing she had not been a good wife, she was in many cases jostled by the mourners, and sometimes horribly disfigured with the view to diminish her chances of re-marriage. The cremation over, a bark hut was built on the spot and everybody would retire except the widow who had to dwell there during the period of her bondage. In the evening following the cremation, as a rule, would take place the "pot-latch" according to the rites which shall be described in the next paragraph.

Among the Carriers, the late notable's relations would, on the morrow, while shedding many a dutiful tear, carefully pick up from among the ashes of the pyre, the few remaining charred bones and hand them to the widow, who would, till the time of her liberation from her widow's bondage, constantly pack or carry them in a small satchel. Hence the name (Carriers) of these Indians. Men though reduced to a modified bondage during the mourning period for their wives, had not, however, to submit to this latter formality.

The procedure just described was—barring the ceremonial peculiar to a notable—the same in the case of all ordinary Carriers. But it differed widely among the Sékanais. These Indians, owing to their dislike to fish and their need of securing fresh supplies of meat, could never remain for any length of time at the same place. So, when they thought the death of a sick member of the band was certain to occur in the near future; they simply placed close to him as much provisions as they could spare, and, having erected with coniferous branches a sort of barrier to shelter their path from his gaze (which was considered ominous to the party), they would abandon him to his fate. Should he die before their departure, they would lower his hut down upon and thus cover his remains and start at once for another locality. Supposing the deceased was an influential person dear to the band, they would hollow a kind of coffin out of a large spruce tree and suspend his remains therein, on the forks formed by the branches of two contiguous trees. Some instances are also recounted in which the remains of such persons were closed up in a standing position in the hollow trunk of a large tree while in its natural state. The lid or door of these primitive coffins was usually formed of a split piece of wood which, when strongly laced with long switches of red willow, held it to the trunk of the tree in its original shape.

Bondage consequent upon widowhood was not practised by the Sékanais, nor were the various ceremonies accompanying succession to rank and title observed among them.

XV.[1]

The most inveterate among all the ceremonial customs of the Carriers, one which in some localities has remained proof against prohibitions from both the civil and religious authorities,—is their practice of giving extravagant repasts or "pot-latches" (Chinook word, meaning "giving away") in honor of their dead. When intended to commemorate an untitled person, one banquet suffices, and is the implicitly observed signal for the termination of the mourning and the liberation of the widow from bondage. But when given in honor of a deceased notable and as a visible signal of his nephew or brother's succession to his title and prerogatives, there are no less than six well defined courses successively given by his successor conjointly with his co-clansmen. Owing to the importance attached to these festivals by the natives, and despite the apparent puerility of some of their details, I feel I shall have to speak at some length of each of the six.

1. Supposing that a Tœneza has passed away, the first in the series of banquets given in his honor will take place three or four days after the arrival of the invited or expected strangers and may be repeated for several nights in succession. It is only of secondary importance and is called *Lhiz thœn hanatsœvœlhthih* ("or the taking away from the ashes") which means that the mortal remains are thereby removed from the "fire-place" where they had been lying since the notable's decease. It is given by the latter's future successor according to the following ceremonial which is strictly adhered to in the case of all subsequent or any banquets.

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1 As prefatory to this paragraph, I would beg leave to remind the comparative Sociologist of the ostentatious banquets in vogue among most of the ancient people, Assyrians, Persians, Egyptians, Greeks of the heroic period, etc., as evinced by the sacred Books, Genesis xlii; Judith xii; Esther i; Daniel v; Homer's Iliad and Odyssey (passim), etc. The student of antiquity will also remember that in such repasts it was customary to give each guest his separate portion and to show one's regard for any person by helping him to a larger share than the other guests. In this manner Joseph treated his younger brother Benjamin, (Genesis xliii). So did Agamemnon act towards Ajax and Eumœus to Ulysses, (Iliad, book vii and Odyssey, xiv.)

In more recent times, we see the same custom prevailing among the Mongols who have many traits of resemblance both moral and physical with our Dénés. Thus when the princes and generals of their vast empire assembled in 1245 to elect a successor to Ogotai Khan, eating and drinking to excess formed a conspicuous part of the proceedings. Then also "every day they put on garments of a different colour distributed by the sovereign," says Plano Carpini, an eye witness. Again, "This ceremony (that of enthronisation) was followed by an enormous banquet . . . This feast was renewed every day for seven days in succession." In Huc's Christianity in China, Tartary etc." Volume i, page 146 and 148.

Everything being ready in one of the largest houses, the aspirant notable's maternal nephew (that is, his own presumptive heir) proceeds to call in every member of any but his uncle's clan, which he accomplishes by striking the ground with a ceremonial staff at the feet of the person thus invited without uttering a word. The future notable's fellow clansmen being reputed co-invitators with him go in of themselves. The *commune vulgus* being assembled in the lodge (before the notables who though the first invited are the last to come), the latter are introduced by the master of ceremonies who, pointing with his staff to their respective places (which is strictly defined by traditional usage), calls them individually by their hereditary names [1] repeating in loud tones for instance "Qi! qi! Rahul, qi! qi!" The interjections accompanying the proper name (Rahul) are of ancient origin and never used in common parlance. Then begins the repast or rather distribution of victuals, double or treble portions being allowed the notables present, the whole accompanied with copious libations of liquid bear's grease for the distribution of which ladles and spoons manufactured from the horns of the mountain goat, similar to those represented by figure 16, are brought into requisition. At the termination of this banquet, the aspirant notable tears a few dressed skins of leather in long strips of the width necessary to make mocassins, which he distributes to the assistants, taking care to give double size to those intended for the notables. This last distribution is in the Carrier's estimation the most important part of the whole proceedings, inasmuch as it is regarded as paramount to the atoning for the notable's death, and is practised whenever one wants to wipe out shame or remove grief.[2]

2. The second "potlatch" is given when a new supply of eatables and skins has been collected, and is in every respect but its aim identical with the first. It is intended as a celebration in honor of the deposition of the remains of the late Tœneza in the appointed place of respect in the house, even though said remains may have been previously cremated. So far, his successor is considered merely as an aspirant to his late uncle's title.

1 This is never done except on special occasions, every notable having besides, at least, one other name.

2 Sometimes whole suits of dress are thus publicly given away.

3. *Tsœz tœzdillih,* ("the imposition of feather down.") This is one of the most important of the whole series and is tantamount to the aspirant successor's elevation to the rank of notable. It is given only after an interval of long and hard hunting by himself and his whole clan. Prior to the great banquet and distribution, a sufficient number of exo-clansmen, erect according to his directions, a rectangular fencing around the spot where his uncle's remains were cremated, taking their daily meals in a trough shaped carved vessel, the exclusive property of leading notables.[1] Then follows the distribution of eatables, of which the greater the quantity, the more powerful will be the influence of the future Tœneza. The population of all the surrounding, and sometimes very distant villages, is usually convoked for this grand festival which marks the red letter day *par excellence* in the Carrier's Calendar.

When everybody but himself and fellow clansmen have retired, the skins they are going to give away next day are counted and they agree among themselves as to those who shall be the chief recipients; after which emerging in Indian file, they proceed to place swan's down on the heads of those they intend to honor on the morrow. Etiquette requires that nobody be excepted from this ceremony. The persons thus marked out then give them a substantial supper.

Next day witnesses the aspirant notable's confirmation as successor to his uncle's rank. In the morning all the people are assembled in the usual way in the largest lodge or house in the village wherein the aspirant having on none but the most indispensable vestments, stands silent facing the pile of dressed skins which he is about to give away. After a short time his assistant takes swan's down from a small satchel made of the skin of that bird's neck and sprinkles it slightly on his hair. This being done, he takes one of the piled up skins, and, having previously extended it to the general gaze, puts it on the new notable's shoulders as one would a mantle; which ceremony he repeats in connection with every other skin taking care that all present have an opportunity afforded them of counting the same. At the very instant that he places the first skin on the new Tœneza's shoulders, one of his exo-clansmen intones the late notable's chant

1 These were given the form of a salmon or other totem animal of their possessor, and were similar to the carved troughs used in the Solomon Islands to prepare and pound food, cf. Proceedings of the London, (England) Royal Geographical Society, June, 1888, page 361.

(for which service he receives immediately a whole skin) which is taken up by the entire assembly except the latter's relatives who commence at once a strain of deafening lamentations. The new dignitary being now fairly laden with multiple mantles, they are then taken from his shoulders. This is the signal for the cessation of the singing. After this, all the dutiful tears are dried up as if by enchantment, whereupon the master of ceremonies blows swan's down on his head by means of repeated insufflations, thereby producing white undulating clouds significative of his new dignity; then he helps the notable to tear and distribute the whole pile of smoke dressed skins, not forgetting to set aside double sized strips for any absent notables. Henceforth, he is a real and accepted tœneza; but to enjoy all the prerogatives of his rank, he will have to make three more distributions.

4. *Natlh'adita* ("he sits down"). This is equivalent to the notable's enthroning. It is a distribution of clothes or skins, intended as a fee for the privilege of sitting at the traditional place of his predecessor, and is made on the occasion of his assistance at the next banquet given by a notable of a different clan. When entering the festival lodge the new Tœneza is followed by his wife packing the skins he is about to distribute. These are extended in a line by young men so that they may be duly counted by the crowd. "These he will give away on the occasion of his Enthronisation," will shout one of them, to which the crowd will answer in loud acclamations: *Sœmotget! Sœmotget!* words of ancient origin indicative of admiration and used only in this connection. After the distribution, the notable sits on his appointed seat of honor.

5. Now, should it become known that the following summer would witness the giving of the last of the series of banquets commemorative of his predecessor's death, on a certain arranged winter evening, while the new notable is sitting together with a band of young men in his house with closed doors, all his fellow notables and villagers congregate outside, and, at a given signal, the whole crowd breaks into vociferous applause upon which a song is struck up within (accompanied by a tambourine) by the aforesaid band of young men as singers. Then a tœneza wearing the insignia of his rank, the wig and ceremonial apron, will dance while keeping profoundly bowing

to the host and singers, and without interrupting his dance he will proceed to his place near the master of the lodge. All the notables present will then follow in their turn observing the same ceremonial. Should there be a female notable among them she will have precedence over any untitled member of the crowd. Instead of a wig, she wears a lofty crown-like head-dress,[1] adorned with strips of her totem-animal's skin and other ornaments. Her ceremonial apron is also much shorter than that of the male notables which falls to the feet and has the lower edge fringed with hanging beaver claws or small pebbles which during his dance produce a continual rattling sound.[2] She does not dance however, on entering the house; but bowing low keeps time with her head-dress to all the sounds of the tambourine. When all the assistants are gathered around the notable thus honored, he serves them a frugal supper after which they disperse to their respective homes.

6. This is the last and most important of all the festivals intended to commemorate the late notable's death. Previous to its celebration, people of the surrounding villages are invited to construct a new lodge for his successor, while the notables carve in the woods, away from the eyes of the curious, two wooden masks representing respectively the face of a man and of a woman. Meantime the most skilled workmen of the village carve out of a large cotton-wood tree two huge toads or grouse according to the clan to which the new *Tœneza* belongs. These different works have to be completed on the eve of the great banquet when the population of distant villages have congregated for the occasion. In the night when all are assembled in the new house, the notables who made the masks, concealed behind a screen formed by skin curtains, adjust them to the face of two young men whose persons are carefully concealed by blankets. After this the curtain is lifted up and the notables proceed to the centre of the assembly and commence—attired in their insignia—to dance in a group whilst the masked jesters make with their heads all sorts of comical movements. The chant used on this occasion has a peculiar

1 So did the Mongol women of the Middle Ages, according to William of Rubruck: "The costume of the women," he says, "does not differ greatly from that of the men, except that they wear a very lofty 'head-dress.'" *Relation des Voyages en Tartarie, Bergeron.*

2 This peculiarity reminds us of the *mepil* of the Jewish high priest, the most noticeable part of which was its fringe composed of little bells of gold alternating with coloured pomgranates. Exodus xxviii, 31 and 34.

rhythm and time. The dance over, the notables retreat behind the curtain which falls and hides them from view.

A new mask is added on the occasion of every subsequent funeral banquet given by the same notable, so that the number of jesters present at these festivities indicates the number of banquets given by him since he succeeded his late uncle.

Next day, in the morning, takes place the grand banquet, which sometimes lasts a whole day. On this occasion, the late tœneza's personal goods which to this day have remained untouched, are exhibited one after the other in full view of the crowd and amidst the lamentations of his relatives, care being taken not to name the deceased. Then also his charred bones, which so far have been daily packed by his widow, are suspended within the satchel to the rafters of the new house, after which, in the course of distributing eatables, his successor rubs his greasy hands on the widow's hair and covering her with a new blanket which he presents to her, says: "I hereby liberate thee; so thou mayest return to thy kindred and marry if thou pleasest."

On the morrow, prior to the general distribution of clothes and skins, not to let the medicine-men pass unnoticed amidst such solemnities, and to ensure their good will against any malady or ill which may befall the assembly, they are requested to make their preventive "medicine." With this end in view, four or five of the most famous capture (?) while dancing the soul or shade of each assistant and restore it to his head with solemn insufflations.

A peculiarity of the final distribution is that the *totem*, toad or grouse, having been placed at either side of the door, each new comer belonging to another clan than that of the host is bound by custom to present said totem with clothes and hunting implements which thereby become the new notable's property. Part of these he will, after the ceremony, divide among his fellow clansmen, keeping for himself only what he thinks he will be able to re-fund by offering to the totem of his present guests an exact equivalent on the occasion of the next banquet given by them. This will be observed by all the partakers of these so-called presents, which are really nothing but an exchange of property from clan to clan.

Then will follow the grand distribution of skins and clothes, after which the host will divide among his predecessor's relatives, all the latter's personal property and even present them with his own wearing apparel, reducing himself to a state of almost perfect nakedness. Then as a finale, the deceased's remains will be deposited in a box suspended on a carved wood column such as (though generally more ornamented than) those delineated in figure 15.[1]

XVI.

The above mentioned and any other dances were usually performed by a single person—generally a man. He would usually dance in a kind of jumping way, making with hands and head occasional gestures

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[1] The Government Reports on Indian Affairs do not distinguish the different kinds of pot-latch but state many facts from which one may form an idea of the magnitude of these feasts. In November, 1883, at Lacksem, Valde's Island, B.C., a pot-latch was held which lasted a week and at which more than 2000 Indians and half-breeds were present. The entertaining tribe's savings of several years are said to have been given away, one young man contributing goods to the value of \$400, (Report, 1884, p. 97). A Chief named Lohah in 1885 gave a pot-latch to about 2500 persons of different tribes at the village of Comeakin, B.C. He feasted his guests for over a month, then sent them away with his accumulated savings of the five previous years. 3000 Indians and half-breeds partook of a pot-latch at the Quamichean Agency, B.C., in June, 1886. It lasted a fortnight and impoverished the entertainers. The goods usually distributed consist of skins, horses, personal clothing, guns, canoes, blankets and in late years money. On one occasion in 1876 we read of \$15,000 worth being distributed in presents, chiefly blankets which among the Indians west of the Rockies was then the standard of value (Report, 1876, p. 36). In another case the gifts consisted mainly of 134 sacks of flour, 140 pairs of blankets, apples and provisions=\$700.

For some years the government has been trying to put down the pot-latch. The reasons assigned are: first, that it is wasteful in the extreme and impoverishes the givers; second, that by collecting together a large number of persons who are under no rule and are given to excess, it forms a danger to the public peace. At length an act was passed and was brought into force by proclamation of the 1st of January, 1885. It abolishes the pot-latch and makes its celebration a misdemeanour. It deals in a similar manner with another feast called *Tamanawas*. We have no detailed account of it such as Mr. Morice gives us of the pot-latch, but the *Tamanawas* would seem to consist of a Medicine Dance somewhat like the Thirst Dance of the North-West Crees and to be accompanied with lacerations. The more distant tribes of British Columbia preserve their ancient customs, and the older chiefs in places where civilization has penetrated defend their practices by arguments such as these:—"We have laboured for the goods, they are ours; why may we not give them to our friends? The white man has his feasts, his theatres, his churches. He is not hindered. We have only the pot-latch and dances for seasons of joy and sorrow, for entertainment and amusement. The pot-latch is long established, it relieves the agony of the deceased's surviving kindred and calls forth the sympathy of friends and neighbours. The presents ensure us a hearty welcome wherever we travel and are themselves but a return in kind for others which we received at other times. Is it not unjust to prohibit so ancient and so beneficial a custom?" Nevertheless, the pot-latch seems in a fair way towards extinction. I should mention that Mr. Lomas of the Cowichan Agency has been trying to convert the pot-latch into an Annual Industrial Exhibition, and has met with considerable success.

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meant as an illustration of the chant executed by the crowd who kept beating time by clapping their hands one against the other. Besides, on grand occasions Indian tambourines were also used as an accompaniment to the singing.

Religious dances were unknown. The nearest approach thereto was the dance performed on the occasion of an eclipse. The Dénés believed this phenomenon to be due to the presence of gale or scab on the sun or moon. To preserve themselves from that dread malady and hasten the luminary's re-appearance (or cure), they would cautiously go out of their habitations, avoiding noise and loud talk, and then, ranging themselves one behind the other, they would start a kind of propitiatory dance to this effect: bending under an imaginary weight though carrying only an empty bark vessel, they would strike in cadence their right thigh, repeating at the same time in piteous tones "*Hanintih; ge!*" "Come back therefrom."

On such occasions the Chilhχotins neither danced nor sang; but among them men and women having their clothes tucked up as when they travel and leaning on a staff as if heavily laden, they walked in a circle till the end of the eclipse.

Another observance formerly in vogue among the Carriers was the *the'tsœlrwœs* (precipitate exit). This was analogous in character to, if not identical with, a practice of which we read as having existed among certain European and Asiatic nations, the *Lycanthropia* of the ancients, the *Loupgarou* of France, the Persian *Ghoule* the Teutonic *Wehr-wolf*; all probably the result of a simulated ecstacy of superstitious origin. In the case in question and on the occasion of a large gathering of aborigines, a band of men would suddenly run out of a lodge and, simulating madness, would, amidst wild yells and incoherent songs, make frantic efforts to bite the passers-by or, failing in this, they would seize upon a dog and devour him on the spot.

Ordinary amusements consisted of the *nœzaz*, or throwing of long polished sticks on the snow, the distance reached determining the winner; and gambling which is of two kinds: *nœta* and *alté*. The first game which greatly resembles the *tsi-mei* of the Chinese[1] is played by a group of natives one of whom concealing in his hands

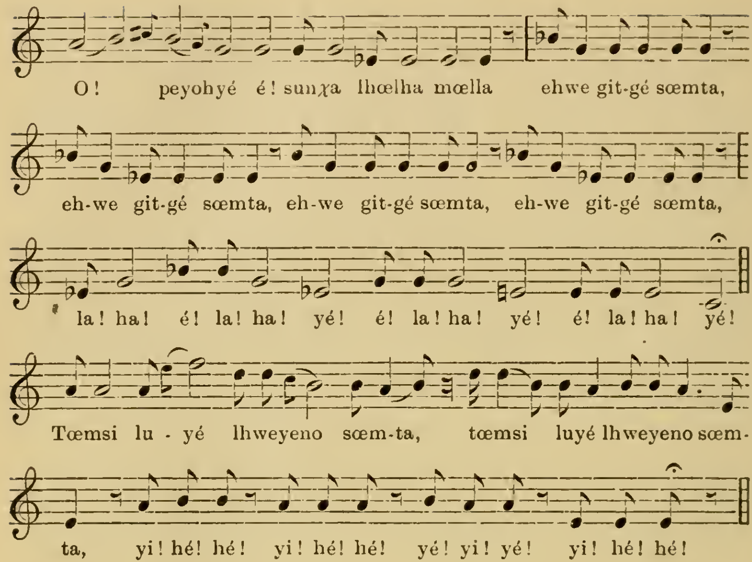
1 L' Empire Chinois, par l' abbé Huc.

two small sticks or bones differently carved keeps jerking his arms and body to the tune of a particular song, so that he may give as little indication as possible to the rival players as to which hand contains the winning stick. A tambourine or some appropriate substitute, such as a tin-pan, is continually beaten as an accompaniment to the game.

This is not the case with *alté* which is played (or rather was played, for it has fallen into desuetude) silently by only two partners with a multitude of small sticks and which is too complicated to be described here. A few other games were also played formerly, but not so commonly as those just referred to, so that I deem it unnecessary to do more than simply mention the fact.

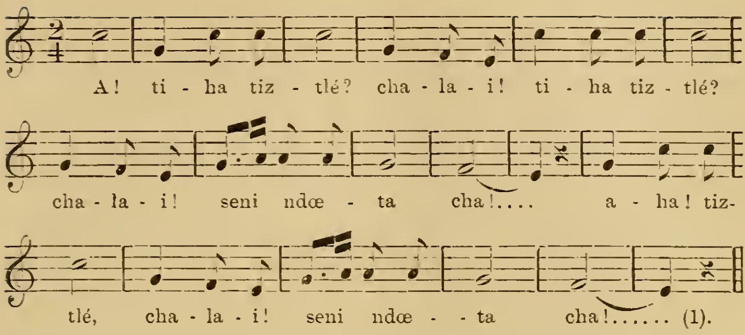
The chants accompanying these games and dances were, musically speaking, of the poorest description,—aboriginal music being of a very primitive character. They are generally composed either of a single musical phrase repeated *ad infinitum* or of a few musical phrases without co-relation or cohesion undergoing the same sempiternal repetitions.

These chants may be classified under two heads: those with ancient words and those with modern or no words. The first are those traditional songs which, among the Carriers, are the exclusive appanage of the notables and are transmitted from generation to generation. They claim that the words thereof are remnants of their primitive language. They are at present quite unintelligible. Although each of their component sounds is familiar with the Dénés' vocabulary, yet a close comparison with the actual Carrier, Chilhχotin, Sékanais and three Eastern dialects of which I have complete dictionaries before me, fails to give a clue as to their original meaning. This circumstance is of itself strong evidence in favour of the high antiquity of the "melodies," as well as of the words: for since they have preserved the latter with such scrupulous care amidst the gradual variations of their language, I do not see why they should not be supposed to have also taken particular pains not to change the former. The two specimens given here will explain themselves better than could an extended description from me. Let me however remark that aboriginal rhythm is so different from ours that it is impossible to set it to time.



Following are two other examples of native music, the first of which is the "melody" used in playing *nœta*, and the second, one of the Dénés' pastime songs which, as will be seen, are little more than polished yells, both are without words.

In fine, I give below for the sake of comparison the great "*barcarolle*" or boating song of the Carriers. It is of modern though Déné origin, and this circumstance will explain the fact that in spite of the irregularity of the finale, both rhythm and melody are more consonant with our musical ideas and evince intercourse with white singers.



XVII.

Apart from the superstitious dances of which mention has been made in the preceding paragraph, the Western Dénés observed no religious ceremonies. They made no sacrifices, worshipped no Deity and had no definite *cultus*, unless we dignify with that name the shamanism of the Northern Asiatic races which obtained among them. True, they vaguely believed in a kind of impersonal and undefined Divinity, not quite pantheistic; but rather more so than individual, almost co-essential with the celestial forces, the cause efficient of rain and snow, winds and other firmamental phenomena. They called it *Yuttœre* ("that which is on high") in Carrier. But they did not worship this power—they rather feared it and endeavoured to get out of its reach, or, when this was impossible, to propitiate it and the spirits who were supposed to obey it, with the help and through the incantations of the *nelhgèn* or conjuror. This shaman was credited, when exercising his mysterious art, with the power of controlling the coming or departing of evil spirits. Even when not actually conjuring, he was believed to be able to kill by his mere will any objectionable person. His services were called into requisition in time of famine, to prevent tempests, procure favorable winds, hasten the arrival of salmon and ensure its abundance; but more generally in case of sickness which they believed to be concrete (not unlike the microbes of modern chemists) and always due to the presence or ill will of spirits.

[1] "A ! how is it that she goes like a fish, chalai ! my mind is sick, cha, etc., etc

When worked into a state of trance by personal exertions, the singing of his own magic chant, the incessant beating of drums and the rattling of the castanet with which he accompanied his dance, the shaman would declare himself to have fallen under the control of his familiar genius. Therefore, pointing its image (fish, bird, mammal, etc.) in the direction of the patient, he would dance towards him and drop on his head his spirit's representatives which (eye witnesses assure me) would at once fade away. Then sucking that part of the body which most ached, he would take out of his mouth either a thorn, a bug, a toad, etc., which he would exhibit as the cause of the complaint. Then, after a momentary recess from the patient he would dance back to him and lo! the image of his genius would come back of itself to his outstretched arms, and the patient would shortly feel all right.

In desperate cases, when the patient had already lost consciousness and death seemed to be fast approaching, the conjuror, if he was at all acquainted with his art, would. in the course of singing and dancing, suddenly fall apparently senseless to the ground and feigning sleep, he would dream and be supposed to have gone to the regions of the ghosts. In badly articulated words he would be heard beseeching the moribund's shade or self to return to his body, for the sake of his friends, etc.; after some little time he would awaken at the proper moment, and cautiously and noiselessly take said shade in the hollow of his hands, and with repeated insufflations restore it to the patient's head. Was this really an effect of an over excited imagination on the part of a half conscious subject, or was it due to preternatural forces? Be this as it may, the elderly men all assure me that in such cases the moribund immediately revived.

To the proper understanding of the foregoing, I must say a word concerning aboriginal psychology. The Dénés believed man to be vivified by a soul which to them was nothing else than his natural warmth (*nezœl*) and which as such died with the body. But besides this, they credited every human being—indeed many still hold to that belief—with the possession of another self or shade (*netsin*) which was invisible as long as he enjoyed good health, but appeared wandering about in one form or another whenever disease or death was imminent. In order therefore to prevent either the one or the other, their endeavours would be directed towards catching it back. With this end in view, they would hang up in the evening the patient's mocassins previously stuffed with feather down, and next morning, should the down be warm, they would with great care and silence put them back on his feet with his supposed shade therein. Whenever the moribund lay unconscious they believed his double to have departed for the land of the shades or spirits, though after death it received another name (*nezul*) and was then supposed to be the impalpable form of the man's previous self. We thus see that the immortality of the soul, though in an imperfect manner, was admitted by these people.

Concerning the state of these shades and the regions they inhabit after death, their notions were rather vague and contradictory. Though all of them seemed to agree that their condition was miserable, since their only food was dried toads (which among the Dénés are the uncleanest of animals) yet they do not seem to have known or imagined much regarding the regions in question.

The following myth may however give a fair idea of the belief entertained by the Carriers on this subject.

"A long time ago two young men having got lost in the woods, reached in the course of their wanderings a certain spot where the trunk of a tree entirely hollowed out by age and decay was lying on the ground. Out of curiosity they crawled in to see where it led to as only one end was visible. After some hard walking on all fours through a dark subterranean passage, they reached a place full of snakes, toads and lizards. Much frightened they endeavoured to go back; but could not—it was an awful place. Yet, summoning up their courage they hurriedly ran through it and after more underground journeying, the road widened and darkness ceased. Then they suddenly found themselves to be on the top of a hill commanding the view of a broad river on the other side of which stood a village. This consisted of innumerable board houses, some of which were black, others red—it was the abode of the shades who were then enjoying themselves on the lawn. Nobody could have an idea of their number and they were making a deafening noise, caused by the interest they seemed to take in their sport.

"At this sight, one of the young men ran away and hid himself in the bush. As for his cousin (such he was), perceiving several black and red canoes hauled on the other side of the river, he halloed for somebody to come and take him across. But the tumult was such that they could not hear him. At last, after repeated efforts to attract attention, having inadvertently yawned, one of them heard the movement of his jaws.[1] Having apprised his fellow spirits of the fact some of them at length came across to fetch him.

"But he had no sooner stepped into their black canoe than he sank down with the part his foot had touched which seemed to be elastic. Which seeing, the spirits at once smelt him. 'He does not smell of smoke,' they said, and then they learned that he had not been burnt. Therefore, madly seizing him in their fleshless arms, they tossed him up in the air as one does a ball, until nothing remained of his former self but his empty skin. In that state they threw him in the river where a big fish swallowed him at once. His cousin who all this time had been in hiding then set out to return to the land of the living and this time without any fear of the snakes and toads, for his sojourn in the regions of the shades had made him another man. While in the act of crawling back in the hollow tree through which he had entered, he heard a terrific voice calling: "Grandson! grandson!" Then at the end of the subterranean conduit, he came upon a giant who adopted him as his grandson. After a very long series of wonderful experiences with this new grandfather, he finally went up above and it is he that we now see standing on the moon."

Such is the Déné myth, or rather part of myth or legend, for what they narrate of this couple is far too long to be repeated here. Now is it not strange that we should find here among hyperborean Indians, the belief in this very Tartarean river which plays such a role in the mythologies of ancient Rome and Athens? Is there any noticeable difference between this broad river of the Dénés and the Styx-atra of Virgil? And does not their hero's experience in the infernal regions offer remarkable analogies with those ascribed by the Greeks and Latins to Theseus and Hercules, Orpheus and Æneas? It is also worthy of notice that this belief of the Dénés, as evinced by the

[1] To understand this particular circumstance of the Dénés' legend, one must know that the nation regard yawning as ominous, and believe it to be a calling back of the departed ghosts to earth.

above legend, that entrance to the abode of the shades is denied to those who have not received the honors of sepulture (typified among them by cremation) was common to most ancient nations, and is still to be found among several modern barbarous people.

But I perceive that I am becoming didactic when I intended to content myself with the mere exposition of facts. Let us be brief.

Metempsychosis was believed in by the Carriers and the Sékanais and very likely by the two other tribes also, though I could not positively affirm this. It amounted in their estimation, to the regeneration of persons who had led a virtuous life and were supposed to be rewarded therefor by a new birth. Transformations into beings of a lower order however, than that of their former condition, were repugnant to their psychological ideas.

They also attached to dreams the same importance as did most people of antiquity. It was while dreaming that they pretended to communicate with the supernatural world, that their shamans were invested with their wonderful power over nature, and that every individual was assigned his particular *nagwal* or tutelary animal-genius. Oftentimes they painted this genius with vermilion on prominent rocks in the most frequented places, and these rough inscriptions are about the only monuments the immediate ancestors of the present Dénés have left us.

XVIII.

Closely related to a people's religious beliefs are their superstitious observances, and, as a rule, the more the former have deviated from original truths, the more will the latter be found to have developed both in number and relative consideration. This is strictly true of the Western Dénés who, lacking even the primordial notion of a Supreme Being, were encumbered with a multitude of vain observances to which they attached the greatest importance. I have already in the course of this monograph incidentally hinted at some of them. Yet, before bringing it to a close, I feel that I shall have to add a few words on this subject. To avoid the tediousness necessarily resulting from a long nomenclature of apparent trivialities, I will make a choice and confine my remarks to a few of those ceremonial rites which may be of interest to the sociologist.

Prominent among these are the observances peculiar to the fair sex, and many of them are remarkably analogous to those practised by the Hebrew women, so much so that, were it not savouring of profanity, the ordinances of the Déné ritual code might be termed a new edition "revised and considerably augmented" of the Mosaic ceremonial law. Among the Carriers, as soon as a girl had experienced the first flow of the menses which in the female constitution are a natural discharge, her father believed himself under the obligation of atoning for her supposedly sinful condition by a small impromptu distribution of clothes[1] among the natives. This periodical state of women was considered as one of legal impurity fateful both to the man who happened to have any intercourse, however indirect, with her, and to the woman herself who failed in scrupulously observing all the rites prescribed by ancient usage for persons in her condition.

Upon entering into that stage of her life, the maiden was immediately sequestered from company, even that of her parents, and compelled to dwell in a small branch hut by herself away from beaten paths and the gaze of passers-by. As she was supposed to exercise malefic influence on any man who might inadvertently glance at her, she had to wear a sort of head-dress combining in itself the purposes of a veil, a bonnet and a mantlet. It was made of tanned skin, its forepart was shaped like a long fringe completely hiding from view the face and breasts; then it formed on the head a close fitting cap or bonnet, and finally fell in a broad band almost to the heels. This head-dress was made and publicly placed on her head by a paternal aunt, who received at once some present from the girl's father. When, three or four years later, the period of sequestration ceased, only this same aunt had the right to take off her niece's ceremonial head-dress.

[1] Might not this distribution be considered as a coincident equivalent vestige of the animal offerings prescribed by the Book of Leviticus, chapter v., for the expiation of sins (including legal uncleanness)? One should not forget the greatly altered circumstances in the midst of which the Déné now live, nor the fact that their only domestic animal, the dog, is to them as to the Jews, an unclean animal. On the other hand, having lost the knowledge of an only God through probable peregrinations among, and commiscegenation with, shamanistic asiatic races, they have no constituted priesthood, to receive these offerings and may reasonably be supposed to have substituted therefor the aggregate of their equals.

Furthermore, the girl's fingers, wrists and legs at the ankles and immediately below the knees, were encircled with ornamental rings and bracelets of sinew intended as a protection against the malign influences she was supposed to be possessed with. To a belt girding her waist were suspended two bone implements called respectively *Tsœnkuz* (bone tube) and *Tsiltsœt* (head scratcher). The former was a hollowed swan bone to drink with, any other mode of drinking being unlawful to her. The latter was fork-like and was called into requisition whenever she wanted to scratch her head—immediate contact of the fingers with the head being reputed injurious to her health. While thus secluded, she was called *asta*, that is "interred alive" in Carrier, and she had to submit to a rigorous fast and abstinence. Her only allowed food consisted of dried fish boiled in a small bark vessel which nobody else must touch, and she had to abstain especially from meat of any kind, as well as fresh fish. Nor was this all she had to endure; even her contact however remote with these two articles of diet was so dreaded that she could not cross the public paths or trails, or the tracks of animals. Whenever absolute necessity constrained her to go beyond such spots, she had to be packed or carried over them lest she should contaminate the game or meat which had passed that way, or had been brought over these paths; and also for the sake of self-preservation against tabooed, and consequently to her, deleterious food. In the same way she was never allowed to wade in streams or lakes, for fear of causing death to the fish.

It was also a prescription of the ancient ritual code for females during this primary condition to eat as little as possible, and to remain lying down, especially in course of each monthly flow, not only as a natural consequence of the prolonged fast and resulting weakness; but chiefly as an exhibition of a becoming penitential spirit which was believed to be rewarded by long life and continual good health in after years.

These mortifications or seclusion did not last less than three or four years. Useless to say that during all that time marriage could not be thought of, since the girl could not so much as be seen by men. When married, the same sequestration was practised relatively to husband and fellow villagers—without the particular head-dress and rings spoken of—on the occasion of every recurring menstruation. Sometimes it was protracted as long as ten days at a time especially during the first years of co-habitation. Even when she returned to her mate, she was not permitted to sleep with him on the first nor frequently on the second night, but would choose a distant corner of the lodge, to spread her blanket, as if afraid to defile him with her dread uncleanness.

The birth of a child was also the occasion of temporary seperation from her husband.[2] It is noticeable that this was more protracted after the birth of a female than after that of a male child.[3] Moreover, after this seclusion, custom obliged the parents to make an offering in the shape of a distribution of clothes, meant as a final purification for the mother and a sort of redemption of the child.[4]

Boys who attained the age of puberty had their wrists, ankles and legs below the knee encircled with rings made of sinew twisted with feather down. To neglect this rite would have been in their estimation to call for precocious infirmities which would have hindered the young man from performing the duties of a good hunter.

The distinction between clean and unclean animals was as strictly defined among them as it was among the Jews.[5] In the same way, until quite a recent date, no woman would partake of blood[6] and both men and women abhorred the flesh of a beaver which had been caught and died in a trap, and of a bear strangled to death in a snare, because the blood remained in the carcase.

I think also that we may appropriately find in an ancient custom of the Chilhχotins, that of public flagellation, an unconscious fulfilment of this precept of the Mosaic law: "They shall lay him down and shall cause him to be beaten before them."[7]

[1] Compare with the prescriptions of Leviticus xv., 19.

[2] Cf. Leviticus xii., 2.

[3] Ibid xii., 4, 5.

[4] Ibid xii., 6.

[5] Cf. Leviticus xi.

[6] Ibid. *passim.*

[7] Cf. Deuteronomy xxv., 2.

Various other observances—whose name is legion and frequently of a puerile nature—were formerly in vogue among the Déné hunters, but as they are of no particular interest to the sociologist, I will refrain from enumerating them.

XIX.

Such as I have described them were, even as recently as twenty years ago, the Chilhχotins, Carriers, Sékanais and Nah'anés. Such, to a great extent have remained the two last named tribes. As yet, the only representatives of our race among them have been, with few exceptions, the missionaries, gold miners and the Hudson's Bay Company's officers and employees. Among the exceptions are two villages of the Southern Carriers which happen to be in the vicinity of small white settlements. Be it said to the shame of modern civilization, this proximity has proved in every way detrimental to the aborigines' moral and material welfare. Intoxicating liquors unscrupulously proffered them have demoralized the unfortunate natives, while immoral relations between their women and the whites have engendered maladies previously unknown and which have deprived the former of that fecundity which was formerly their pride. However, let us not exaggerate; even in this respect they have stood their ground much better than many Indian tribes which I could mention.

In places where the white race is practically identified with the Hudson's Bay Company's people, the Dénés have fairly progressed. With the exception of the Sékanais, they now dwell in comfortable log houses, built after the style of the country, have neat enough stables for their horses and cattle and they cultivate what will grow in small clearings near their villages, without abandoning their former and more lucrative pursuits,—hunting and fishing. The Hudson's Bay Company, which in most places has retained the virtual monopoly of the fur trade among them, treats them paternally, helps them liberally in cases of distress and scrupulously avoids the sale of hurtful stimulants to them.

Although the Dénés, and especially the Carriers, literally crave for knowledge, yet, owing to the paucity of missionaries among them, religious instruction is about all that can be given them so far. In these latter years however, an effort has been made by the writer of this paper to teach them to read and write their own language, and the result has been really wonderful. In order to attain this satisfactory and promising result, he has had to compose a syllabic alphabet somewhat on the principle of that so suitably invented by the late Mr. Evans for the Cree language; but which he soon found to be totally inadequate to render correctly the numerous and delicate sounds of the Déné dialects. Besides (why should I not say it!) it lacks that method and logic which have been applied to the new or improved syllabics and which have thereby simplified the acquisition of the language. I am now continually in receipt of letters from Indians whom I never taught and who have learned to read after one or two weeks (in some cases I might say three or four days) private instruction from others. The following Carrier apologue written with the new signs will serve as an illustration thereof.

Tsutsœn cha inkéz tœrœs cha lhehœntaz hoh, tœrœs tsutsœn
tsidano; ét howa œtga ukhwa hwozté. Hohta tœrœs tsèpa
lhiz thœrh naltsœt, ét howa utuz lhiz za sœlli.

"The aspen in a fight with the black spruce knocked it down in the fire whereby it got roasted.[1] But at the same time, the aspen fell on the ashes of the fireside, and that is why it is ash coloured."

And, I believe, I may now close this monograph, not that the subject is exhausted, far from it. There are even several points connected therewith which for the sake of brevity I have left untouched. Moreover, much remains to be said anent the question of the Western Dénés, probable origin and quite a volume might be written concerning their wonderfully rich language. One could, for instance, propose to the admiration of the philologist the prodigious multiplicity of its verbs which, when under all their forms, aggregate to the incredible number of about 150,000!—the astonishing quantity of their varieties which comprise verbs affirmative and negative, active and passive, reflective and mutual, impersonal and unipersonal, potential and generalizing, objective and subjective, verbs of rest,

[1] In allusion to the parched appearance of its bark.

verbs of locomotion, verbs of incubation, etc., etc. But to do so would be to enlarge beyond the scope of the information asked for by the recent circular of the Canadian Institute which I have endeavoured to answer through these pages, and then, according to the French proverb, "*A chaque jour suffit sa peine.*" On the other hand, what is not done to-day may, with God's help, be accomplished at some future time.

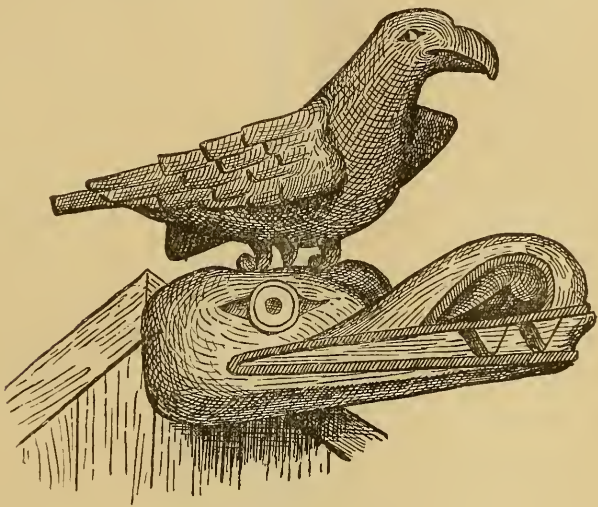


FIG. 1.—CARVED TOTEMS.

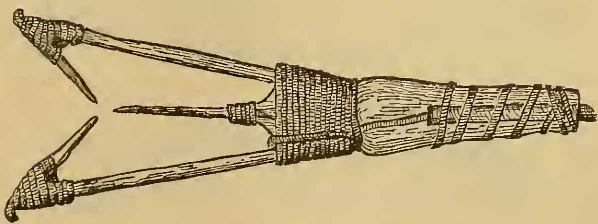


FIG. 2.—CARRIER HARPOON; $\frac{1}{8}$ SIZE.

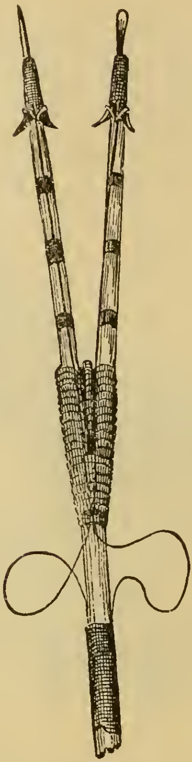


FIG. 3.—CHILHχOTIN DOUBLE-DART; $\frac{1}{7}$ SIZE.

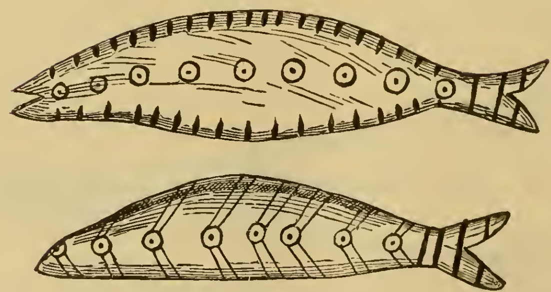


FIG. 4.—BONE COREGONE FRY, (used as bait); NAT. SIZE.

FIG. 5.—HORN DART; $\frac{1}{2}$ SIZE.

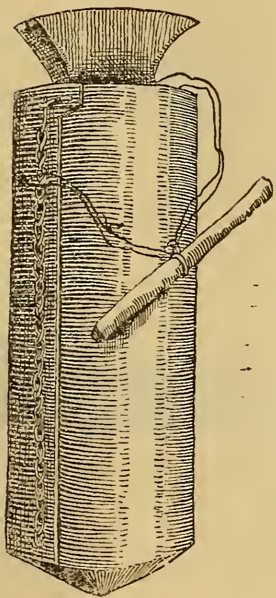


FIG. 6.—BARK BOTTLE; $\frac{1}{2}$ SIZE.

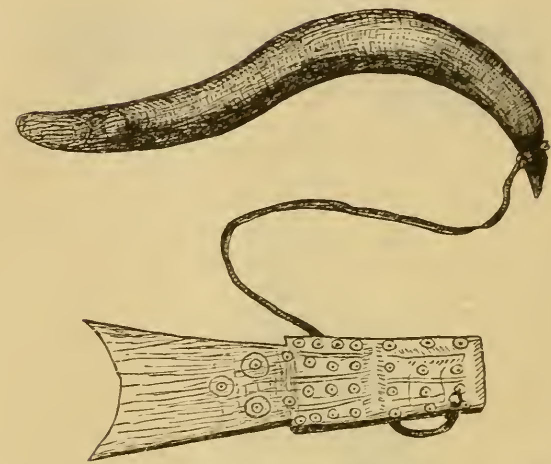


Fig. 7.—Bark peeler and cambium scraper; $\frac{1}{2}$ size.

Fig. 8.—Bone Chisel or scraper; $\frac{1}{3}$ size.

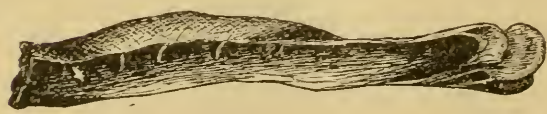


Fig. 9.—Bone scraper; $\frac{1}{5}$ size.

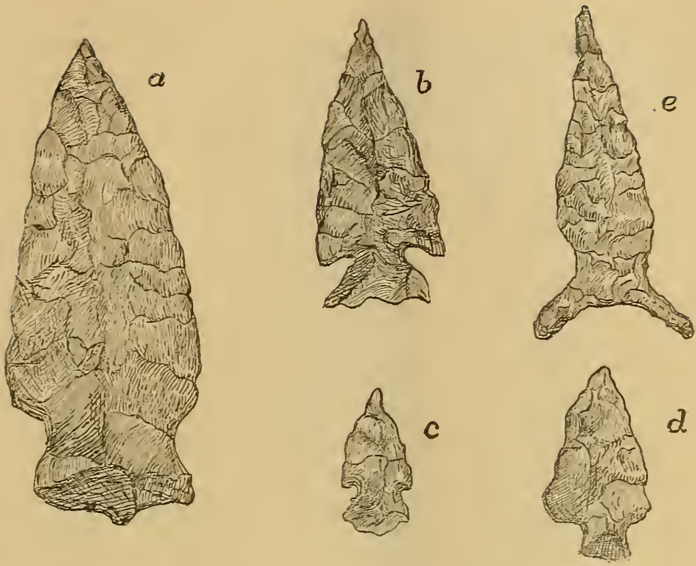


FIG. 10.—DENE FLINT ARROW-HEADS; NAT. SIZE.

FIG. 11.—BOW-POINT; NAT. SIZE. | FIG. 12.—SPEAR-HEAD; $\frac{1}{3}$ SIZE.

FIG. 13.—STONE "Casse-tête;" $\frac{1}{3}$ SIZE.

FIG. 14.—BONE TRIPLE ARROW; $\frac{1}{2}$ SIZE.

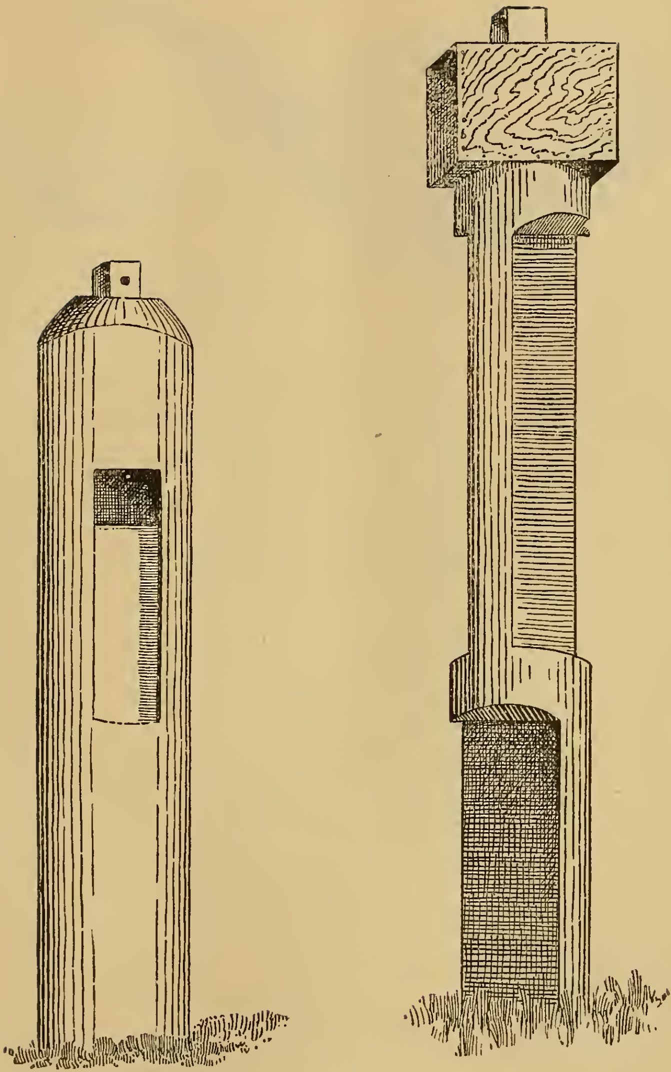


FIG. 15.—FUNERAL POSTS.

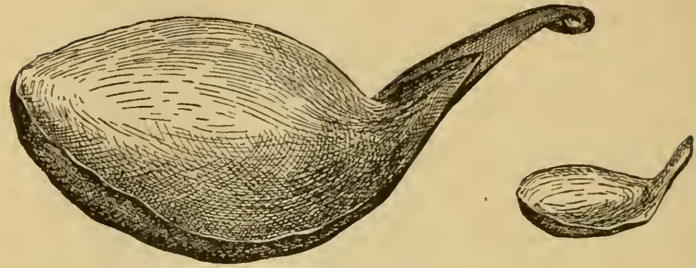


FIG. 16.—HORN LADLE AND SPOON; $\frac{1}{4}$ SIZE.

BRIEF SUMMARY.

ERRATA.

Page 110,	Line 17 from the top—	*for*	Nahanés	*read*	Nah'anés.
" 110,	bottom line	"	t. chene	"	t-chené.
" 112,	Line 6 from the top	"	Nah-anés	"	Nah'-anés.
" "	" 10 " " "	"	Tsekenné	"	T'sekenné.
" "	" 15 " " "	"	Tsatens,	"	T'satens.
" 113,	" 12 " " "	"	Nah-anes	"	Nah'-anes.
" 114,	" 2 " " "	"	Sékanais	"	Sékanais.
" 115,	line 4 from the bottom	*for*	Dentalium Indianorum	*read*	dentalium indianorum.
" 116,	" 1 " " top	"	Dentalium	"	dentalium.
" "	" " " " "	"	Hyaqua	"	hyaqua.
" 125,	" 6 " " "	"	Tœnezoi	"	Tœneza.
129,	" 2 " " bottom	"	hwonœth'a	"	hwonœlh'a.

[The following letter dated 30th June, 1888, was received from A. Bowen Perry Esq. Inspector, North-West Mounted Police, Prince Albert, North-West Territory.—CH. S. COM.]

SIR :—

I have to acknowledge your Sociological Circular of June '88. I fully agree with you as to the importance of the work with which your circular deals. Such information as you require must be obtained speedily for the state of the Indians is changing most rapidly. Old customs are passing away; their ceremonies are almost of the past, certainly with many tribes; their family customs are assimilating to those of their white brethren; and in fact in almost every section named in your circular the information to be obtained will be of a hearsay character. I speak more particularly of this district of Saskatchewan. The Indians are all Crees with one exception, a small band of renegade Sioux from Minnesota.

Missionaries have for many years labored among the Cree Indians and with no little success. The Crees have for some time devoted themselves to farming and abandoned their nomadic life. Schools have been maintained. These influences combined with the strong and successful attempt of the government to break up old habits and customs have effected a complete change in the Indian. character and habits. Not always for the best it must be admitted. With civilization, disease has been introduced, immorality has increased and physical degeneration ensued. It seems that physical degeneration universally follows the semi-civilization of the Indian The causes are many. Change of food, from fresh buffalo meat and fish to a diet of badly baked bread and bacon. The bread is unleavened; the flour being simply mixed in water and half baked in a frying pan or in ashes. Consequently the bannock as the bread thus made is called, is very indigestible and unfit for food. Again in their old life they wandered about from place to place, lived in lodges which afforded plenty of ventilation. Now they live the year around, or the greater part of it, for some of them take to their lodges in the summer, in small log huts, ill lighted, unventilated, half filled with smoke and crowded together. Dirty and careless in their habits, it is not long before the hut becomes filthy and the ground around saturated. Remember that the huts are clumped together and the unhealthy state of the present Indian habitation on a Government Reserve is apparent. The agents and employees of the Indian department do what they are able to encourage the Indians to build larger houses and keep more cleanly habits, but as far as I know with little success. Disease marks them for her own; if of a contagious or infectious nature it runs its course; for the last two or three years measles have prevailed amongst the Northern Indians, and with a deadly result. Preventible diseases are most terrible. Amongst the Southern tribes of the Territories especially it is the exception to see a healthy well developed Indian child. The Northern tribes have not suffered to the same extent but still have not escaped. What appears to me to be another cause for the physical degeneration of the Indian is the want of exercise. When the Indian was compelled to earn his own living by the hunt he was compelled to live in the open air and to take sufficient exercise to develop himself physically. Now the Treaty Indian, relying on a paternal Government for rations, spends his time lazily about the Reserve exerting himself unwillingly and gorging himself with unwholesome food which is lavishly provided on some of the Reserves.

If I might suggest, it would be perhaps well to have the present state of the Indians authentically recorded. The change from barbarism to civilization is interesting and the gradual development will illustrate one of the Social laws. It is not always well to trust to official reports and government records to record the true facts of the Indians' state. They seldom deal with what will be of historical value nor do they always give unvarnished and plain statements.

As an offshoot of the Indians I would call your attention to the half breeds both English Scotch and French. Their origin and history are but little known, their habits and customs in the past unregistered. Having been in contact with the French half-breeds for the past three years I have become possessed of some very interesting facts concerning them. Equally with the Indian their future is problematical. I therefore think that your Institute might investigate the offshoot of the Indians as well as the Indians. I shall be very happy to give any information in my power which may be of any use. There are many gentlemen in the Territory who would be able to give you varied interesting and accurate information, and thinking it possible that their names may not be known to you, I take the liberty of giving you a list which you will find enclosed.

The subject which you have undertaken to investigate is most extended and I believe that it will be a reproach to the literary men of Canada and Canadians generally if the question be not thoroughly exhausted and the results accurately recorded.

You have my hearty sympathy.

Critical note on Mr. J. B. Tyrrell's paper, entitled "Catalogue of the Mammalia of Canada exclusive of the Cetacea," by Ernest E. Thompson.

Being one of the members of the Institute who objected to the publication of Mr. Tyrrell's paper on account of its being without value as a zoological contribution, I have been asked to put my objections in more specific form for publication as a part of the Proceedings and as a fitting commentary on the paper. But since a full extended critique on the errors and vague generalizations of which it is chiefly composed, would far exceed the limits of allotted space, and would result in a paper more lengthy than the original, I will point out briefly the wrong principles on which it is based and will give a few examples of the matter that chiefly is reprehensible in the catalogue.

The only value that a scientific paper in this field can have, must come either from its new facts or from its carefully compiled and collated facts, and of course in both cases absolute precision and correctness are essential.

In the case of compiled facts, it is, not merely a rule of courtesy, but an inflexible law of scientific writing that all quotation and assistance must be acknowledged with due credit to its proper authority. It is hardly credible that any one will deny what is so fully accepted by all experienced writers, and yet it appears as though Mr. Tyrrell had set out with the express intention of running counter to these principles throughout his paper.

Passing over without comment the general vagueness in all matters relating to geography, and the annoying omission of dates in nearly all references to time, I will briefly direct attention to a few characteristic paragraphs. The Panther (*Felis concolor*) is given as, "Found in rough wooded regions in Southern Quebec, etc." If the writer has any reliable records of his own for this, surely he should have given them, or if he has it on other authority he should have given his authorities. In all probability the statement is true but without data of any kind it is scientifically worthless.

Similarly, of the Elk (*Cervus canadensis*) he says, "up to a hundred years ago an inhabitant of Eastern Canada, etc." "Eastern Canada" is vague enough to defy criticism almost, since it may mean anywhere east of the Red River which is about the central line; but if Mr. Tyrrell really has any reliable records of "Elk" in what is commonly understood by "Eastern Canada," this was the proper place either to give them if unpublished or to refer to them if already in print.

In the same manner he has treated a great number of the species, eluding specific criticism by taking refuge in vagueness and never giving credit for quotation excepting in the case of some of the Seals. The whole of his paragraph on *Hesperomys leucogaster* is taken verbatim or nearly so from the present writer's paper on the Mammals of Manitoba, but no hint is given that it is a quotation. A similar remark applies in the case of *Synaptomys cooperi*. It is difficult to understand how the writer justifies such plagiarism.

The Wood Hare (*Lepus sylvaticus*) is given as, "Becoming quite common throughout Ontario," whereas in the Northern nine-tenths at least of the Province this species is unknown.

The remark on the Pouched Gopher (*Geomys bursarius*) is one of the most flagrantly ignorant of any; he says, "originally described from a specimen brought from Eastern Canada." This Gopher was described by Shaw from a skin "supposed to have been brought from somewhere in the interior of Canada." The *Geomys bursarius* is an animal of the Mississippi valley—it was observed in Southern Manitoba by Kennicott but it is very certain that it was never taken within many hundreds of miles of the region that Mr. Tyrrell seems usually to mean by "Eastern Canada."

He gives the Black Squirrel (*Sciurus carolinensis*) as ranging "as far west as the north shores of Lakes Huron and Superior." It would be exceedingly interesting and valuable, if he would give substantial proofs of this surprising statement, etc., etc.

The avowed purpose of this article is to put on record, my objections to Mr. Tyrrell's paper and the above examples have been given as representative of nine-tenths of the matter it is composed of; but it is only fair to conclude by indicating such passages and endeavors as are worthy of commendation. Its chief value is as a philological contribution, his records of the Indian names cannot fail to be of use, though even here his besetting sin greatly detracts from the value of the work, for he adopts no special alphabet and uses no diacritical marks, so that the pronunciation is left pretty much in the same state of uncriticisable uncertainity that is characteristic of the paper.

In one or two instances however our author has given us notes that are suggestive of the real observer, and whenever he has done so we get a glimpse of capabilities for doing work of considerable value. I might instance his remarks on the Wapiti, Buffalo, Hoary Marmot, Blue Fox,—though by the way he has apparently not read Mr. Nelson's article on the subject—and on several of the Seals—with quotations here properly acknowledged.

It is always a pleasure to welcome a beginner in any field, and it is to be hoped that Mr. Tyrrell will not misunderstand what is meant for quite friendly criticism, but will recognize the absolute necessity of reproof when so many vital principles of scientific work are violated; and further we cannot but hope that in the near future we may be favoured with something from Mr. Tyrrell's pen that shall be more worthy of one whose travels have been so extensive and whose opportunities and capabilities are so much beyond the average.

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PROCEEDINGS OF THE ORNITHOLOGICAL SUB-SECTION OF THE BIOLOGICAL SECTION OF THE CANADIAN INSTITUTE.

EDITED BY ERNEST E. THOMPSON.

(First Meeting, December 21, 1888).

The members of the Biological Section, who were desirous of forming the Sub-section, met at the house of Dr. Wm. Brodie, Parliament Street, Toronto, at the above date, aud having formulated a code and constitution, the following officers were elected for the ensuing year,—Dr. Wm. Brodie, Chairman; Mr. Geo. E. Atkinson, Recording Secretary; and Mr. J. B. Williams, Corresponding Secretary. Mr. Ernest E. Thompson being Editor, *ex officio*.

(The nomenclature in use throughout these papers is that of the American Ornithologist's Union, as published in 1886).

1. After the completion of business Mr. Williams shewed a number of mounted specimens of Ontarian Woodpeckers, and remarked on their distribution and habits.

2. Dr. Brodie exhibited a Fox Sparrow (*Passerella iliaca*), taken at Toronto, 4th of October, 1888, and remarked on its rarity in this region. He also exhibited a specimen of the Longeared Owl (*Asio wilsonianus*).

(Second Meeting, January 8, 1889).

3. **Robins wintering at Toronto.**—On January 1, I observed four American Robins (*Merula migratoria*) in Rosedale.—J. B. WILLIAMS.

4. **American Goldfinches wintering at Toronto.**—On January 1, I observed several large flocks of Goldfinches (*Spinus*

tristis); two specimens were procured so that the identification is beyond question.—DANIEL G. COX.

5. **Pine Siskins at Lorne Park.**—I procured two specimens of this species (*Spinus pinus*) out of five or six hundred, on December 31, 1888, several other flocks were seen.—ERNEST E. THOMPSON.

6. **Note on Butcher-bird** (*Lanius borealis*).—While passing through the University grounds on New Year's day, I picked up the body of an English Sparrow that had been beheaded I suppose by a Butcher-bird, as I saw one of that species flying about close at hand.—HUBERT H. BROWN.

7. **Spruce Partridge in Grey County.**—While resident in Melancthon Township, Grey County, Ontario, two years ago I met with a single living specimen of this grouse (*Dendragapus canadensis*). I also saw several specimens that were fresh killed and was informed that it was quite common in some of the more extensive swamps. This record greatly extends the known range of the species in the Ontarian Peninsula.—JAMES R. THURSTON.

8. **Bald Eagle near Toronto.**—At Victoria Park on January 1, I saw a large Bald Eagle (*Haliaëtos leucocephalus*). The species is said to be a common winter resident in open seasons, frequenting the shores of the lake on account of the food supply afforded by numerous dead fish that are washed up on the beach.—HUBERT H. BROWN.

9. After the handing in of the above reports, Mr. Ernest E. Thompson advanced a scheme for the systematic recording of the geographical distribution of each of our species of birds. He proposed first to prepare and have lithographed a large map of the Province of Ontario; the political features to be omitted, but all the main geographical and topographical features to be carefully entered; all watersheds; all escarpments; each fifty feet of elevation; each main botanic area—as, the limits of White Pine, Jack Pine, Chestnut, etc.; the main geographical features; the main areas of slope exposure; the areas of disease as indicated on the charts of the Health Department; and, of course, the rivers, mountains, etc. One copy of this he proposed to set apart for each species, and to enter

on the map each authentic occurrence of the species in question, much as is being done at Washington by the Department of Agriculture, for the Birds of the United States. It was proposed to indicate breeding, migrating and winter localities by spots of different colors, until sufficient details had been procured to justify a generalization of the facts.

The scheme was favorably received by the meeting, and a committee appointed to collect existing materials for the map, and to ascertain cost, etc., of preparing the same.

(Third Meeting, January 22, 1889).

10. **American Crow and Goldfinch wintering.**—While out on January 12, to the north of the Woodbine Race Track, I saw a solitary Goldfinch (*Spinus tristis*) and two Crows (*Corvus americanus*). Later in the day I saw three other Goldfinches.—Geo. E. Atkinson.

11. **Golden crested Wren wintering near Toronto.**—On January 16, I noticed a solitary Golden crested Wren (*Regulus satrapa*) at Lorne Park. It was flitting about among the pine tassels in its characteristic manner. Although given by McIlwraith as an abundant winter resident, this is the first that I have observed wintering in this locality. There are, however, one or two mid-winter records for Toronto.—Ernest E. Thompson.

12. **Yellow-billed Cuckoo at Toronto.**—In the summer of 1884, while collecting insects on the Don flats, I chanced to discover a pair of Yellow-billed Cuckoos (*Coccyzus americanus*) in the little alder swamp that used to be under the Jail Hill. I soon satisfied myself that they had a nest there and indeed found it in the following fall ; but on my next visit I learnt that the male bird had been shot by a man named Fox, and the female had disappeared, however I again discovered the latter, she had found a new mate and was now engrossed with domestic cares in the ravine of the third creek. I did not find their nest here nor had I much opportunity of further observing them, for a band of wretched boys came along shortly afterwards and slaughtered both birds one afternoon.—William Brodie.

13. **Shrike carrying food in its claws.**—While at Toronto marsh on January 17, I saw a Shrike (*Lanius borealis*) flying over with some dark object in its claws, that might have been either a mouse or a sparrow.—Ernest E. Thompson.

14. **Rare birds at Toronto.**—As a result of an examination recently made of the mounted collection of Hon. Geo. W. Allan, I am, through the courtesy of that gentleman, enabled to publish the following unusual occurrences at Toronto:

15. **Northern Phalarope** (*Phalaropus lobatus*).

16. **Wilson's Phalarope** (*P. tricolor*).

17. **Great Gray Owl** (*Ulula cinerea*).

18. **Hawk Owl** (*Surnia ulula caparoch*).

19. **Yellow-billed Cuckoo** (*Coccyzus americanus*).

20. **Canada Jay** (*Perisoreus canadensis*).—Taken in Toronto in the winter of 1837. Previously the species was unknown, but in that winter a great host suddenly appeared in the town and continued all winter as common in the streets as House Sparrows are now. In the spring these Jays all disappeared and have not since been seen anywhere near this city.

21. **Orchard Oriole** (*Icterus spurius*).—This bird has also been taken by Dr. Brodie, see "Auk" 1888, p. 211.

22. **White-winged Crossbill** (*Loxia leucoptera*).

23. **Woodthrush** (*Turdus mustelinus*).

24. Also a **Cardinal** (*Cardinalis cardinalis*) taken near Sandwich, Ontario.—Ernest E. Thompson.

25. **More rare birds at Toronto.**—I find in my collection the following birds taken in the vicinity of Toronto.

26. **Wood Thrush** (*Turdus mustelinus*) shot, east of the Don, in May, 1888.

27. **Pine Grosbeak** (*Pinicola enucleator*) shot, in North Toronto, January 18, 1889. This specimen is remarkable in being the only bird of the species observed here this year, usually they are quite common in winter, but owing, no doubt, to the exceptional mildness of the season they have not made their appearance in numbers.

28. **Yellowbilled Cuckoo** (*Coccyzus americanus*).—Taken at the Humber, June, 1886.

29. **Richardson's Owl** (*Nyctala tengmalmi richardsoni*).—Taken April, 1888.—WM. CROSS.

30. **Red-breasted Nuthatch, wintering at Toronto.**—According to McIlwraith this bird is found here only in the spring and fall, but my experience is that it is a common winter resident about Toronto. I procured three on Christmas day 1888, and two on January 1st, 1889. I do not agree with the authority quoted, that they frequent pine trees, as I have almost invariably seen them about the hardwoods.—DANIEL G. COX.

31. **Crows wintering.**—On January 1, I saw numbers of crows in various parts of Toronto. Messrs. Cox and Thompson observed the same rather unusual occurrence.—J. B. WILLIAMS.

32. **Kinglets migrating.**—On the 15th of October great numbers of golden-crested Kinglets (*Regulus satrapa*) appeared in the woods to the east of Toronto; the migration was evidently at its height.—WM. BRODIE.

33. After the above reports were handed in Dr. Brodie proposed that an effort be made to provide printed labels for the use of the members ; he suggests that the scientific name should be in bold type, the English names smaller, with ruled blanks for locality, date, size, etc. The matter was discussed at some length but no definite action was taken.

(Fourth Meeting, February 5, 1889).

34. **Bald Eagle in Muskoka.**—While in Muskoka during the summer of 1888, I discovered three nests of the Bald Eagle (*Haliaëtus leucocephalus*) near Lake Rosseau ; and have just learnt that Mr. Cross subsequently received a pair of adult birds that were trapped in exactly the same locality.—JAS. H. FLEMING.

35. **Note on winter-birds.**—The following have just been received at Mr. Cross' taxidermist store :

Two Hairy Woodpeckers (*Dryobates villosus*) shot at Finger-board, north shore of Lake Superior.

Four Snowbirds (*Plectrophenax nivalis*) shot near Oakville, February 2, all males.

Thirteen Snowbirds, shot near Norway, February 2, all males.

Four Snowbirds shot near north Toronto February 3, all males. The fact is very remarkable that not only these, but also a number more that were received about the same time from the North-West, were all males.

Long-eared Owl (*Asio wilsonianus*).—One specimen taken just west of the Humber River, Toronto.—James R. Thurston.

36. **Birds wintering.**—The following birds were observed since last meeting, about January 10, a Tree Sparrow (*S. monticola*); on February 2, large flocks of Shorelarks, Pine Siskins (*Spinus pinus*), Redpolls American Goldfinches (*Spinus tristis*) and Crows.—Ernest E. Thompson.

37. **Pine Siskins still numerous.**—While out in company with Mr. Williams on January 29, I saw several flocks of Siskins (*Spinus pinus*) and secured one specimen.—Jas. A. Varley.

38. **Notes on habits of Nighthawk.**—I would like to ask if the members have noticed or can explain the peculiar habit the Nighthawk (*Chordeiles virginianus*) has of flying silently for four slow steady beats of its wing, then giving five very fast beats after which it utters its scream, and beginning at the slow beats again, it repeats the performance indefinitely and with surprising regularity.—Geo. E. Atkinson.

39. **Bird notes in Toronto Marsh, January 25, 1889.**—About ten a.m. I reached the marsh, and as the immediate object of my visit was the capture of field mice, I walked across the frozen bog towards the higher reeds 100 yards south of the byres. My attention was almost immediately arrested by the sight of two large dark hawks that were quartering the marsh, and presently down they pounced on something in the reeds. I concluded at once that they were Rough-legged Buzzards (*Archibuteo lagopus sancti-johannis*) and that they were here for the same purpose as myself viz. : the capture

of arvicolæ. By a practical application of theoretical ornithology, I concluded that the best place for the mice, was the part where the hawks had been seeking, and very soon I found the truth of the conclusion; as I drew near the hawks left, and I began to see mouse tracks everywhere. A dark object in the top of a reed bush attracted my attention, I found it to be a mouse (*A. riparius*), it was too firmly fixed to have been dropped by a hawk, and I was at a loss to account for its presence in such a situation until presently I descried a Northern Shrike (*Lanius borealis*) watching me from a distant cat-tail. I tried to get a shot at the butcher, for undoubtedly it was he who had fixed the mouse on the reed top, but he was too shy, each time I drew near he dropped off nearly to the earth, skimmed so low that it seemed he must graze the ground, until the base of the next perch was reached when up at right angles to the top he would bound with one sudden spreading of his piebald wings and tail. I followed in vain for some time till the Shrike became more alarmed and flew away out of sight. The Roughlegs meanwhile had been sailing about the distant reed-beds when suddenly they were set upon by a flock of a dozen Crows, the latter kept up a noisy persecution that induced the Hawks to move off to some distance, whereupon the Crows satisfied to have scored a great moral victory flew on and all parties concerned renewed their former occupations. Mice proved fairly common but hard to catch alive, two dead specimens including the one stolen from the Shrike's larder, being all I had to show for a morning's work.

Another Shrike was observed near the Don, and this, with numerous English Sparrows, completed the list of birds observed on this occasion.—Ernest E. Thompson.

(Fifth Meeting, February 19, 1889).

40. **Early spring birds.**—While at Milne's Hollow, eight miles north-east of Toronto, on February 16, I saw numbers of Shore Larks and Bluejays.—Wm. Brodie.

41. **American Goldfinches still with us.**—On February 16, my friend Mr. Gray shot five of the above species.—Daniel G. Cox.

42. **Purple Finch arrived.**—On February 17, I observed a flock of Purple Finches (*Carpodacus purpureus*), the first of the season.—Geo. E. Atkinson.

43. **Note on winter birds.**—The following have been received by Mr. Cross since last meeting :

One Snowy Owl (*Nyctea nyctea*), shot at Port Hope on February 16.

One male Black-backed Gull (*Larus marinus*), shot on Lake Ontario; length, 2 ft. 7 in. ; wing, 20 ; tarsus, $3\frac{1}{4}$; middle toe, $3\frac{1}{4}$ inches; extent, 4 ft. 7 in. ; weight, $4\frac{1}{2}$ lbs.

One Great Horned Owl (*Bubo virginianus*) a male, from Weston, on February 7.

Four Snowbirds (*Plectrophenax nivalis*), from West Toronto on February 8.

On the 8th of February also I saw a flock of thirty snowbirds on the sandbar.—James R. Thurston.

44. **Albino Robin.**—Last summer I was shown a white Robin (*Merula migratoria*) that had been shot in North Toronto by Mr. R. Nurse.—Geo. E. Atkinson.

(Sixth Meeting, March 5, 1889).

45. **Saw-whet and other early birds.**—A little Saw-whet Owl (*Nyctala acadica*), was brought into the store from west of the Humber, it was found lying dead but still grasping a mouse, its latest victim, in its claws. It was in good condition and no cause could be assigned for its death.

46. **A Screech Owl** (*Megascops asio*) was received on February 27 ; like the majority of specimens taken in this region, it was in the gray phase of plumage.

47. **Purple Finches** (*C. purpureus*) were noted in the Queen's Park on March 3.—James R. Thurston.

48. **Red Crossbills at Toronto.**—I observed a flock of these birds in the Queen's Park on March 3.—Hubert H. Brown.

49. **Redpolls in the city.**—On March 3, I noticed a flock of these birds (*Acanthis linaria*) on Wellesley Street, Toronto. Owing to the unusual mildness of the winter they have not been as common as usual this season.—J. B. Williams.

(Seventh Meeting, March 19, 1889).

50. **Spring arrivals.**—On March 16, Bluebirds (*Sialia sialis*), Robins (*Merula migratoria*), Cedar birds (*Ampelis cedrorum*), Song Sparrows (*Melospiza fasciata*), Chipping Sparrow (*Spizella socialis*), arrived in considerable numbers. One Bluebird, three Cedarbirds, and eight Purple Finches were shot in Rosedale by Mr. Cox the same day.—Wm. Metcalf.

51. **Spring arrivals.**—On March 16, while at Ayr, Ontario, I saw numbers of Blackbirds, Bluebirds (*Sialia sialis*) Robins (*Merula migratoria*), Purple Finches (*Carpodacus purpureus*), Grosbeaks, Hawks, and Owls.—Hubert H. Brown.

52. **Spring arrivals, etc.**—On March 16, at Toronto, I collected three Siskins (*Spinus pinus*), one Shore Lark (*Otocorys alpestris*), and one Bluebird (*Sialia sialis*).—J. B. Williams.

53. **Spring arrivals, etc.**—On March 16, Mr. Cross received from Weston another Great Horned Owl (*Bubo virginianus*). On March 17, I observed flocks of Purple Finches (*Carpodacus purpureus*) and Rosebreasted Grosbeaks (*Habia ludoviciana*) feeding on the berries of the mountain ash, on Beverley Street, Toronto.—James R. Thurston.

54. After the presentation of reports Mr. Williams showed a picture of the **Hoatzin** (*Opisthocomus cristatus*), an anomalous bird of South America. It is so peculiar in both its anatomy and habits that it has been made the type and sole representative of a separate group. Mr. Williams described the finger that is found on the wing of this, and after a discussion of its probable uses, and a comparison with the similar organ that is found in our Coots and Gallinules, the meeting closed.

(Eighth Meeting, April 2, 1889).

55. **A Rare Gull, etc.**—On March 25, a fine female specimen of the Glaucous Gull (*Larus glaucus*), was brought into Mr. Cross store; it was in the pure white plumage of the young in the second winter. This is the second record for the species at Toronto. It was shot on the Island. The following are its dimensions:—Length, 27; extent, 55; wing, 17; tarsus, $2\frac{1}{2}$; middle toe and claw, $2\frac{5}{8}$; culmen, 2; gape, $3\frac{1}{4}$; tail, $7\frac{1}{2}$ inches.

56. **Two Kittiwakes** (*Rissa tridactyla*) were brought in at the same time, and on the 30th of March a female Great Horned Owl (*Bubo virginianus*); this specimen was taken at Vaughan, and had evidently begun to incubate.—JAMES R. THURSTON.

57. **Arrivals.**—March 20, Crow Blackbirds (*Quiscalus quiscala æneus*), arrived; Bluejays (*Cyanocitta cristata*) seen on 23rd; Red-winged Blackbirds (*Agelaius phœniceus*) arrived March 30.

58. **Loiterers.**—Pine Siskin (*Spinus pinus*) taken on 23rd; Tree Sparrow (*Spizella monticola*) on 30th of March.—HUBERT H. BROWN.

59. **The first Geese.**—A large flock of wild geese was observed flying south-west on March 30.—JOHN MAUGHAN, JR.

60. **Kingfisher arrived.**—The first of this species (*Ceryle alcyon*) was observed on the Don River, Toronto, on April 1.—WM. METCALF.

(Ninth Meeting, April 18, 1889).

61. **Arrivals.**—April 5, Brown Creeper (*Certhia familiaris americana*); April 6, Ruby-crowned Kinglet (*Regulus calendula*); April 8, Wood Pewee (*Contopus virens*), and Meadow Lark (*Sturnella magna*); April 10, Highholer (*Colaptes auratus*); April 11, Vesper Sparrow (*Poocætes gramineus*), and Savanna Sparrow (*Ammodramus sandwichensis savanna*); April 13, Cowbird (*Molothrus ater*), Golden-crowned Kinglet (*Regulus satrapa*), Wilson's Thrush (*Turdus fuscescens*); April 14, Hermit Thrush (*Turdus aonalaschkæ pallasii*).—GEO. E. ATKINSON.

62. **Winter birds of Muskoka.**—In Muskoka district where

I spent the past winter (88-9), Pine Grosbeaks (*Pinicola enucleator*) were abundant, but so remarkably shy that but few were procured. American Goldfinches (*Spinus tristis*) were also abundant; all the summer residents of this species went South in the fall, those that stayed over winter seemed to come from farther north. Canada Jays (*Perisoreus canadensis*) were not uncommon, and Three-toed Woodpeckers (*Picoides arcticus*) were abundant. The Meadow Lark (*Sturnella magna*), is said to be quite unknown at Bracebridge. The Pileated Woodpecker (*Ceophleus pileatus*) is fast disappearing from this region where once it was quite common.—Wm. Melville.

63. **Hawk Owl at Toronto.**—On April 14, while walking in St. James Cemetery, I came across what I believe was a Hawk Owl (*Surnia ulula caparoch*), I saw it clearly and am satisfied of its identity, although no means were at hand for collecting it.—James R. Thurston.

64. **Arrivals on April 17.**—Greater Yellow-leg (*Totanus melanoleucus*); White-crowned Sparrow (*Zonotrichia leucophrys*); White-throated Sparrow (*Z. albicollis*); Field Sparrow (*Spizella pusilla*); Swamp Sparrow (*Melospiza georgiana*); Tree Swallow (*Tachycineta bicolor*); Winter Wren (*Troglodytes hiemalis*).—James H. Fleming.

(Tenth Meeting, May 7, 1889).

65. **Arrivals, April 19.**—Phoebe (*Sayornis phoebe*); Red-headed Woodpecker (*Melanerpes erythrocephalus*); Towhee (*Pipilo erythropthalmus*); Bobolink (*Dolichonyx oryzivorus*); Purple Martin (*Progne subis*); Whippoorwill (*A. vociferus*), arrived 14th.

66. **April 27.**—Spotted Sandpiper (*Actitis macularia*; Ring Plover (*Ægialitis semipalmata*); Chimney Swift (*Chætura pelagica*); Barn Swallow (*Chelidon erythrogaster*); Cliff Swallow (*Petrochelidon lunifrons*); Bank Swallow (*Clivicola riparia*).

67. **May 2.**—Scarlet Tanager (*Piranga erythromelas*).

68. **May 3.**—Pine Warbler (*Dendroica vigorsii*).

69. **May 6.**—Baltimore Oriole (*Icterus galbula*); Red-eyed Vireo (*Vireo olivaceus*); Ovenbird (*Seiurus aurocapillus*).

70. **May 7.**—Chestnut-sided Warbler (*Dendroica pennsylvanica*). Observed by the Subsection.

(Eleventh Meeting, May 21, 1889).

71. **Arrivals, May 8.**—Redstart (*Setophaga ruticilla*); Yellow Warbler (*Dendroica æstiva*); Blackburnian Warbler (*D. blackburniæ*); Nashville Warbler (*Helmonthophila ruficapilla*).

72. **May 9.**—Crested Flycatcher (*Myiarchus crinitus*); Kingbird (*Tyrannus tyrannus*); Catbird (*Galeoscoptes carolinensis*).

73. **May 10.**—Nighthawk (*Chordeiles virginianus*); Rose breasted Grosbeak (*Habia ludoviciana*); Black and White Creeper (*mniotilta varia*); Wood Thrush (*Turdus mustelinus*).

74. **May 16.**—Canadian Warbler (*Sylvania canadensis*).

75. **May 18.**—Indigo Bunting (*Passerina cyanea*); Wilson's Warbler (*Sylvania pusilla*); Baybreasted Warbler (*Dendroica castanea*). Observed by the SUBSECTION.

76. **Olive-sided Flycatcher at Toronto.**—On May 18 while out shooting I secured a Flycatcher which proved to be of the above rare species (*Contopus borealis*). This is the second record for Toronto.—JAMES H. FLEMING.

77. **A supposed Loggerhead at Toronto.**—On May 18, while out west of the city, in a scrubby corner of an open field, I found a Shrike's nest with three eggs in it, and afterwards shot both birds, finding in the female a fully formed egg. These birds did not seem to be our usual form *Lanius ludovicianus excubitorides*, but rather the true *ludovicianus* of the South.—JAMES R. THURSTON.

(Twelfth Meeting, June 4, 1889).

78. **Cowbird's egg in Vesperbird's nest.**—On May 24, I found a nest of *Poocætes gramineus* with one cowbird's (*Molothrus ater*) egg, and three eggs of the owner.—J. B. WILLIAMS.

79. **Arrivals, May 24.**—Blackheart Sandpiper (*Tringa alpina pacifica*); Semipalmated Sandpiper (*Ereunetes pusillus*); and Curlews.

80. **May 27.**—Caspian Tern (*Sterna tschegrava*); Common Tern (*Sterna hirundo*).

81. **May 31.**—Red-breasted Snipe (*Macrorhamphus griseus*).

82. **June 2.**—Found nest of common Junco (*Junco hiemalis*) on a hillside at Rosedale, Toronto; it contained five young ones.—James R. Thurston.

83. **Arrivals, June 1.**—Tennessee Warbler (*Helminthophila peregrina*); Magnolia Warbler (*Dendroica maculosa*); Black-cap (*D. striata*); Maryland Yellow-throat (*Geothlypis trichas*).—James H. Fleming.

84. **Blackbilled Cuckoo nesting.**—On June 2, I found the nest of *Coccyzus erythropthalmus*, in the woods to the north of Toronto; it was a very flimsy affair and placed on a fallen branch which was lodged in the fork of a sapling about thirty inches from the ground. It contained two eggs.—Wm. Brodie.

85. **A Pair of Olive-sided Flycatchers.**—On June 2, Mr. S. Mitchell while shooting near Toronto observed a pair of Flycatchers, they were a good deal on the ground and kept so close together that he killed them both with one barrel, one was shattered, the other he brought to me, but unfortunately it was spoilt before it could be skinned. It was a *Contopus borealis.*—Wm. Brodie.

86. **Another Olive-side.**—On June 3, I collected a specimen of *Contopus borealis,* making the fifth example taken at Toronto.—J. B. Williams.

87. **Field Sparrow-nesting.**—On May 23, I found a nest of Field Sparrow (*Spizella pusilla*) with four eggs. Is not this early for the species?—James H. Fleming.

(Thirteenth Meeting, June 18, 1889).

88. **Pileated Woodpeckers nesting.**—On June 4, during my recent trip to Muskoka, I was fortunate enough to discover the nesting place of a pair of these birds (*Ceophlœus pileatus*). The nest was about 50 feet from the ground in a hemlock tree about ten miles north of Bracebridge. The head of the female was visible in the entrance to the nest, and the male bird was sitting on a branch close by. A heap of chips lay at the foot of the tree.—C. W. Armstrong.

89. **Nesting of Baltimore Oriole.**—On June 14, I found three nests of this species (*Icterus galbula*), one with two young and two eggs; each of the others with four eggs.—George E. Atkinson.

90. **Arrivals of Interest.**—On June 12, Mr. Cross received two Yellow-billed Cuckoos (*Coccyzus americanus*), and on the 17th another, all were shot near Toronto. These, together with a pair shot by Mr. Jacobs of Centre Street, as Mr. Thompson informs me, make seven records for this locality, and show that the species is a regular though far from common summer resident.

91. **June 14.**—Virginian Rail (*Rallus virginianus*), first taken.

92. **June 16.**—Black Tern (*Hydrochelidon nigra surinamensis*), shot.—James R. Thurston.

(Fourteenth Meeting, October 1, 1889).

93. **Nesting of Screech Owl.**—On June 20, we received a brood of four young Screech Owls (*Megascops asio*) taken from the nest; one was in the red plumage, three in the gray.—James R. Thurston.

94. **Strange behaviour of Kingbird.**—On July 1, while out with my catapult, I was followed and scolded so persistently by a Bluebird (*Sialia sialis*) that I fired a charge of shot at it, it seemed to be hit on the head for at once it fluttered and began to soar straight up. When about a hundred feet up it was suddenly attacked by a Kingbird (*Tyrannus tyrannus*) which seized it by the neck and fluttered downward with it, retaining its hold till both were close to my feet when the Kingbird flew off and I captured the Bluebird in my insect net.

95. **Another Yellow-billed Cuckoo.**—On July 29, at Wells' Hill, North Toronto, I shot another Yellow-billed Cuckoo (*Coccyzus americanus*).—George E. Atkinson.

96. **Rare birds at Toronto.**—A Least Tern (*Sterna antillarum*) was shot here by Mr. Wm. Loane on September 5. This with Dr. Brodie's record for Toronto, and Mr. McIlwraith's for Hamilton, makes the third for Lake Ontario.

97. **Baird's Sandpiper** (*Tringa bairdii*).—Mr. McIlwraith considers this species a rare one in Ontario, mentioning that he knows of but four having been taken. On September 24, a specimen was received at the store and several others on previous seasons. Mr. Ernest E. Thompson informs me that on September 10, 1887, he procured two on Ashbridge Bay, and saw several others. On September 16, 1889, he got another at the same place, so that we may consider this bird a regular, though not a common fall migrant.

98. **Stilt Sandpiper** (*Micropalama himantopus*).—On September 26, we received three of these rare Sandpipers, all shot at Toronto.

99. **White-rumped Sandpiper** (*Tringa fuscicollis*).—Taken September 24. A late capture.

100. **Buff-breasted Sandpiper** (*Tryngites subruficollis*).—One shot by Mr. Wm. Loane, September 5.

101. **Peregrine Falcon** (*Falco peregrinus anatum*).—Killed here September 25; stomach distended with grasshoppers.

102. **Fall birds.**—Night-hawk (*Chordeiles virginianus*) last seen September 30; Rusty Grakle (*Scolecophagus carolinus*) shot on Don Flats September 30; Sparrow Hawks (*Falco sparverius*), Broad-winged Hawks (*Buteo latissimus*), and Sharpshins (*Accipiter velox*) very abundant, October 1; the stomachs of nearly all these last were full of grasshoppers.

103. **Late nesting of Cuckoo.**—On August 12, I found the nest of a Black-billed Cuckoo (*Coccyzus erythropthalmus*) in Rosedale, North Toronto; it contained two eggs.—James R. Thurston.

104. **Fall Migrants.**—On September 28, I collected one Black-throated Blue Warbler (*Dendroica cærulescens*), and on the 22nd, one Winter Wren (*Troglodytes hiemalis*); on September 28, straggling flocks of White-crowned (*Zonotrichia leucophrys*), White-throated (*Z. albicollis*), Swamp (*Melospiza georgiana*), Song (*M. fasciata*) andVesper (*Poocætes gramineus*) Sparrows; also Myrtle Warblers (*Dendroica coronata*) and Vireos, were observed moving southward.—Hubert H. Brown.

(Fifteenth Meeting, October 15, 1889).

105. **Last Migrants.**—October 3, I shot a Solitary Vireo (*Vireo*

solitarius) on Spadina Avenue, Toronto; on October 5, noted the last White-crowned Sparrow (*Zonotrichia leucophrys*) and the last Highholder (*Colaptes auratus*).—George E. Atkinson.

106. **Fall Migrants, etc.** — On October 7, I collected one Pigeon Hawk (*Falco columbarius*); one Swamp Sparrow (*Melospiza georgiana*) found dead on the street; and one Brown Creeper (*Certhia familiaris americana*). On October 10, I shot one Snowbird (*Plectrophenax nivalis*) out of a flock of four on the sandbar.—Hubert H. Brown.

107. **General Notes.**—On October 10, we received at Mr. Cross' store:—one Horned Owl (*Bubo virginianus*) shot near Toronto; its stomach contained one Deer-mouse (*Hesperomys leucopus*). Also four Short-eared Owls (*Asio accipitrinus*), one Barred Owl (*Syrnium nebulosum*), several Saw-whets (*Nyctala acadica*), and one Wood Duck (*Aix sponsa*). On October 11, one Redtailed Hawk (*Buteo borealis*), its stomach contained several field mice (*Arvicola riparius*); one Sharpshin (*Accipiter velox*); one American Pipit (*Anthus pensilvanicus*), shot on the Island out of a large flock with Shorelarks. On the 12th, large numbers of Gulls were observed gathering about the Bay as usual to winter. On October 14, a male Goshawk (*Accipiter atricapillus*) in immature plumage, was taken.

108. **Cooper's Hawk at Toronto.**—On October 12, I received a fine hawk that had been disabled by flying against the wires in the city. It proved to be a male *Accipiter cooperi*, the first of the species ever observed in Toronto or vicinity by any of our members.—James R. Thurston.

(Sixteenth Meeting, October 29, 1889).

109. **Northern Shrike arrived.**—While at Lorne Park, Peel County, Ont., on October 19, I noticed a northern Shrike (*Lanius borealis*) the first observed this fall. It was in the immature plumage, and was pursued at a respectful distance by a flock of noisy Chicadees (*Parus articapillus*) of which, however, it took no notice so far as I could see.—Ernest E. Thompson.

110. **General notes.**—On October 19, we received at Mr. Cross' store:—two Barred Owls (*Syrnium nebulosum*) and one Screech Owl (*Megascops asio*) from near Toronto.

111. **Spruce Partridge in Haliburton County.** — On October 19, we received one of this species (*Dendragapus canadensis*) from Haliburton.

112. **October 22.**—Received at the store one Black Hawk (*Archibuteo lagopus sancti-johannis*), one Redshouldered Hawk (*Buteo lineatus*), one Screech Owl (*Megascops asio*), one Blackheart Sandpiper (*Tringa alpina pacifica*) all taken at Toronto.

113. **October 23.**—Received from Colborne, one Richardson's Owl (*Nyctala tengmalmi richardsoni*).

114. **October 24.**—Received a Bald Eagle (*Haliaëtos leucocephalus*) shot on the 5th concession of York, W.

115. **October 25.**—Received Green-winged Teal (*Anas carolinensis*), one Wilson's Snipe (*Gallinago delicata*), shot at Toronto.

116. **October 26.**—Received a Spruce Partridge (*Dendragapus canadensis*) from Haliburton and one Black Duck (*Anas obscura*) from Toronto.

117. **Oct. 29. Great Gray Owl.**—A fine specimen of this northern bird (*Ulula cinerea*) was sent to day to the store from North Bay, Lake Nipissing. Its stomach contained, one entire Shrew—apparently *Sorex cooperi*, and the remains of some field mice (*Arvicola riparius ?*).—James R. Thurston.

118. **Fox Sparrow arrived.**—On Oct. 26, while at Well's Hill, North Toronto, I shot a Fox Sparrow (*Passerella iliaca*). This is the only specimen reported this year.—George E. Atkinson.

119. **Fall migration and habits of the Pine Linnet or Siskin.**—On October 2, I observed three Pine Linnets (*Spinus pinus*), the first of the season. They were flying high in the air near Springfield, on the Credit. Their numbers increased in this neighborhood through October, and now, October 29, the species is extremely abundant. They are observed chiefly in flocks of various sizes among the silver-birch trees on whose catkins principally they subsist at this season. While on the wing each member of the flock utters its loud twitter, so that the presence of the birds is noticeable from a great distance; but as soon as they alight, each one sets about collecting

food, in silence, and usually no sound is uttered by them until some member of the company takes wing to reach a more inviting bunch of catkins, and utters his chirrup, as he does so. The Pigeon Falcon (*Falco columbarius*) seems to be their chief enemy at this time; one of the species was observed darting after a flock of the Linnets on October 28.—ERNEST E. THOMPSON.

(Seventeenth Meeting, November 12, 1889).

120. **Purple Sandpiper at Toronto.**—A specimen of this species (*Tringa maritima*) was brought into my store. It was killed on Toronto Bay, October 30. This makes the second record for Ontario, the other being that in McIlwraith's Birds of Ontario.

121. **Double-crested Cormorant.**—A specimen of *Phalacrocorax dilophus*, shot near Toronto was brought to me October 31.

122. **Cinereus Owl.**—A specimen of *Syrnium cinereum*, reached me from Powassan, Muskoka. Its stomach was distended with *Arvicolae.*

123. **Winter birds.**—The following winter birds have been observed already:—*Archibuteo lagopus sancti-johannis*, October 31, and twice since, both black and buff phases; *Nyctala tengmalmi richardsoni*, November 8; *Nyctea nyctea*, November 8, this, like the Great Gray Owl, seems unusually numerous this year; also taken November 9. *Urinator lumme, Larus franklinii, Larus philadelphia,* and *Larus delawarensis*, taken November 11, at Toronto.—WM. CROSS.

124. **Horned Owl devouring skunk.**—The stomach herewith shown is that of a *Bubo virginianus*, and is crammed with the flesh of a skunk, which doubtless to judge from the odor of the feathers was killed by the Owl itself.

125. **General notes.**—On November 8, I observed the following species, Northern Shrike (*Lanius borealis*); Bluebird, male, (*Sialia sialis*); and White-breasted Nuthatch (*Sitta carolinensis*).—JAMES R. THURSTON.

126. **Winter-birds arriving.**—On November 8, I shot three Redpolls (*Acanthis linaria*) in Rosedale, and on the 9th I saw a

Snowy Owl (*Nyctea nyctea*) sitting on the top of a flagstaff at the corner of Yonge and Wellesley Streets, in the city.—J. B. WILLIAMS.

127. **Late summer birds.**—On November 8, I shot a male Canada Flycatcher (*Sylvania canadensis*); on the 10th I saw a flock of Red-shouldered Blackbirds (*Agelaius phoeniceus*).—JOHN EDMONDS.

128. **Migrants.**—On November 3, I saw two Hermit Thrushes, (*Turdus aonalaschkae pollasii*); and one Bronze Blackbird (*Quiscalus purpureus æneus*).—GEORGE E. ATKINSON.

(Eighteenth Meeting, December 10, 1889).

129. **A late Plover.**—On November 9, I collected a specimen of Golden Plover (*Charadrius dominica*) on the Ashbridge sand-bar, it was in good condition and apparentiy in full possession of all its powers.—JOHN EDMONDS.

130. **Pine Grosbeaks, arrived.**—While at Georgetown in the County of Halton, on November 15, I noted a small flock of *Pinicola enucleator* feeding on the berries of the mountain ash.—WM. BRODIE.

131. **A late Towhee.**—I collected a male *Pipilo erythropthalmus*, on the Don Flats, November 16; it was in good condition. Mr. Thompson informs me that the bulk of this species went south during the first week of October.

132. **King Eider at Toronto.**—A fine male specimen of *Somateria spectabilis* was collected in Toronto Bay, November 25. This is the first positive record of the species for the Province.

133. **Great Gray Owls.**—A second specimen of *Syrnium cinereum* was received from the Nipissing region on the 22nd of November; and on December 2, I received a specimen that had been shot at Victoria Park near Toronto; on December 7, I received another from Lorne Park, Peel County, Ontario; and on December 4, another from Port Arthur. This species is more abundant this year than ever I have known it before; a taxidermist in Quebec informs me that he has received nearly a dozen this winter already, which is more than he obtained in the previous seven years that he

has been in business. I can say much the same myself, for this year already I have had six fine specimens more than all put together that I have had in the previous years I have been in Toronto.

134. **A flock of Short-eared Owls.**—A flock of over fifty of this species (*Asio accipitrinus*) was seen on the sand-bar of Ashbridge Bay, December 5. Seven specimens were killed at three shots and brought to me.

135. **Razor-billed Auk at Toronto.**—The capture of this species (*Alca torda*), on Toronto Bay on December 10, is one of the most interesting bird events of this fall. The specimen answers exactly to the description in Ridgway's "Manual," except that it has the white line from the eye to the base of the culmen, and this should be absent at this season. The following are the measurements:—length, $16\frac{1}{8}$ inches; extent, $25\frac{5}{8}$; wing, $7\frac{1}{4}$; tail, $3\frac{1}{4}$; tarsus, $1\frac{3}{16}$; culmen, $1\frac{1}{8}$; depth of bill, $\frac{5}{8}$. Back, black; secondaries, tipped with white; under parts, pure white; space behind the eye, dusky white.

136. **Snowy Owls.**—This species (*Nyctea nyctea*) is very plentiful this year, eighteen having been brought to me already. I have been struck by the fact, not generally known I believe, that this bird has "horns" or "ears." I have paid particular attention to this fact this season, and find that the feathers of the horns are fully one-eighth of an inch longer than the surrounding feathers, and very much darker in colouring or spots. I find them in every specimen I examine, though they may easily escape notice in a dried skin. Three of my specimens were collected on Toronto Island on December 10, and all were from the neighborhood of Toronto city.

137. **General notes.**—The following have been received at the store since last meeting:—*Lophodytes cucullatus*, male, Toronto, November 9; *Bubo virginianus*, Davisville, November 22; another, Harrietsville, December 5; *Nyctala acadica*, Todmorden, December 10; *Falco columbarius*, male, Ashbridge Bay, December 6; a pair of *Ceophlœus pileatus*, male and female from Haliburton, November 29; *Picoides arcticus*, from Parry Sound, December 2; *Pinicola enucleator*, Wells' Hill, Toronto, December 3; *Lanius borealis*, Toronto, December 10, remarkable for the dull faded brown of its plumage.—WM. CROSS.

138. **White-breasted Nuthatch, wintering at Toronto.**

—On December 1, I observed a pair of this species (*Sitta carolinensis*), and make record of the same as the question of their wintering here has been raised.—J. B. WILLIAMS.

(Nineteenth Meeting, December 31, 1889).

139. **Pine Grosbeaks at Toronto.**—December 23, met with a flock of nine or ten Pine Grosbeaks (*Pinicola enucleator*); three or four were males; procured a male and female; when fired at, the flock flew away uttering a shrill cry. They were in the woods north of Rosedale. It is five years since I last met with any close to the city.

140. **Nuthatch wintering.**—December 19, saw two White-breasted Nuthatches (*Sitta carolinensis*) in Queen's Park.—J. B. WILLIAMS.

141. **Bohemian Waxwing at Toronto.**—On Parliament Street, December 22, I saw one of this species (*Ampelis garrulus*) feeding on the berries of the mountain ash.

142. **Shrike capturing Goldfinch.**—In Rosedale on Dec. 15, I watched a Shrike (*Lanius borealis*) in pursuit of a Goldfinch (*Spinus tristis*); it captured the latter on the wing and disappeared with it into the bushes.—JAMES R. THURSTON.

143. **Flicker wintering in Ontario.**—A specimen of *Colaptes auratus*, shot at Chatham a few days ago, has come into my possession.

144. **Northern Shrike.**—A fine specimen of this bird (*Lanius borealis*) has just reached me, it is in the clear bluish ash plumage. It is remarkable that all the specimens taken in the early part of the season, are in the dull brown stage, and those that come later are in the bluish. Is this due to the wearing off of the brown on the feathers, or to the fact that the younger birds arrive first?—WM. CROSS.

145. **Yellow-bellied Woodpecker.**—Reference was made to this species as a true Sapsucker—Dr. Brodie objected, that he did not accept all the current stories about its sap-sucking propensities. Mr.

Williams mentioned some interesting facts that had come under his observation, which proved the bird to be a habitual borer for sap. Mr. Thompson cited another similar instance and referred to the fact that the species arrived in the spring when the sap began to move. Dr. Brodie believed that the bird would occasionally be found wintering here, and read numerous records of gizzard contents to show that the bird did not subsist on the inner bark of trees, but that it was an omnivorous feeder like the *Colaptes auratus*. Mr. Williams promised to present his observation on paper at a future meeting.—The Secretary.

144. After the handing in of reports, Mr. Williams exhibited specimens of the Pine Grosbeak (*Pinicola enucleator*). Mr. Thompson referred to their feeding on the scale-like seeds of Conifers, and remarked that there were several competitors for this class of food in the winter, and that three distinct forms of beak were adapted for extracting the seeds from the cone—these three are represented by the beaks of *Pinicola enucleator*, *Spinus pinus*, *Loxia curvirostra* The first secures the coveted morsels by main force, being a remarkably massive, strong bill ; the second the Pine Linnet's, is an exceedingly sharp pointed probe-like forceps, adapted for insertion between the scales ; but the last, the bill of the Crossbill, though so odd-looking, is the most perfect instrument of all, and by its help the scales are bent outwards and the seed extracted with remarkable celerity.

MEMBERS OF THE ORNITHOLOGICAL SUB-SECTION.

December 31st, 1889.

Wm. Brodie. L.D.S., *Chairman, etc*	233 Carleton St.,	Toronto.
Geo. E. Atkinson, *Recording Secretary*	415 Spadina Ave.,	"
J. B. Williams, *Corresponding Sec'y*	23 St. Vincent St.,	"
Ernest E. Thompson, *Editor*	86 Howard St.,	"
James H. Ames	83 Bay St.,	"
Hubert H. Brown	445 Yonge St.,	"
Daniel G. Cox	372 Ontario St.,	"
Wm. Cross	265 Yonge St.,	"
John Edmonds	572 Parliament St.,	"
Jas. H. Fleming	19 Elm St.,	"
John Jackson	370 Parliament St.,	"
John Maughan. Jr	90 Wellington Sq.	"
Wm. Metcalf	6 Gifford St	"
Chas. E. Pearson	167 College St.,	"
Jack Ramsay	47 Sullivan St.,	"
James R. Thurston	9 Milan St.,	"
H. Turner	35 Sussex Ave.,	"
James A. Varley	104½ Rose Ave.,	"

THE "FLYING PROAS" OF THE LADRONE ISLANDS.

BY CAPT. STUPART, R. N.

Lord Anson in his voyage round the world in 1740–44, speaks thus of these boats :

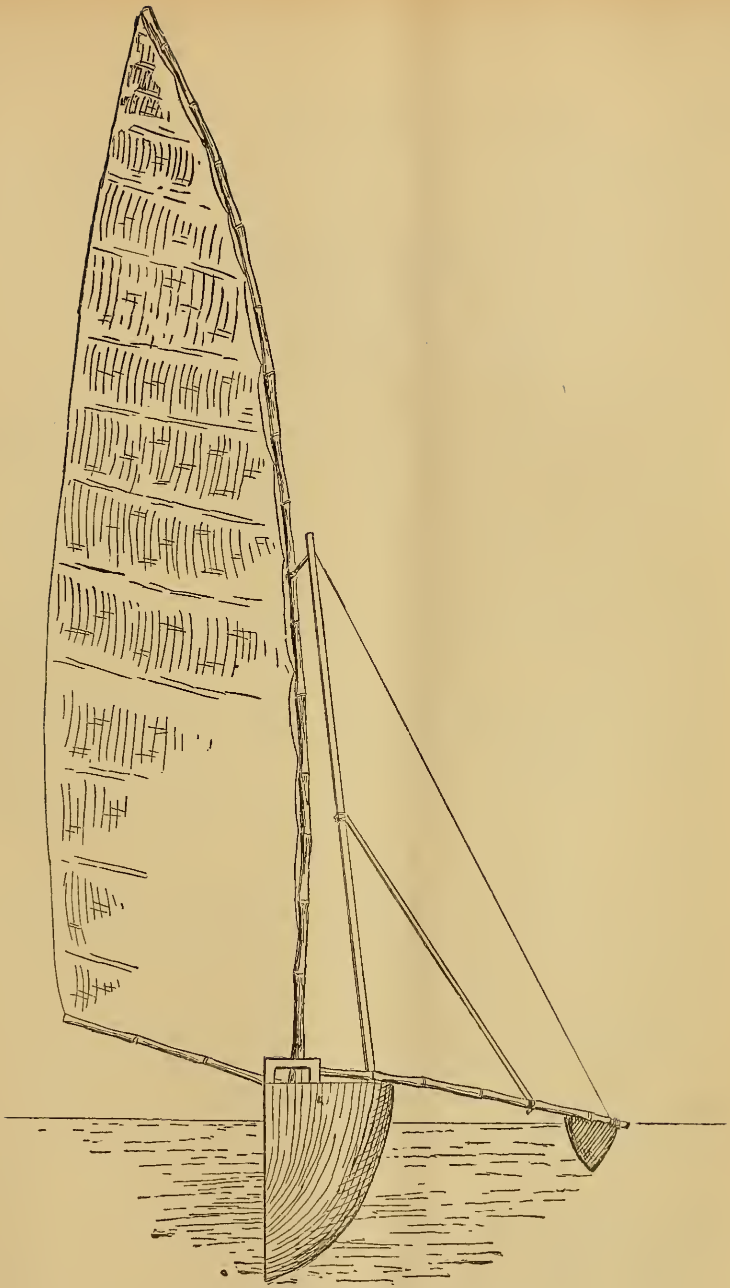
"If we examine the simplicity and ingenuity of its construction and the extraordinary velocity with which it moves, we shall find it worthy of our admiration and deserving a place amongst the mechanical productions of the most civilized nations, where arts and sciences have flourished ; hence these boats deserve our attention."

The Islands are situated between 10° and 20° north latitude, and in longitude 145° East ; they were first made known to the world in 1521, by Magellan.

Dampier (who has always been considered a most accurate observer and a good describer) followed in 1686 ; he writes : "The natives were very ingenious beyond any people in making boats or proas, as they are called in India, and therein they take great delight. I did for my own satisfaction try the swiftness of one of them ; sailing by our log we had 12 knots on our reel, and she ran it all out before the minute glass was half out, which if it had been no more, is at the rate of 12 miles an hour, but I do believe she would have run 24 miles an hour."

There is another point which gives a more correct idea of "Pacific" navigation than I have met elsewhere. Mr. Walter Coote, F. R. G. S., accompanied Bishop Selwyn in his periodical visit to the Pacific Islands in the yacht Southern Cross, in 1882, and he thus speaks of the navigating knowledge of the "Santa Cruz" natives.

"The natives of Santa Cruz do not hesitate to make cruises far out of sight of land, their knowledge of the stars being very considerable." "I have noticed the elder of the three boys whom we subsequently brought away from here, teaching the names of various stars to his younger companions," and they knew the *direction* of their native island however distant it might be.



PROA OF THE LADRONE ISLANDS.

Length, 27 ft.; Depth, 5 ft.; Width, 4 ft. 6 in.; Yard, bamboo Outrigger bamboo Sails, matting. The flat perpendicular is always the lee side

PRISON REFORM.

By A. M. Rosebrugh, M. D.

[*Abstract of a paper read before the Canadian Institute, 1889*].

The claim that prison reform had its origin in the bosom of the church is not an idle claim. Pope Clement XI., in 1703, wrote over the door of the Roman prison of St. Michele : *Parum est improbos coercere pœnâ, nisi probos efficias disciplinâ.** But prison reform has been a plant of slow growth, and it was not until long after the death of John Howard, the prison philanthropist, that prison reform took practical shape. Howard was the means of inaugurating a more humane treatment of prisoners, but the principle enunciated by Clement XI., is not even yet fully recognized. Penologists believe that while incorrigible criminals should be permanently incarcerated, the corrigible ones should be reformed by discipline, by labour, secular and religious instruction, etc., and that short of this our penal institutions are a failure—crime is not diminished, and society is not protected.

Among the means that have been found to be of most service in effecting the reformation of prisoners, the following are considered the most important, namely—Classification, Industrial Employment, Indeterminate Sentences, Conditional Liberation, Secular and Religious Education, and Prisoners' Aid Societies.

1. Classification.—The most important requirement in the reformation of prisoners is classification. Very little can be accomplished in the reformation of prisoners while old offenders are allowed to associate with other prisoners. There is but one remedy and that is the absolute separation of the prisoners, so that no prisoner shall come in contact with any other prisoner. No half measures will suffice ; no grouping into classes is of any avail ; the choice must be between separation and contamination.

As about $\frac{4}{5}$ of all prisoners, on an average, are kept in county jails,

* It is useless to imprison criminals unless you reform them by discipline.

it seems the height of folly to allow the free range among them of old offenders. "Any advance in the reform of prisoners," says Gen. Brinkerhoff, "must commence with the county jails, and such separation must be secured as shall not allow any one prisoner to associate with any other prisoner during the period of his incarceration in such jail."

This system is called the separate, cellular, or individual system. The separate system was recommended in England by a select committee of the House of Lords as far back as in 1835; again in 1847, and still again in 1850. The committee in their report in 1850, state that "they entertain a very decided opinion on this head—that the separate system must be accepted as the foundation of prison discipline, and that its rigid maintenance is a vital principle in the efficiency of county and borough jails."

Copies of this report were transmitted to the Governor General of Canada in 1865, strongly urging the adoption of the separate system in Canada, and adding: "You will bear in mind that no ordinary difficulties, nor indeed any difficulties should be allowed to stand in the way of the establishment of the system."

In the International Prison Congress held in London, in 1872, the delegates from Russia, Germany and Belgium, reported that they were satisfied with their prison system so far as it was cellular or separate and no further.

In Great Britain the cellular system is in operation in all the local prisons, and these prisons are now under the absolute and undivided control of the Home office. Convicts who are under sentences of five years or more, spend the first nine months in cellular confinement. After the first nine months they are allowed to work in association, but at other times they are kept separate. It is found that short sentences with cellular confinement in the local prisons has a much greater deterrent effect than longer sentences without such cellular confinement. The cost of the construction of the jails on the cellular plan is greater, but it is good economy, firstly, because the prisoners receive shorter sentences, and, secondly, because there are fewer re-committals.

Industrial Employment.—Regarding the necessity for industrial employment for prisoners, there is no difference of opinion among prison managers. There can be no reformation or proper discipline without it. Prison experts also believe that prison labour has no appreciable effect on free labour either in the prices of products or wages. In the United States it is claimed that the total product of convict labour as compared with the total product of free labour, is less than $\frac{3}{5}$ per cent. In reformatories and other institutions where reformation is the principal end in view, such industries should be engaged in as will best tend to make the prisoners self-supporting after their discharge. In penitentiaries where life prisoners and incorrigibles are imprisoned, that system of labour may be adopted which will tend to make the prison self-sustaining—care being taken of course, to reduce the competition with free labour to a minimum. "Labour," says Warden Massie, "in its several pursuits, stands next to Christianity, first and indispensable; without it reformation of character may be said to be impossible."

Master Workman Powderly says, very properly:

"Do not keep criminals in idleness, but do not throw their labor on the market for a less price than that paid to honest labor; reform the imprisoned as well as punish them; give them work for the brain to do as well as for the hands; teach them how to be Christians while teaching them how to work; take what is given to the contractor of their earnings and give it to themselves when they leave prison, or allow their earnings to go to the support of their families, if they have any, instead of throwing these families on the charities of the town, while the prison contractor reaps a reward from the crime that causes him to wish that the crop of criminals may grow larger."

The Indeterminate Sentence.—An indeterminate sentence is one which has no maximum limit. The criminal is simply convicted and sentenced for the crime of which he is charged. On indeterminate sentences prisoners can earn their discharge by good conduct, but if they are incorrigible they may be held for life. In the reformatory at Elmira, N. Y., the young men must earn their discharge by mastering a trade and passing a thorough examination in certain studies. The indeterminate sentence is in operation in some of the work houses in the United States where tramps and habitual drunkards are incarcerated. The Hon. Frederick Hill, Inspector-General of Scotland was the first to recommend the indeterminate sentence. It assumes that a person convicted of crime is morally diseased and should be imprisoned as an insane patient is confined, and that he should not be discharged until cured.

Conditional Liberation.—Conditional liberation or the parole system is almost a necessary accompaniment of the indeterminate sentence system. It is a modification of, and an improvement upon, the English ticket-of-leave system. The prisoner is not released until employment is found for him and he is required to report periodically to some officer designated by the prison authorities. Failing this he is recommitted. So long as his conduct is good he is encouraged and given substantial aid if necessary. In 1864 a new Penal Servitude Act was passed in England embodying the Crofton system which includes indeterminate sentences and conditional liberation. Since then crime has steadily decreased in Great Britain. At Elmira, N. Y., it is claimed that fully 80 per cent. of all prisoners who are discharged on parole are permanently reformed.

Education.—Another important requirement in prison reform is education. A large proportion of incarcerated criminals are quite illiterate. It is from the illiterate and the idle classes that a very large percentage of the criminal class is recruited. Industrial training should be incorporated with our education system and attendance at school should be made compulsory. In industrial schools and reformatories, a good common school education should be given, and proficiency both in studies and in acquiring a trade should be made both an incentive and a *sine qua non* to a discharge. At the reformatory for young men at Elmira, N. Y., no one is discharged until he has thoroughly mastered a trade and passed the required examination in his studies. The discharge is quite independent of outside influence.

Religion.—For the reformation of prisoners religion is the highest motive power that can be brought to bear. No permanent progress in prison reform can be expected without it. The religious influence of the chaplain or Sunday-school teacher should be supplemented by that of God-fearing prison officers and employés, otherwise all efforts in this direction may be completely neutralized. No reformation can be expected in a prison where there is a profane or intemperate official.

Prisoners' Aid Associations.—The cause of prison reform has also been promoted by Prisoners' Aid Associations. These societies extend a helping hand to prisoners on their discharge from prison. Employment is found for them, and, when necessary, tools or money is supplied. This critical period in the prisoner's history is thus tided over and every effort in the direction of reformation of character is encouraged. The Prisoners' Aid Association of Canada is doing a good work in this direction, and the managers are now making an effort to establish branches in all the cities and larger towns of Ontario.

Prison Reform in Ontario.—In the Province of Ontario the Prisoners' Aid Association of Canada has memorialized the Local Government on the question of prison reform. This society has asked the Ontario Government to appoint a Commission of competent gentlemen to collect information regarding Prisons, Reformatories, Houses of Correction, Work-Houses, etc., with a view to the adoption of the most approved methods of dealing with the criminal classes, suggesting to the Government the propriety of erecting sufficient Prison and Reformatory accommodation in the Province to completely relieve the gaols of criminals convicted of crime and under sentence, and asking for a report on the following, viz. :—(1) The causes of crime, such as drink, over-crowding, immoral literature, Sabbath-breaking, truants from school, etc. : (2) the best means of rescuing destitute children from a criminal career : (3) the best means of providing and conducting Industrial schools : (4) the propriety of the Government assuming larger control of County Gaols : (5) industrial employment of prisoners : (6) indeterminate sentences : (7) the best method of dealing with tramps and habitual drunkards.

This Association has also commended the following resolutions to the favorable consideration of the Government :*

1. County Jails should be maintained only as places of detention for persons charged with offences and awaiting trial, and should not be used for prisoners after trial and conviction.

2. County Jails should be conducted strictly on the separate or cellular system.

3. Persons convicted of crime should not be detained in county jails, but should be dealt with according to the age and natural proclivities of the criminal.

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* Since this paper was read before the Canadian Institute these resolutions have been endorsed by church courts, county judges, sheriffs, wardens, gaolers, etc., by the religious and secular press, by eminent American penologists such as Gen. Brinkerhoff of Ohio, Brockway of Elmira Reformatory, Brush, of Sing-Sing, etc., and also by the Canadian Institute and other societies.

4. A boy under fourteen years of age, not previously vicious, should be restored to his parents upon their giving a guarantee of his future good conduct. Failing this he should be sent to an Industrial School.

5. A boy under sixteen years of age, having a natural tendency toward crime, or being convicted of a second offence, should be sent either to a Reformatory direct, or to an Industrial School on trial, according to circumstances; and a special court should be organized to deal with these cases, as well as with females charged with light offences. A boy should never be brought to open Police Court nor be sent to a county jail.

6. Industrial Schools and Reformatories should not be considered as places for punishment, but should be utilized wholly for the reformation of character. The young persons sent to these institutions should not be committed for any definite period, but they should be detained until reformation is attained, irrespective of the time required. The officers of these institutions should be carefully selected, preferably by a system of examination and promotion, and without reference to party or social influence.

7. As industrial employment is a necessary step towards reformation, and as this cannot be supplied by the county jails, the necessity arises for prisons and reformatories of ample dimensions, where such employment can be provided, and where other influences of a reformatory character may be utilized, and where a system of classification may be carried on.

8. The expense and management of such persons in such institutions should be borne by the county from which they are sent, when such expense exceeds the proceeds of the industrial labor of the persons so sent.

9. Tramps and habitual drunkards should be sent to an institution where they can be provided with productive industrial employment, and where they can be brought under reformatory influences, and they should be detained in said institution under indeterminate sentences. Incorrigibles should be sentenced to penitentiary for life. They should be considered as having forfeited all right to regain their liberty unless reformation takes place.

10. In order to meet the requirements of the case there should be sufficient prison accommodation in Ontario to relieve the county jails of all persons undergoing sentence. This accommodation should be provided either by enlarging the Central Prison or by erecting two additional prisons, one in the east and the other in the west. There should be unification in our prison system. The prisons should be graded, and the reformatory principle in its most improved form and after the best models should be incorporated with said system.

11. The question of prison labor should be removed from the arena of party politics, and members ofl abor organizations should look at this question from a patriotic rather than from a trades standpoint.

A practical difficulty in the way of prison reform in this Province is the divided control of the county gaols. The gaols are under the inspection of the local Government, but the construction and maintenance is under the control of the county councils. Prison reform requires unification and centralization of the prison system of the state. Without it true prison reform is impossible. Unification and centralization is necessary in our education system. It is quite as necessary in our penal system. In Belgium and in Great Britain all the local prisons are constructed on the same system (the cellular system). This was not effected in England until the Central Government assumed absolute control of all the local prisons. Previous to this, every effort was made by the Government to induce, and even to compel, the local authorities to make the change but without avail. We should profit by the experience of the Mother Country.

THE LANGUAGE OF THE MISSISSAGUAS OF SCUGOG. [Abstract]

BY A. F. CHAMBERLAIN, M.A.

In the course of a visit paid to the Indians of Scugog in August, 1888, the writer was enabled to collect a vocabulary of some 700 words, besides personal and place names. The vocabulary shows the Mississagua to be almost pure Ojebway, there being, however, several points in which it seems to possess dialectic peculiarities, such as the use (more frequent than in Ojebway) of the o—so often elided or absent in other Algonkin dialects, as recorded by travellers ; it is very difficult to catch this o-sound, and it is perhaps more often indistinctly sounded than omitted altogether. A few words also seem peculiarly Mississagua and to differ from those in use by other Ojebway tribes. The language which the Mississagua most closely resembles is that of the Algonkins of the Lake of the Two Mountains as recorded by Cuoq (Lexique Algonquin, 1886). The following words are not to be found in Wilson's and Baraga's Dictionaries, or different words are given :

Ash (Black) .... *wisádjak.*
Bald-headed Eagle .... *amigigikwani.*
Bark-dish (for winnowing rice. ..*noshkátshigan.*
Bulrush................ *anókanashk.*
Burdock .... *osákatábawug,* (sticky thing).
Chisel .... *éshkon* (horn).
Chickadee .... *gidji konéshi.*
Chipmunk .... *ogwingwis.*
Clam .... *ássens.*
Currant (wild black).... *amikowomin.*
Ear-fish (of Lake Huron).. *otáwgamek.*
Fox-bird .... *ánuk.*
Hemlock .... *kákamish.*
Hell-diver .... *shíngibis.*
Heron .... *moshkóosi.*
Iron-wood .... *máneh.*
Landing (for boats) .... *kapískoin.*
Maple (hard) .... *aninátik.*
" (soft)........... *chigimanish.*
Meat-bird .... *gwingwish.*
Milky Way ....*namehpakweh-bikamitowut,* (the sturgeon making *rily* water).
Mat (for drying rice on) .. *opódjigan.*
Mudturtle .... *míshika.*
Moth (night-flying)........... *nitos.*
Parched rice .... *kawpísigan.*
Sarsaparilla........ *okádak* (leg-root.)

Sassafras .... *menagwákomis,* (scented tree).	Stove .... *piwabikisikon*
Spruce .... *kowándak.*	Sun-fish .... *okwatashi.*
Sticks (for beating rice).. *pawágmatak.*	Trolling-line .... *odádjigókon.*
	Water-lily .... *okitabuk.*

The Mississagua vocabulary appears to contain but few non-Algonkin words. *Owistoiia* (blacksmith) appears to be an Iroquois loan-word; *nápané* (flour) is but the French *la farine* Indianised; *bojou* (good day) the ordinary salutation, is the French *bon jour.* At Scugog, however, very many English words such as knife, fork, table, buttons, spoon, etc., are used by the Indians in ordinary conversation, and they have forgotten many of their own words formerly in use. One Indian said they had no word for "tree," and several of them had hard work in recollecting the words asked from them. In response to enquiries as to the existence of a "children's language," the writer succeeded in discovering only two words (used by the children) which differed from the ordinary speech, viz.: *tehteh* (father) and *dodon* (mother). The words, as a rule, are strongly accented especially when a monosyllabic, and there is sometimes a peculiar drawl, as e.g. in the word for porcupine *ka......h'....k'.* The short ă and ŏ are not very distinct, and both tend to become the *u* of *but; d* and *t* are indistinct, the sound really made being a medial between these, the same holding of *p* and *b*, and *g* and *k*. A peculiar sound is that of the pronominal prefix *n'* as in *n'teh* (my heart). The vocabulary contains a fair proportion of monosyllables and dissyllables, the former being radical words (in most cases) the meaning and etymology not being apparent; this holds also of many dissyllables. Such are:—*múkwa* (bear), *amík* (beaver), *múkuk* (box), *ondék* (crow), *ódjig* (fisher), *áki* (earth, etc.), *min* (blueberry), *n'os* (my father), *n'teh* (my heart), *nin* (I), *mang'k* (loon), *moons* (moose). Like other Indian language the Mississagua contains many of those descriptive names which are of interest to the student of Onomatology. Such are:—*Debikisis* (moon = night sun), *muskegamin* (cranberry = marsh-fruit), *okadak* (sarsaparilla = leg-root), *menagwakomis* (sassafras = scented tree), *manistanis* (sheep = hide not durable), *shishibanwing* (shot = duck-stones), *omúkaki* (frog = devoid of hair, or fur), *pewábik* (iron = it crumbles off), *wabimotchichagwun* (looking-glass = where they see ghosts), *otagwanibisan* [rainbow = he (*i.e.,* the Manitou) covers the rain with a mantle], etc. But few words appear to be of onomatopœic origin. To this category belong most probably :—*shiship* (duck), *kokosh* (pig), *papi*, (laugh), *kokoko* (owl), *kakaki* (raven) and perhaps a few others. The change that has taken place in the vocabulary, judging from a comparison with the " Old Algonkin of La Hontan," and a Ms. vocabulary of Mississagua (1805), does not seem extensive, *e.g.*:

1805	makwa,	amik,	chichip,	wikiouam,	pouacan,	chipi,	cema,	nipi,	etc.
	(*bear*)	(*beaver*)	(*duck*)	(*house*)	(*pipe*)	(*river*)	(*tobacco*)	(*water*).	
1888	mukwa,	amik,	shiship,	wikiwam,	poagan,	sipi,	sema,	nipi,	etc.
1703	———,	amic,	chichib,	ouikiouam,	poagan,	sipin,	sema,	nipi,	etc.

THE ORIGIN AND DEVELOPMENT OF GRAMMATICAL GENDER. [Abstract]

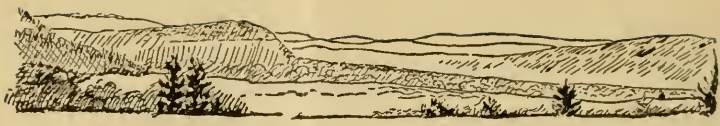
BY A. F. CHAMBERLAIN, M.A.

The ordinary view of the origin of Grammatical Gender is expressed by Prof. Whitney (Language and the study of Language, 1803, p. 78) in these words :—"The whole language was the scene of an immense personification, whereby sexual qualities were attributed to everything in the world, both of nature and of mind; often on the ground of conceptions and analogies which we find it excessively difficult to recognize and appreciate." Canon Farrar attributes it to the domination of the imagination (Chapters on Language, 1873, p. 188). Paul expresses a similar opinion (Princip. der Sprachgesch., 1886, p. 220). The common ground taken by those who try to explain Grammatical Gender is that it arose from the fundamental distinction of sex, through the medium of personification.

The principal languages possessing Grammatical Gender are the Indo-European, Semitic, Hamitic, Bantu (Hottentot, etc.), Oigob, Caucasian (some only), the Khasia (of S. E. Asia) and perhaps a few others. In an able essay (Das Nominalgeschlecht in den indog. Sprachen, Internat. Zeitschrift f. allgem. Sprachwissenschaft IV, 100-109) the eminent philologist and grammarian, Karl Brugmann, endeavours with some success to prove that personification will not explain the phenomena of Grammatical Gender in Indo-European speech. Bleek's numerous essays on the Bantu languages are very valuable, as also is the work of M. Lucien Adam (Du Genre dans les diverses Langues, Paris, 1887), and much of value is to be gleaned from the encyclopædic volumes of F. Müller. Regarding the American group of speech, Dr. Brinton says :—"A grammatical sex-distinction, which is the prevailing one in the grammars of the Aryan tongues does not exist in any American dialect known to me" (Lang. of Palæolithic Man, 1888, p. 14). Along with the American stand the Australian, Melanesian, Polynesian, Malayan, Mongolian (Samoyed, Uralian, Altaic, Japanese, Corean, etc.), Monosyllabic of S. E. Asia (some only, as Burmese, Chinese, Siamese, Annamese), some African tongues (as Fulah, Nuba, Kunama, Barea, Somali, Niam-niam), Dravidian (except where Sanskrit has influenced), Caucasian (some only as Lezghi, Ude, Georgian, Mingrelian, Lazic, Suanic), Basque, Negro Languages of W. Africa (as Serer, Nupe, Soninké, Mandingo, Serechule, Basa, Grebo, Kuru etc.), Kham-Bushman, Nicobarese and Andamanese. The distinction of *animate* and *inanimate* so characteristic of American tongues appears also in several old-world languages, as :—Caucasian (Abchas, Kasikumuk, Artschi, Hürkan, Tschetschenz, Thusi, etc.), Dravidian, etc. The Khasia, Tibetan, and Hürkan and Avar are of especial value for our study of this subject. It is in the American languages taken in connection with these that the solution of the problem is to be found. To the American tongues, considered in this respect, M. Lucien Adam and M. Raoul de la Grasserie, have devoted considerable attention. The probability of the distinction between animate and inanimate having preceded that of male and female is very great. The able essay of M. de La Grasserie (Revue de Linguistique, XIX, 96-102) throws considerable light upon the subject. The following scheme shows the ideas of M. de La Grasserie, regarding the origin and development of Grammatical Gender:

I. Ego (animal)—non-ego. II. animate (homo)—inanimate (vitalistic distinction). III. rational — irrational (rationalistic). IV. andric—metandric (conception of man as superior in intelligence and dignity to woman). V. Meidzobiotic—meiobiotic (conception of greater or less intensity of vitality. VI. Masculine—Feminine.

Man first distinguished the *ego* and the *non-ego*, and along with this the *like-me* and the *unlike-me*. Then he separated the animate and the inanimate into two great groups, himself included in the first. The next step was to discover the rationalistic distinction between himself and the other animals; this led to his esteeming himself higher in dignity and intelligence to woman, and again to a distinction based upon the degree of intensity of vitality which finally led up to the differentiation of masculine and feminine. Instead of there having been one original sex-distinction from which grammatical gender and all other genders arose, there have been many more, more in some languages than others, and not until all these categories have been examined and searched into can the problem of the origin of Grammatical Gender be solved.



Lines of the Giant range—West of Silver Mountain.

BROAD OUTLINES OF THE GEOLOGY OF THE NORTH-WEST OF LAKE SUPERIOR.*

BY ARTHUR HARVEY.

So little serious Geological work has been done to the north of Lake Superior that it is almost a virgin territory, yet this is surely one of the pivotal points of the geology and geography of the continent. If we look for the governing range, the key to the formation of North-Eastern America, we shall find it in the height of land which runs from a little N. W. of Lake Superior to Labrador. There is no exception to the rule that great heights and depths produce great geologic and geographic features; the capes and palisades around Thunder Bay and its vicinity are lofty still—McKay Mountain rises 1000 feet, and Thunder Cape 1200 above the water—but this is not nearly all their story; the great lake near them suddenly deepens, and if one could look up, even now, from the bed of Lake Superior near these points, we should see over 2000 feet of a coast range towering above us, cliff upon cliff; nor can one doubt that this was less than half, probably less than a fourth of the original height of the Laurentian country there. A map is offered, giving a conjectural outline of the Archæan continent, and rising upon this base we may well imagine more than one range of mountains—as lofty, as rugged, as the Rocky Mountains of to-day.†

* This paper was written with special reference to the mining industry of the north shore, and plans of all the working mines and some of the abandoned ones were submitted; also statistics of production. These the author omits in this abstract, as being of evanescent interest.

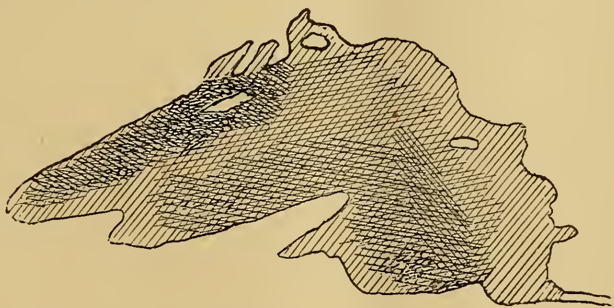
† This map showed a continent extending from the Lake of the Woods to Newfoundland. The southern boundary ran through the lake country, crossing from Lake Huron to the foot of Lake Ontario, *via* Lake Simcoe. There was an extension southward from this point through New Jersey. It covered most of the country north of the lakes and River St. Lawrence, and the principal mountain chains had an east and west trend.

This land quite possibly existed in truly pre-glacial days. It requires no great daring to imagine the time when ice was not. But as soon as the globe had cooled so far as to admit of the existence of water, ice would begin to show in winter at the poles, and slowly extend from the regions within which the nights are four and three months long to those in which they last but two and one. When it reached from the north the confines of this primitive continent, glaciers having meanwhile formed upon the mountain ranges, the ice action, uniting with unchecked sub-aerial influences, would increase in power and effect. So, age after age, the assault of the elements would naturally degrade the whole extensive area, dispersing its materials. Sooner or later barrier after barrier must go; finally (after several oscillations of level) even that one north of Lake Superior—and so, we may be persuaded, the Great Laurentian Continent came to an end as such—by the effects of warm airs and softening rains from the south and west, and the persistent attacks of Polar cold from the north and east.

Until the last great barrier of lofty hills had been overcome, the general temperature south of it was probably quite mild, in spite of latitude, but the breach having once been made, the waves of cold would resistlessly pour through—and thus, perhaps, we may comprehend the extension of an ice age over a great adjoining area, and the planing down of the heights to something near their monotony of to-day. Thus too we can readily understand how the great plains north of the height of land behind us were formed, very gradually sloping to the Hudson's Bay; how the James' Bay mudflats came to exist; how the lands and islands of our Arctic Ocean came to be shaped as the map shows them—with forms familiar to all who have observed the glaciated regions of Muskoka and the northern shores of the upper lakes. And if we wish to form an adequate idea of the vastness of these forces, the length of time during which they operated, the height of the old mountains, and the thickness of the strata worn away, we have only to consider that from the ruins of this continent came the tens of thousands of feet in thickness of the Cambrian, Silurian, Devonian formations, and what others not, in great variety, extending over a quarter of million of square miles south of it, and perhaps more yet to the north.

It seems not unlikely that one chief breach of the rampart against cold occurred where Lake Superior is, and that great icebergs streamed from that point into a southern sea. The great depth of the lake, even now, gives color to this supposition. With thousands of feet of newer formations distributed over its bed, it is yet the deepest depression on the continent, and the belts of greatest depth—survivals, so to speak, of its former greater profundity—run southerly and south-westerly. Along its westerly shores, from Thunder Cape to near Duluth, embracing the Isle Royale, the present depth is from 800 to 1000 feet, and as the level of the lake is 602 feet above tide water, its floor is here from 200 to 400 feet lower than the level of the sea. At the early epoch we are now considering, the lake was perhaps many thousand feet deeper still, and there was an uninterrupted stretch of ocean all the way to the present Gulf of Mexico. As the detritus from the primitive formations settled in this sea—as the Alleghanies grew and the Rocky Mountains developed—this ocean contracted into a gulf, running south from Lake Superior. As the area of the gulf became restricted by the continuance of these processes, it would assume a shape not unlike that of the Baltic of to-day ; one arm running up from the present position of St. Louis, by Duluth, to Black and Thunder Bays ; the other from the same point up the valley of the Ohio, and by Chicago north and east. Then might well follow the period spoken of in "The Geology of Minnesota," Vol. I., p. 35, when the lake region was cut off from the salt water, when Lake Superior was 500 feet above its present level, but the water still ran by the St. Louis valley (Duluth) to the Mississippi. Afterwards the southerly out-flow stopped, the regions between the lake and the gulf rising further yet, and a new eastward channel to the Atlantic grew into being—this comparatively recent system now under many names having an outlet to the ocean by the noble St. Lawrence. Gen. Warren's map, showing a stream connecting Lake Winnipeg with the Mississippi, while an arm of the Gulf of Mexico brings salt water as far up the great valley as the parallel of Chicago, the Ohio and the Missouri being extensions of this arm, represents a very probable late stage of the transformations referred to. The scenes are still shifting, the secular change now going on is doubtless on the lines of the past, the basin of Lake Superior is still filling up, though as ever, very slowly; soundings almost everywhere disclose a bottom of clay, brought down by the rains and rivers from its rim, still being degraded. The Gulf of Mexico is being further filled up, along its northern border. The banks of Newfoundland are still being added to by the cargoes of northern icebergs. The impediments to the outflow of inland waters by the St. Lawrence are still being removed, for the St. Lawrence rapids, Niagara, the Sault Ste. Marie, are still wearing away. In due time there will be only rivers where some of the lakes now are ; Erie and St. Clair being the first to disappear.

Mr. A. T. Drummond, I perceive, has been treating of this subject in the Record of Science—and as that periodical has to a certain extent the *imprimatur* of Sir William Dawson, no paper in it should be disregarded. But from Mr. Drummond's special view, I cannot but dissent. He treats the lakes as mere expansions of pre-glacial rivers, and he marks on his map the lines in which those rivers ran. He makes his principal river run north-east from Duluth. Now that Lake Superior was a gulf and not a mere river is shown by the soundings ; the deep belts are from 25 to 100 miles broad, which precludes the fluvial idea, and they are scarcely in the line he traces. I show a copy of the United States hydrographical map, adding to it Bayfield's soundings, and a smaller shaded map exhibiting graphi-



cally, though imperfectly, the arithmetical facts, the darkest being the deepest part of the lake. Again, the geological strata are newer as one proceeds south-westerly ; that was therefore the direction of the earliest currents and iceberg streams. Mr. Drummond notes that Lake Superior is on an axis of depression, but he does not seem to recognize that this axis is not in the line of his valley as marked, but on the contrary runs from east to west, far to the southward of his line nor does he consider the lateness of the synclinal folding—which must of course have taken place after the deposition of the strata folded. Mr. Drummond's views offer no explanation of the southwesterly *debouchment* of the Nepigon, Black and Thunder Bays, which is south and a little west, not eastward as by his theory it ought to be; they do not elucidate the problem how the lakes became contracted, how their overflow was turned from the old direct line to the Gulf of Mexico, to that by way of Chicago; then in succession to that by Niagara or the Trent down the Mohawk and Hudson valleys; these closing, to the Richelieu and Champlain valleys, and finally to the Gulf of St. Lawrence. If my supposition is correct, Lakes Erie and St. Clair cannot be recent lakes, in the sense Mr. Drummond states, but are the shrunken remains of one that covered all Western Ontario and the lower peninsula of Michigan, in times quite recent, I admit, compared with the antiquity of some lake basins; and I regard it as almost trifling to talk of the Straits of Mackinaw as existing in those old days, for the level alluvial soil stretching broadly from west of the Sault Ste. Marie to Lake Michigan precludes the idea that there were any such straits until a very recent epoch. I think, moreover, that Mr. Drummond must form a grander conception of the forces at work in framing continents before he can comprehend the wide distribution of precisely similar forms of life, or the great superficial extent of many strata, *e.g.*, the Potsdam sandstone, which he may trace from Gaspe to Missouri.

Another imposing feature of the old Laurentian shore may have been a great volcanic range. By analogy, it must have been near the water; allowing for the wearing of the cliffs, we may suppose it southward of the present Lake Superior coast, but there are no data yet for locating it with precision. The only guess I have come across as to the locality of any volcanoes about Lake Superior, is one attributed to Dr. Selwyn, that there was a great burning mountain where Lake Nepigon now is, which, in blowing itself away, made the basin of Lake Nepigon. I see nothing to confirm that theory. Lake Nepigon is not in a deep basin or immense crater; it seems to be simply a bit of Lake Agassiz (the former extended Lake Superior when it stood at a high level) left when the level of Lake Superior fell—as the Georgian Bay might be left an independent lake if Lake Huron were to be lowered. The locality where I have been able to give most study to the eruptive traps, lies between the Current and

Kamanistiquia Rivers on one side, and the Pigeon River on the other—for 50 or 75 miles inland. Near the Current River, the chloritic slates of the eastern part of that district are over-laid by black slates (argillites), under and between these being several layers of chert. All such were deposited in a quiet time upon the Archæan granites; red Huronians. Their stratification is regular, as even as that of the North Toronto clays, and very like it. But the whole country was afterwards shattered by earthquakes; great cracks would form, as it was cooling, or being folded by differing distribution of pressure, or swelled up by volcanic gases; and through these cracks—50 to 200 feet in width, and miles in length—up rushed lava streams, over flowing the slates for miles around, to a depth varying with the slope of the surface and the distance from the fissure. I do not know of over 50 feet in depth of lava, but I have heard of 200 feet. Where this lava sheet has been glaciated or otherwise worn away, the matter which filled the cracks often shows above the level, like a wall—so markedly that these features have received the local name of "rampykes." I have found several of them, and hundreds of miles of country, perhaps thousands, have been deluged with lava through their agency, but I have found no volcanic pipes—round or nearly so—cores of old burning mountains. The Michigan geologists have remarked several intercalated lava beds; also ash beds. The fact that these are volcanic formations is so well established that there seems no room left for other theories: it does however appear extraordinary that from the Lake of the Woods eastward to North of Lake Huron, you are constantly finding this capping of diorite, evidence of the fiery time, and that yet you find no round volcanic vents.

Then follows another period; the natural forces locally at work become less imposing, and the earthquake fissures no longer emit molten lava. They are, however, still occasionally formed, tearing through granite and chert and slate and trap, but they are from 2 to 10 feet only in breadth, and appear to have become mere drains for the surrounding country; these are now the rich silver bearing veins of the Thunder Bay district – having become filled up with quartz and spar, and in many cases with quantities of native silver and sulphide, with zinc blende, a little galena and some iron pyrites.

In other neighbouring regions, the trap or lava seems to have aided much in the segregation of copper. When it overflowed a later formation (in places easily traced on both sides of the great synclinal trough of Lake Superior) the vapours or gases formed bubbles which rose to near the surface of this viscous mass, and the resulting cavities have through processes obscurely known and lengthy to describe, become filled up with native copper. These are the well known amygdaloidal beds. They are well developed on the south shore, but there too we have the copper and sand-stone conglomerate of the Keeweenaw formation, in which are the Calumet and Hekla and Red Jacket Mines, which is more profitable to work. On the north side the copper is altogether in the amygdaloidal formations, and their principal exposure is on the American Isle Royale—the old Minong Island.*

This paper should not be closed without some reference to what is called "the granite country" to the north and west of the Kaministiquia slates. You pass through it on the C. P. R., between Port Arthur and Rat Portage. It bears the plainest marks of the most terrible glaciation—long, and I dare think oft repeated. Bare rounded hummocks of rock, like a sea with crossing swells. lie all around you. Lakelets without number, scooped out by departed bergs, dot the great monotonous expanse. The Lake of the Woods

* This was the principal source of the copper the Indians used, though they had extensive mines at Ontonagon and other places. These fellows had a great eye for surface indications, they had to be observant because of the great labor involved in their work, and the terrible loss if it should be wasted. When the whites took to mining on Lake Superior, they used to look for the Indian mining pits, and if they had not been finished there would surely be copper within a short distance of the bottom. The Indians mined by making fires on the rock, throwing water on the heated surface to break it, then pounding it with their green-stone hammers. One pit was found on Isle Royale in 1870, filled up with the accumulations of leaf mould for centuries on which pine trees 2 feet in diameter were growing. It was 100 feet across, nearly circular, 20 feet deep. At the bottom was a mass of copper, raised upon skids, and weighing over 16 tons. Lying in the hole were handspikes, 7 or 8 feet long. Both skids and bars were thoroughly impregnated with copper solutions. The two skids were 10 or 12 feet long, 8 or 9 inches thick; the marks of knife or hatchet were visible on them, and on the handspikes which are now in the Detroit Museum. The copper mass showed signs of having been hammered all over with stone hammers, of which dozens were lying around. This mass was raised, sent by steamer to Detroit, and offered to the Council to be put up as a monumental base in front of the City Hall, but the proposition was not entertained and it was sent to Wyandotte to be smelted. Mr. Shortiss of this city saw it on Isle Royale, and saw it with the stamp mark of its weight at Wyandotte. It has been a theory of some archæologists that the men who did this work were Toltecs from Mexico, but I think it was the work of ordinary Indian tribes. No mining colony would live on Isle Royale during winter; I have found the trail by which they came to a point about a dozen miles from Grand Marais where they crossed in canoes; they were therefore canoe Indians, inhabitants of the forest regions, not of the prairie or of the cultivated lands of Mexico. I have examined also into the reports of ancient silver diggings, but only to discredit them.

is so full of islands that it almost loses its lacustrine character. In this granite country you have gold, with a considerable portion of silver in alloy with it. Metals of various kinds seem to "carry" the gold with them—in some places iron pyrites seem the main associate of the precious metal, in others copper, while at the Huronian mine there is a quantity of telluride of gold. The country is, however, a *terra incognita*, but little is known of the thickness of the strata or their special characters. One may say that the pioneers of geology, the mining explorers, have only touched the fringe of the district; specimens obtained from Indians seem to prove that great riches may be found. I hope to give it further study next season.

One of the great difficulties in geological work in the Lake Superior country is that one must depend for classification on the petrological character of the rocks; they seem to contain no fossils, unless the "cannon balls" of the Animikie slates be such. Doubtless the great heat, the enormous pressure, the infiltration of metallic solutions, the violence of the agencies existing when the Huronian and Keeweenawan rocks were formed, were reasons why life should not exist or why traces of it should be destroyed, but the presence of particles of graphite and phosphate and the collection of iron into enormous beds seem to lead to the belief that the epoch of their formation was not anterior to the existence of life upon the world. It would add another charm, could we find any fossils in the 10,000 feet of Animikie, or the 50,000 of Keeweenawan rocks. Yet even without them, there is a weird fascination about the great lake and its neighborhood, felt by the Indian, the Jesuit, the modern traveller, as well as the geologist, which makes frequent visits there in the highest degree enjoyable.

Lines of the Giant range—East of Silver Mountain.

THE CRUEL PLANT—(*PHYSIANTHUS ALBENS*).

BY ARTHUR HARVEY.

I find that a specimen of this plant was exhibited to the Linnæan Society in 1867-68, to show the seed-vessel, and this is the only reference to it I have seen in Scientific Societies' proceedings. It is a little curious that both Mr. Charles Armstrong and myself should have independently of each other prepared a paper about it for the Canadian Institute. Mr. Armstrong's note, read before our Biological Section, dealt with the genus Asclepias of which it is a member; I shall not repeat his statements, but at once draw attention to the *Physianthus albens*, of which I have a specimen for your inspection. The plant I have is two years old; it is a climber which covers a trellis about four feet square. I keep it in a cellar in winter, and set it in the open air in the end of May. It begins to flower in August, and no sooner do the flowers open than moths, attracted by the perfume, (which is not unlike that of the hyacinth, but not so strong) visit the plant and find that excursion their last. The specimen before you shows a moth caught in the trap by its proboscis, and you can see dozens of them in the same unfortunate "fix" throughout the flowering season. This moth is the "Silver Y" (*Noctia gamma*), and by far the greater number of moths caught are of this kind. I have, however, noticed an occasional cabbage butterfly (*pieris rapæ*) and a few wild bees and ants—the latter caught by the leg. We will now investigate (1) the machinery which catches the moths, and (2) the *raison d'être* of the trap.

The *Physianthus* (bladder flower) is named from the shape of the corolla, which swells near the base into a sort of bulb, enclosing the following machinery—two ovaries and a pistil, covered by a sort of cap which fits upon them, around which are five eyes, from which points five pairs of recurved jaws extend. Under these jaws are two anthers, closely pressed between the jaws and the seed-vessel.

Perhaps the point and the jaws may be considered part of the anther, covering two pollinia. The drawing presented will make the structure clear to you.

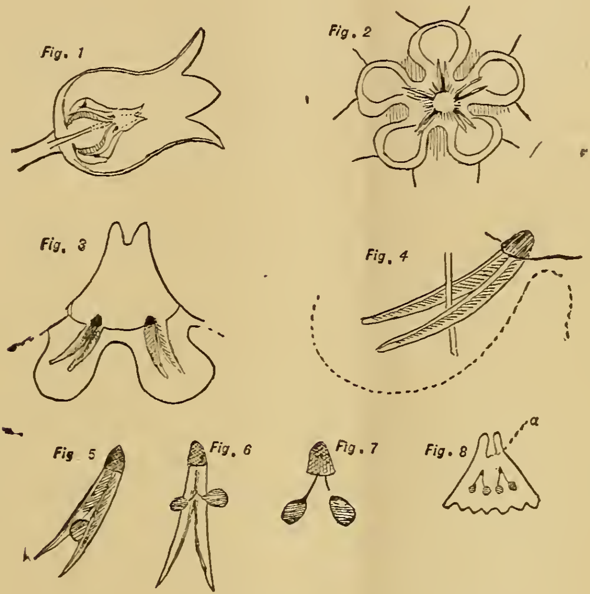


Fig. 1.—Section through middle of flower; imbricated passages at the base, around the incipient seed-vessel.

Fig. 2.—Plan—looking into the flower, showing the arrangement of the "jaws." Petals removed. Enlarged two and a half diameters.

Fig. 3.—The "jaws," showing their inclination.

Fig. 4.—How the proboscis of a moth is caught and held.

Figs. 5 and 6.—Escaped *Pollinia*, protruding from between the jaws.

Figs. 7 and 8.—The Pollinia, after removal of the jaws. The tip of the style is at *a*., Fig. 8.

Now when the flower is immature, these jaws are soft, but as it comes into full bloom, they harden and become woody. At this time the proboscis of a moth, thrust towards the nectaries, slides into the little groove between the jaws, and when once inserted, is caught like a boot in a boot-jack. The "Silver Y" tugs hard and long, but tugs in vain, and in a few hours dies.

You will at once perceive that a plant which catches a moth by the proboscis and lets it dangle and dry up, is not insectivorous. It seems also contrary to law to slaughter insects aimlessly, and upon close examination I have found that in a few cases where a moth's proboscis seems to have widened the cleft between the jaws, but ever so little, the *pollinia* have found their way up through the orifice. (Fig. 5 and 6) I have seen pollinia where no moth hung dead, but so rarely that I think some insect must have been at work to separate the jaws. This however does not satisfy me, it is waste of life to have so many insects killed for such few results. My son Charles (one of our associates, and by far the youngest of them) tells me that if you carefully pull the moth from the flower, the jaws break away. And there is a beautiful sort of hinge or socket to them, set at such an angle that if they are raised from their recurved position by such a force they diverge, and do easily become detached. In the former case the pollinia can protrude without difficulty; in the latter they become uncovered; in either case fertilization becomes easy by means of spiders, ants, small plant-lice, or other insects which frequent flowers by hazard or by choice. This leads me to believe that in Brazil and Central America, where the *Physianthus* I am told is native, it is frequented by stronger moths than we have here, or possibly by humming birds, which without difficulty break away the jaws, liberate the pollinia, and perhaps even carry them away to other flowers, so to bring about cross fertilization. The plant here is a very shy seeder; I had but three well formed seed-vessels on mine. The ovary, as I said, is double; one part falls away, the other swells to the size of a pigeon's egg. In its native woods there must be more seed-vessels, and this gives strength to my inference, but we may very fairly call upon our kindred Societies in Central and South America, with whom we exchange Proceedings, to take up the enquiry, and substitute fact for hypothesis.

We have a member of the genus Asclepias in our every field, called the silk-weed. Its behaviour in connection with the setting of its seeds is very singular; I hope to be able to make a close study of it next season. I should be glad if this paper invites the attention of others in distant lands to the methods by which the seeds of other plants of the family Asclepias are fertilized.

I can scarcely think this *Physianthus* has become adapted to the catching of moths or humming birds' tongues by, so to call it, the first intent. If the jaws were in any sense less complete, a moth's proboscis could scarcely be caught at all. There may have been some other cause for the special form of anther-covering and the protection of the pollinia while reaching maturity—and when the existing form had been reached as to its main points, it was probably found that it served for uncovering them too by insect agency, when concealment was no longer desirable—and then further specialisation would ensue. Perhaps many of the complex peculiarities of plants and animals, *e.g.*, the dimorphism and diœcism of parasites—may have grown into existing types by successive stages—a form evolved for one simple purpose proving useful for a second, and advancing upon that new line.

PHYSIANTHUS ALBENS.

By Charles Armstrong.

Read before the Biological Section November 4th, 1889.

The plant which I bring before your notice to-night belongs to the Order *Asclepiadeæ*, a large order of more than 600 species, nearly all of them very beautiful climbing plants, some of the rest very curious.

Periploca Græca is I think the only hardy shrub in the order. All the rest are natives of hot climates. The genus *Hoya* (the wax-plant of our greenhouses) are fleshy-leaved creeping or climbing plants with umbels of sweet wax-like flowers. The *Pergularias*, climbing yellow flowered plants, are also beautifully sweet. Sap of *Gymnema Lactiferum*, a native of Ceylon, is used instead of milk where milk is scarce. Some others are used for food. On the other hand this plant on the table, a *Stapelia* (you would think it a cactus) with *Duvalia*, *Orbea*, *Obesia*, *Tridentia* and others in which the stems are fleshy, with small points or bracts instead of leaves, have flowers rich in colours and markings, but so offensive in odor that they almost make you sick; I might say that they smell like rotten meat. A few of the order are natives of our own country. You know them by the names of *A. Cornuti* (milk-weed), *A. Tuberosa*, (pleurisy root), etc.

I have thus far trespassed on your time in order to give you some idea of the strange difference which may exist in an order. The plant before us is the *Physianthus Albens.* The calyx is large, five-parted; corolla, companulately urceolate with five swellings outside at the base, and a corresponding number of cavities inside; limb, spreading a little, five-cleft; column, inclosed; stamineous corona of five leaves; leaflets, cucullate, furnished each with a horizontal scale outside; anthers, terminated by a membrane; pollen, masses pendulous, fixed by their tapering tops; stigma, ovate, two-horned at the apex; follicles, ovate, ventricose, bent downwards, semi-bilocular;

seeds, comose, adhering to the lamellæ of the dissepiment ; twining, herbaceous plants ; leaves, opposite, cordate ; racemes, interpetiolar, few-flowered, cymose, flowers white.

It was first introduced about 1830 from the Province of St. Paul, Brazil, but did not become popular. About three years ago it was brought forward by the enterprising seedsman Peter Henderson as the "cruel plant." It well deserves the name, for the moths observed (about sixty) were all caught by their proboscis. They were all of one species *(Plusia Gemma)* and remained hanging till tney died of starvation.

The hard edges of the cucullate leaflets are pressed together at the top and are open at the base, and I think have a slight contractive movement when touched; certain it is that when the moths try to withdraw their tongue from the nectaries it is caught in the wedge formed by the meeting of the two edges. If the insect was stronger it might withdraw its tongue, and in so doing the pollen masses would stick to it, and on penetrating the next flower, would leave the mass on the stile. My conclusions, so far as I have gone, are that the insects so caught cannot aid in cross fertilization. In its native state it is possibly done by humming birds or very large insects. Future observation may show the few pods we get are fertilized in the earlier part of the season by humming-birds or *Sphingidæ*, and I would ask you during the coming season to note carefully our native *A. Cornuti* and *Tuberosa* and obtain as many specimens as possible.

CITY SANITATION AND SEWAGE DISPOSAL.

BY L. J. CLARK.

It gives me great pleasure to have the opportunity of again bringing before your attention a subject fraught with so much interest to the people of Toronto, as the safe and economic disposal of its sewage. This is a subject that is engaging the attention and taxing to the utmost the ingenuity of all urban municipalities where the health of the community is held in any regard.

It is also with a good deal of diffidence that I take up a subject we might naturally look for the solution of, at the hands of medical men and civil engineers. Perhaps you will say that it is on the theory that "fools rush in where angels fear to tread," but I would ask you to reserve judgment till you hear what I have to say on the subject, and then render your verdict according to the facts submitted.

City sanitation in its broader sense applies to water supply, house construction, plumbing, street cleaning, meat and milk inspection, etc., as well as sewage disposal, but as those departments are in competent hands, I shall on the present occasion confine myself to the latter subject.

Before entering into the particular scheme I advocate I shall briefly refer to some of the schemes already in the field.

They may be designated: 1st, as Messrs. McAlpine and Tully's; 2nd, Mr. C. Sproat's; 3rd, Messrs. Herring and Gray's; 4th, Porous Carbon System; and 5th, The Iron deodorizing process. The two latter methods may do very well in small towns and inland cities where there is only a choice between these ways and land filtration or sewage farms. But where there is such a cheap and effectual way of getting rid of the trouble, as obtains in Toronto, they are quite uncalled for.

Mr. Emil Knichling has collected some valuable information as to the cost of the various ways of disposing of city sewage. He was employed for one whole year by the civic authorities of Rochester to devise a scheme for meeting the sewage difficulty of the east side of the city, and after a careful comparison of the various methods he makes the following comparative statements :

1.	By Chemical Treatment	$595,000
2.	By Filtration without cultivation	620,000
3.	By Sewage Farming with cultivation........	860,000
4.	By Discharge of crude sewage into Lake	300,000

The above is the estimated cost for the purification of sewage for 63,000 population.

When we consider that Rochester is 6 or 7 miles from the lake we can see how immensely this tells in favor of the City of Toronto discharging its crude sewage into the Lake, situated as it is on the lake shore.

Furthermore, Prof. Laut Carpenter, in his recent report, says : "The value for manure of the sediment obtained by subsidence is 'nil,' and that the deposit obtained by any of the so-called precipitation processes is almost 'nil.' I do not say that they do not in some cases produce a clear effluent, but at considerable cost, and there are *no returns* from the sale of manure."

Another writer says : "That the titles of the companies that have been chartered to convert sewage into manure and failed would fill a good sized volume." And in Messrs. McAlpine and Tully's report they quote authority stating "that *farmers would not haul it away for nothing.*"

The cheap and effectual method I referred to a short time ago is to send it out into the Lake into deep water by the force of gravity, the cheapest and most effectual force in the market.

This brings me back to consider Messrs. Herring and Gray's scheme as well as Mr. Sproat's, as both these schemes require a large *annual outlay for pumping.*

This is the first objection, and not only on account of its expensiveness but also its offensiveness, as the following quotation from the Minutes of Civil Engineering, Vol. 94, referring to the Cheswick Sewage System will show :

"The smell of the sewage is, as a rule, most offensive on Sundays, especially in the evening, when it is often so bad as to make the engine-room *intolerable* even to men accustomed to sewage smells."

Mr. Baldwin Latham says :—"It may be said in the generality of places, if due provision be made for storage, and if the principle of interception be also taken into account, there are few places in this country that need to resort to the expensive process of pumping the sewage in order to secure a free out-fall."

In the face of all this, why, I ask, should a system be adopted that is both expensive and offensive till the most thorough investigation has proved beyond a doubt that *gravity* is unequal to the task?

The second objection I take to the aforesaid scheme (H. and G.'s) is the syphons across the Don. The wells of these, they admit, will have to be cleaned. But they give us no indication how it is to be done, nor have they included in their estimates anything to meet it. This would be no small item if the same precautions be taken to keep these syphons free that are taken with the Boston syphon.

My third objection to the scheme is the location of its outlet pipe, together with the screening station proposed at Balmy Beach and Victoria Park. What an *unmitigated nuisance* would thus be created along that beautiful part of the lake front! All chances of its ever becoming a pleasure resort would be nipped in the bud. It would certainly prove a millstone around its neck.

But last and greatest of all objections is the insecurity of its outlet pipe from becoming choked, or I may rather say the certainty of its becoming choked. It stands to reason that the amount of sewage is dependant on the amount of the city water supply, and as that averages about 12,000,000 gallons per day, we cannot look for a greater amount than that to flow through our outlet pipe ; and, indeed, in the dry season of the year, after deducting what is used for sprinkling lawns and streets, for building purposes, and what is converted into steam in our many steam-boilers, we shall find that we will have a much less amount than that.

Now, as Messrs. Herring and Gray propose to have an outlet pipe 2,000 feet long and 6 feet in diameter, running out into the lake, the simplest arithmetical calculation will show the velocity with which a given quantity of water will flow through said pipe :—

12,000,000	per day	will give	vel. of	9.4	inches	per sec.
9,000,000	"	"	"	7.0	"	"
8,000,000	"	"	"	6.25	"	"

This last I consider all we could count on in dry weather for flushing the outlet pipe, viz., $6\frac{1}{4}$ inches per second.

Now it was proved beyond any question by such men as Beardmore, Neville, Latham and Knichling that a velocity of $2\frac{1}{4}$, $2\frac{1}{2}$ and 3 feet per second is necessary to make them self-cleaning. By reference to the table we find that under the most favorable circumstances, viz., 12,000,000 galls. per day, we only get a velocity of about 9 inches per second, or just one-third of what it should be. The inevitable consequence will be that the heavy parts of the sewage that have been carried along in the sewers where the fall has been sufficient will immediately begin to subside when it reaches the submerged part of the pipe, and where the velocity will be as before stated. I venture to predict that if such a scheme were carried out it would not continue in working order one season through.

An instance in point has recently occurred at the Orillia Asylum, where the sewage emptied into the lake through a pipe 200 feet long. Some of the property owners along the water-front complained and 200 feet more was added on. The result was a blockade, and the pipe had to be opened at the former place.

Now let us turn to a brighter prospect. I believe I have a sovereign balm for every evil I have pointed out in the foregoing schemes. It consists in attaching a flushing tank arrangement to an intercepting system somewhat similar to Messrs. McAlpine and Tully's which I shall briefly describe as follows :—

For the sake of analogy we may compare it to a tree-trunk, its roots and branches. Beginning at the top of the trunk we would start at say the intersection of Gerrard Street and Yonge Street, thence along Gerrard Street East, intercepting Church and Jarvis Street sewers until we meet Parliament Street. Thence down Parliament Street to a little South of King Street, where a flushing tank would be situated. From the flushing tank we would continue South to Front Street, then turn East along Front Street till we meet the Don River. Then sink under the bed of the river to the Eastern side, then follow down the angle made by the bed of the river with its East bank to its new outlet, then turn a little to the East out of the current of the stream and continue out to deep water. Starting from the corner of Parliament and Gerrard, a part of the present Parliament Street sewer may be utilized as far south as Shuter Street. We would there tap the present sewer and take a branch to our flushing tank. The flushing tank and the approach to it would be capable of containing about 500,000 gals. of water and would have an *elevation of 32 feet.* The outlet pipe from the tank out into the Lake would require to be a steel one 6 ft. in diameter, and this would constitute the root of the tree.

The main branch would be an intercepting sewer along Front Street from the Garrison Creek sewer to Parliament Street, where it would connect with our outlet pipe. The second branch would be a similar intercepting sewer on the east side of the Don from about Pape Avenue and running west to join the outlet pipe at the east bank of the Don. Then when the present King Street West sewer is completed from the Subway to Dufferin Street we would have the whole city from west of Dufferin Street to east of Pape Avenue provided for.

The junction of the branches on Front Street East and West would be provided with check valves so hinged that they would offer no resistance to the flow of water towards the outlet, but as soon as the pressure came in the opposite direction they would close and prevent regurgitation in the sewer.

This would then be the working of the system. All the sewage in that part of the city north of Gerrard Street would be brought down the Parliament Street sewer and into the flushing tank, which would be furnished with an automatic flushing arrangement so that when the sewage in the tank rises to a height of 32 feet it would open the check valve and allow the whole contents to rush out into the Lake. As soon as the tank would be empty the valve would close again and allow it to fill and again empty, etc., etc., "as long as grass grows and water runs," according to the old adage. The time required for the tank to empty would be less than 7 minutes. The time to fill would depend on the supply. If 4,000,000 gallons of sewage were intercepted in 24 hours the tank would be filled eight times or once in 3 hours. If less the time would be longer.

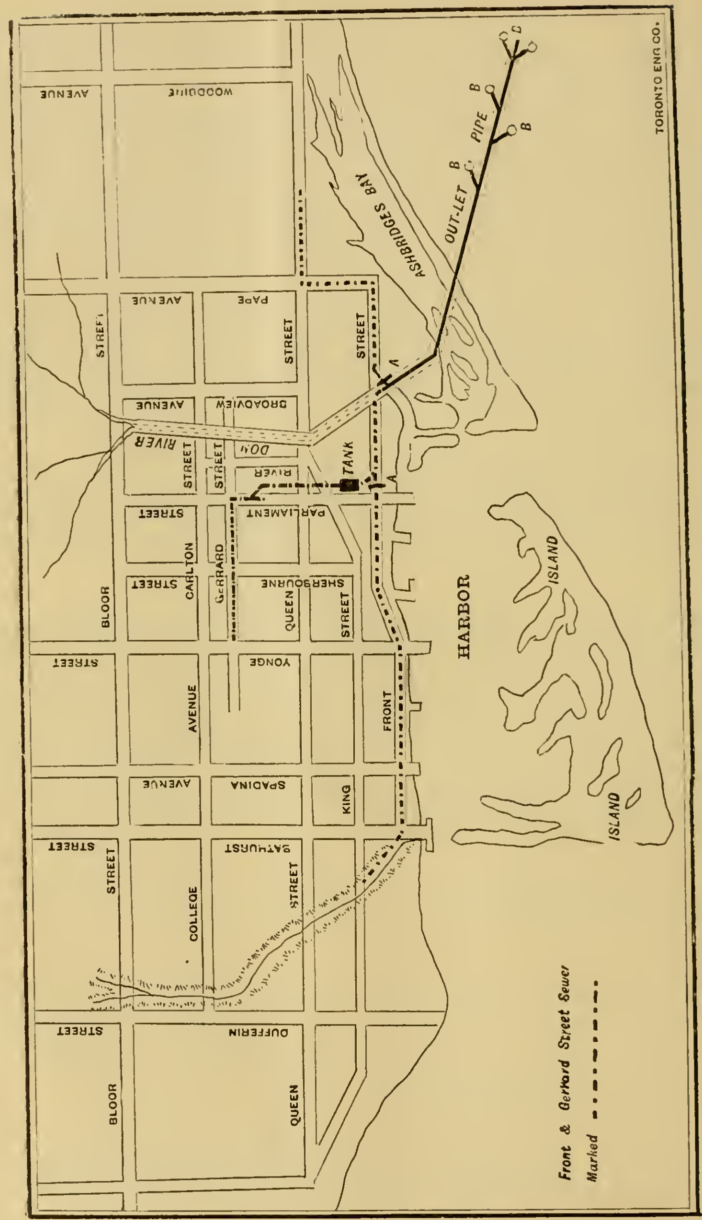
Four flushes per day would be quite sufficient to keep the outlet pipe free, as that is the object of the tank. The velocity of the outlet pipe would be from 6 to 10 feet per second, and would carry along bricks, stones, pieces of iron or lead.

During the interval between the flushings the sewage from Front Street East and West would keep up a constant flow through the outlet pipe, only being checked by the closing of the valves when the tank was in operation.

This short cessation, instead of being a disadvantage to the system, would be a decided advantage to it, as it would produce a slight ebb and flow at each flushing of the tank, which would help to scour it in its lower levels. The fall in Front Street from the bottom of Garrison Creek sewer to the level of the water at Parliament Street, a distance of 11,000 feet is 9.3 feet or 1 foot in 1,183 feet, a very good fall and capable of giving a velocity of 4½ feet per second flowing two-thirds full. Buffalo is projecting a sewer now with a fall of only 1 foot in 4,650 feet. I am afraid they will have trouble there. A reference to the map and drawings will help to make the above description clear.

The map shows probably the best location for the flushing tank. It is provided with a ball and float as shown in Fig. I. This is not an essential part of the system, as a syphon or any other device might be used to open and shut the tank.

Fig. II. shows the bed of the Don with outlet pipe sunk in the angle formed by the bottom with the East bank. The intercepting


TORONTO ENG CO.
ASHBRIDGES BAY
OUT-LET PIPE
HARBOR
ISLAND
ISLAND
TANK
DON RIVER
WOODBINE AVENUE
PAPE AVENUE
BROADVIEW AVENUE
RIVER STREET
PARLIAMENT STREET
SHERBOURNE STREET
YONGE STREET
SPADINA AVENUE
BATHURST STREET
DUFFERIN STREET
BLOOR STREET
CARLTON STREET
GERRARD STREET
QUEEN STREET
COLLEGE AVENUE
KING STREET
FRONT STREET
Front & Gerrard Street Sewer Marked

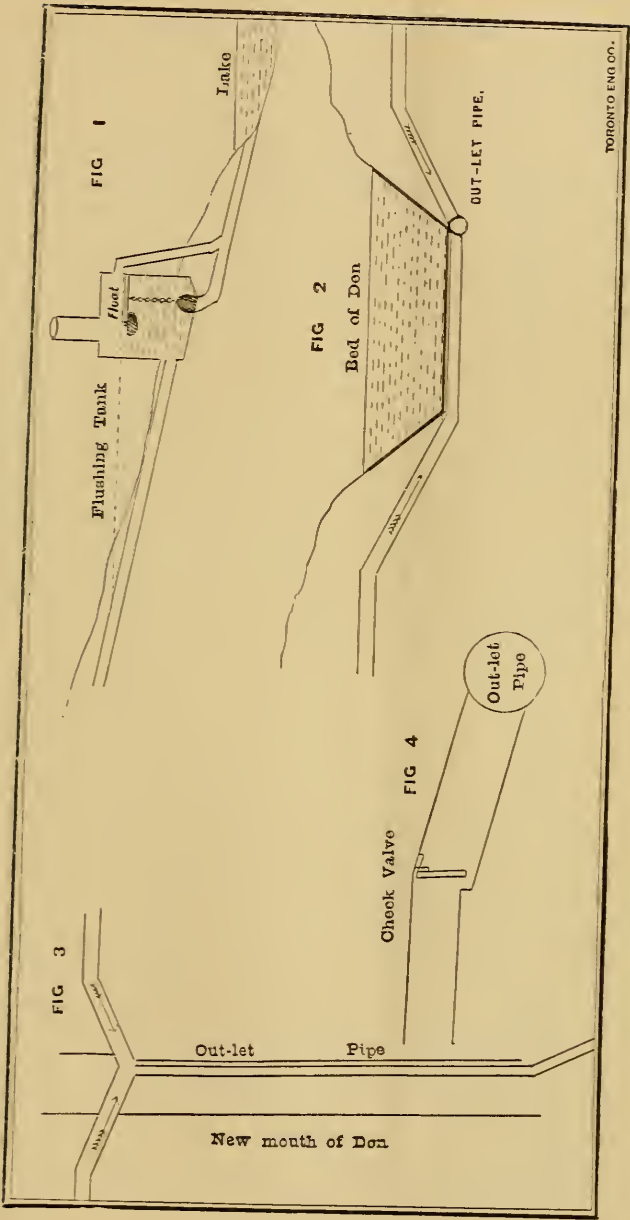


FIG 1
Lake
Float
Flushing Tank
FIG 2
Bed of Don
OUT-LET PIPE.
TORONTO ENG CO.
FIG 4
Out-let Pipe
Check Valve
FIG 3
Out-let Pipe
New mouth of Don

sewers of Front Street—West and East—join here in the outlet pipe.

Fig. III. shows a plan of the same.

Fig. IV. is a check valve to be placed in the branches to prevent regurgitation when the flush is on. It is so constructed that it always remains open and offers no obstruction to the flow of sewage towards the outlet, but when the pressure comes in the opposite direction it closes. Their position is indicated in the map, at letter *a*, *a*. The several outlets indicated on the map by *b*, *b*, *b*, *b* will be referred to later on.

I wish now to call your attention to the capacity of the system and show how it will be able to meet the requirements of the city when it contains 1,000,000 people. A five foot sewer on Front Street West, running $\frac{2}{3}$ full would deliver 32,000,000 gals. per day; allow $\frac{1}{4}$ as much for the East of the Don, 8,000,000. Then supposing the tank fills every 15 minutes, it will deliver 2,000,000 per hour, equal to 48,000,000 per day, making a total of 88,000,000 gals. This is a very liberal allowance, being 88 gal. per head. The Waterworks will have to wake up before that time comes.

I come now to the consideration of that part of the subject that has exercised men's minds perhaps more than anything else, namely, the contamination of the city's water supply by allowing the crude sewage to discharge into the Lake. I think that I can show that such a fear is quite groundless. Prof. Laut Carpenter says in his communication with our Mayor and the Board of Health as follows: "With much that has been said both in Chemical and Engineering reports on the self-purification of water, first by discharge into running water of some miles in length and shallow, and second by discharge into a large volume of water containing oxygen I am disposed to agree. I know of many cases in which the first is relied on, for example the Thames (England) receives the sewage of many towns on its banks, such as Reading, Windsor, etc. And yet the water drawn lower down the river for supplying the City of London still passes the test very well. London is considered a healthy city."

During the past summer I visited several American cities for the purpose of acquiring information on the sewage problem. I found the City of Cleveland more nearly circumstanced like Toronto in that respect than any other place I visited. It has its Cuyahoga River, which is an intensification or aggravated form of our Don. Then they have an artificial harbor much less in size than our bay, into which this river with its discharge from twenty sewers runs, giving a concentrated condition of our own water front. Now, when we consider their intake of water is only one mile from the outlet of their harbor, what need have we to fear when we put five miles between our intake of water and the discharge of sewage? The danger in our case would be just one twenty-fifth of theirs. I was curious to know what an analysis of their water would reveal, so procured a copy of their Water Works report. A very comprehensive series of tests had been made on samples taken at distances of ½ mile, 1 mile, 1½ miles and 2 miles from the shore, a sample was taken 15 miles from the shore at a depth of 75 feet for a standard of comparison, and the following quotation contains the opinion of the "Water Works trustees:"—"It will be a source of general public satisfaction to know that there is no material difference in the water at the present inlet and at other points, and that the supply now furnished is almost equal in purity to that obtained 15 miles from the shore, and that in but few cities in the country are the people so fortunate in having an abundant supply of pure water and at so little cost."

To satisfy myself still further I obtained a report of the Medical Health Officer, Dr. Ashman, which I also found to be very complete. It gave a general death rate of 18.78 per 1000, and of diphtheria and typhoid fever of about 14 in 10,000. These statements indicate that Cleveland is a very healthy city notwithstanding the nearness of its intake of city water to the harbor outlet. I notice that the general death rate for the seven cities of Quebec rises to 31 per 1000 and that the infantile mortality is almost incredible. Through the kindness of Dr. Canniff I obtained statistics which enabled me to deduce the general death-rate of Toronto, which I found to be a little over 19 per 1000, and of diphtheria and typhoid fever to be 13 per 10,000, so that we stand about par with Cleveland. There is not the shadow of a doubt but that there would be perfect immunity from danger in Toronto with the sewage discharge five miles from the city water intake. With regard to the self-purification of impure water I have a theory which I would recommend to the members of our Biological Section for further investigation. I think it is conceded by all scientists that vegetable life precedes animal life, and also that animal life—fish for instance—cannot live in pure distilled water.

Then it follows that water capable of supporting animal life must contain nitrogenous sub-marine vegetation to be maintained by the nitrogenous production of plants or animals being conveyed into it from the land. It appears to me that if the sewage of the City of Toronto was allowed to flow well out into the Lake and was well distributed, its noxious elements would be disposed of in the following ways. A large amount of it would become oxidized by the free oxygen of the water and another portion would enter into new compounds, promoting vegetable growth, and whatever might be left would be so utterly weakened by dilution as to be entirely harmless. I believe no more harm to our water would arise from a moderate amount of sewage going into the lake than would be done to vegetables and grains, by the application of manure to the soil. The latter is often overdone by our market gardeners, and the result is an unhealthy production of garden "sass." The former is often overdone, as may be witnessed any day at the foot of Yonge Street.

In order to secure a better distribution of the sewage at the outlet, I would recommend that openings be made at three or four different places in the pipe, so that each one might be used a year at a time and then rest for two or three years. I believe that by this method in process of time there would become established in the immediate neighborhood one of the best fish feeding grounds in the lake. It is worth looking into.

The biological analysis of various samples of water made by Prof. Ramsay Wright bears out my contention that no danger to the city water can arise from depositing the sewage in the Lake at a sufficient distance from the intake. He says, "The following are the results obtained on the 8th and 22nd of June respectively. In most cases the number of bacteria given is an average of two and sometimes three samples taken in different bottles."

No. 1.	Eastern Gap, June 8th	5000
No. 2.	Bell Buoy	0
No. 3.	Western Gap	1000
No. 4.	Pumping Well	519
No. 5.	Reservoir (Rosehill)	10
No. 6.	Tap, School of Science	17

A number of other tests was made, but the above is sufficient to show that bacteria do not find their proper environment and necessary pabulum out in the free waters of Lake Ontario.

The analyses that have been made by Dr. Ellis are quite as satisfactory as those of Prof. Wright. I would strongly recommend that these analyses be made periodically and published in the city papers. It would also be well to make a special analysis at the present time of the sewage at the foot of Yonge Street to prove the effectiveness of the Conder system.

I now come to my last consideration and that is, what will it cost to bring about this desirable state of affairs? And here I may say that no city that I have seen or know anything about can be drained so cheaply as Toronto.

While Brockville, Kingston and Ottawa, or Rochester on the other side of the line, have to drift their way through rock and contend with ravines we have nothing of the kind in the city proper, and the slope to the south and east is all that could be desired.

Our largest expenditure would be for the outlet pipe. I have based the cost of this on the price paid to Mr. J. Abell by the city for the water works extension, 12,500 feet of steel pipe, 6 feet in diameter, at $12 per foot would cost $150,000. For laying the same I have made an estimate of $80,000, and as Mr. McNamee, of Montreal, gets $40,00 for laying the water works pipe nearly the same distance, viz., 10,600 feet, with a lot of rock excavation to make, I must surely be on the safe side. For Front Street sewer Messrs. Herring and Gray estimated $57,212 from Garrison Creek to Parliament Street, I allow $120,0 0 as I require a larger sewer. For making connections with the present sewers, $20,000. These are Messrs. Herring and Gray's figures for all the connections from Garrison Creek to Pape Avenue:—4,000 feet on Gerrard Street, at $10 per foot, $40,000; 1,500 feet on Parliament Street, $15,000; flushing tank, $20,000; and finally 10 per cent. margin for contingencies, $48,500,—making a total of $533,500.

CONDENSED STATEMENT OF COST.

1. Outlet pipe, 12,500 ft. by 6 ft. dia., $12	$150,000
2. Laying same..............................	80,000
3. Front Street sewer, 11,000 ft..............	120,000
4. Connections with present sewers	20,000
5. Gerrard Street sewer, 4,000 ft.	40,000
6. Parliament Street sewer, 1,500 ft...........	15,000
7. Flushing Tank...........................	20,000
8. East of the Don..........................	40,000
	$485,000
9. Engineer's expenses and contingencies, 10%..	48,500
Total...........................	$533,500

I have increased some of these items from my first estimate, on the advice of a friend who has had a large experience in works of this kind.

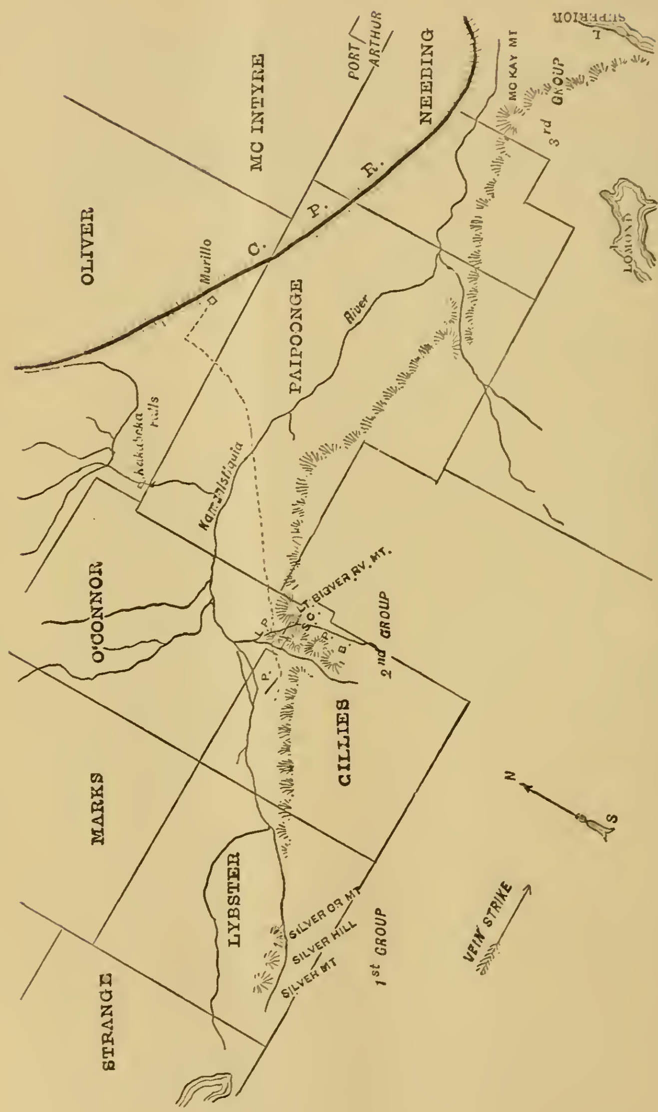
And now, gentlemen, I have laid before you a scheme which I believe to be entirely unique, and which I believe will pass the most crucial test. Indeed I consider that in laying it before the professional acumen of the society I am submitting it to the most competent tribunal in this city, and if it meets with your approval I shall be satisfied.

KAMANISTIQUIA SILVER-BEARING BELT.

BY HERBERT R. WOOD, *Fellow of Toronto University.*

1. Descriptive *Geology* and *Topography.*
2. *Mineralogy* of *Veins.*
3. *Geology* of veins and brief notices of *Mines.*
4. *Prospects* as a *Mining District.*

The Kamanistiquia Silver Belt, or that portion of country extending along the south bank of the Kamanistiquia, beginning, roughly speaking, at McKay Mountain, and trending nearly direct west to Whitefish River, is from a geological and mineralogical point of view of great interest. It consists of a series of trap-covered bluffs and hills, the base and sides of which are formed by the silver-bearing slates (Animikie slates of Sterry Hunt) of pre-Cambrian age. The entire region about Port Arthur lying both to the east and the west, including Thunder Cape and Pie Island, while subjected at some remote age to volcanic overflow, presents in its facial features as well as in the character of the trap evidences of six separate and distinct periods of eruption. The trap-rock taken from Little Pig Mountain, lying about midway of the belt, is on the surface porphyritic in character holding crystals of *diallage* in a black matrix, while taken from a depth of 30 or 40 feet is a compact hard rock of even texture. The trap rock taken from McKay Mountain seems to lie in three or at least two bands; the upper trap layer, lying at the top of the mountain one thousand feet high, differs considerably from second layer; between these siliceous slates are situated, grey and black or dark grey. These series of coarse grained trap layers indicate two periods of overflow, the middle or lower trap layer being in all probability coeval with the trap covering the bluffs and hills of the belt to the westward. Five miles to the north-east of Port Arthur in the vicinity of the Shuniah Mine, the trap again seems to present a different



The shaded portion very roughly represents the Silver Belt's limit on the north.

character, underneath the fine-grained trap diabase or siliceous like slate is found, while in the town of Port Arthur itself along the lake shore, another layer of coarse-grained trap is found. There seems to be only the one solution to these layers—different periods of overflow and subsequent cooling. Or, it may be possible that a fault or slip may have extended along the country from McKay Mountain to White Fish Lake, but of this I have no satisfactory evidence. Some of the trap contains Magnetic Iron Ore and it all holds water, some Manganese also Fe O, and large percentage of silica.

Through the valleys at the foot of the bluffs a heavy layer of hard pan or clay lies; this has been formed no doubt from the fallen trap which has gradually become disintegrated or decomposed. It is in places sixty or seventy feet deep; underneath this lies the trap again which would look as if depressions or faults had indeed occurred in the country. The thickness of the trap varies from ten to a hundred feet or more, and it rests unconformably on the slates. These slates vary in hardness as I am informed by the miners who drill every little distance very markedly. They are dark black, holding considerable free carbon, so that where slakensides or slips are observed the free carbon rubs off on the hand. Iron pyrites is scattered through them to some extent and a very singular occurrence are the nodules, boulders, or concretions of a hard crystalline character occurring through them. These are usually crystalline and hard resembling trap and having frequently in their centre iron pyrites, or a more coarsely crystalline mineral resembling asbestos. While they are usually crystalline I have observed them of a laminated texture resembling the slates as well. Sometimes the iron pyrites is disseminated irregularly through them. They weigh from a few ounces upwards to two or three tons. I am unable to offer any satisfactory theory regarding their formation.

Small nodules of iron pyrites are also quite common, presenting no radial structure as observed in the iron pyrites nodules occurring in the chalk in the South of England. These slates are laminated or bedded, they present no slaty cleavage, nor are they very often thrown up or distorted, usually lying horizontally. There are three groups of veins situated in this belt—one at Whitefish Lake, constituting the Silver Mountain group; another at the Beaver Mine, 15 miles east of the Silver Mountain, and about twenty-five miles west of the McKay Mountain; the third lying in a group of Islands along the shore of Lake Superior, in Jarvis Island, and McKellar Island.

These veins with hardly an exception run north-west and south-east. But that they should occur in only three groups or localities seems very improbable, and further prospecting will no doubt develop a complete series of fissures throughout the belt. They vary in width from mere formation stringers a finger's breadth, and not properly speaking a vein, to 16 feet in width. I have only been able to make observations in the second group of veins comprising some ten or twelve as yet discovered veins. With regard to the veins generally speaking they are true fissures filled no doubt from below. They belong to the class of ribanded veins, the vein matter being most large calcspar quartz, accompanied by fluorspar, heavy spar, zinc blende, iron or copper pyrites, argentite, native silver, galena, and traces of pyrargyrite. They vary in width at different depths, pinching in frequently to a hand's breadth and often splitting, sending out branches enclosing large quantities of slate. Though the order of occurrence of the vein matter is usually zinc blende or galena lying next to the walls of the vein followed by quartz or calcspar, these are frequently reversed and often no blende or galena is observed (see drawings) whatever. The Silver-bearing minerals are found only in zones or streaks, and while the centre vein may assay satisfactory mill returns, the ore ready for smelting is only in pockets.

The Native Silver occurs in five conditions :

A. In wire-like forms thickly disseminated through the quartz.

1. This may be coarse and without pieces radiating, or attached.

2. Very fine closely knit, making the gangue of which little is present indistinguishable. May be mixed with some sulphide, or alone.

B. Occasionally mixed with nuggets of sulphide, but this is rare.

C. In coarse strings, in coarse-grained calcite, which if the calcspar be detached are six or seven inches long, twisted, and usually tarnished.

D. In fine hair or moss-like masses associated it may be with a little wire silver in a vug in the quartz.

E. Associated with iron pyrites in vug in calcite—Beaver Mine.

NOTE.—One specimen of native silver taken 75 feet underground, Badger Mine, the silver seems to be in thin sheets along the cleavage planes of calcite. This is an interesting specimen and a section of which under microscope would fully explain. The silver seems almost in the character of a pseudo-morph after the calcite.

NOTE 2.—Occasionally in leaf in the neighboring slate or in the quartz of the vein.

The *Argentite, Silver Glance, Black Sulphide of Silver* occurs under four conditions:

1. *As leaf* in the seams of the quartz, or coating calcite crystals, and also in the slate contiguous to the vein. Frequently a thin seam or leaf coats the slate next to the vein matter, and from this apparently little stringers are observed running in to the vein between the quartz crystals, filling small cavities and forming nuggets.

2. *As strings* closely mixed with the quartz gangue giving it all a uniformly dark color.

3. *As nuggets*, or massive, from an ounce or less in weight to six or seven pounds, chiefly found in coarse-grained drusy calcite, also in vugs in the quartz.

4. In *feather-like forms*, as is seen in native silver, filling the gangue entirely so that it is scarcely discernible.

NOTE (*a*). A great deal of the darker zinc-blende has argentite intimately associated with it. Thin folia-like pieces of sulphide lying between the cleavage planes of the blende or coating it on the surface.

(*b*). The argentite is frequently associated with iron pyrites.

(*c*). Galena is frequently closely associated with the argentite, but I am informed that it does not carry silver.

The *Argentite* is malleable, of lead grey and almost black color, frequently iridescent and brittle, thus resembling stephanite. It exhibits a radiating fibrous structure in botryoidal nuggets. Perfect crystallization is very rare, though I have observed rhombic dodecahedrons, cubes, and cubo-octohedrons and combinations of dodecahedron cube and octohedron.

Zinc Blende.

1. *Light yellow*, called *resin* blende by the miners.

2. *Dark brown*, *liver-colored* blende brown SPR.

3. *Dark or black (black jack)* with which the argentite is very commonly associated either as thin folia coating the blende, or interpenetrating it in the cleavage planes. Some of this blende assays as high as $300 per ton.

a. As regards its position in the vein it usually lies next the walls associated with galena in some of the veins, or about the detached pieces of slate which are frequently present in the quartz matrix.

b. It is also occasionally scattered through the vein matter.
In the linings of blast furnaces I have seen the same order as (*a*) the zinc blende lying next to the firebrick and mixed with it, then followed by galena coating it.

Native silver when associated with the blende is usually mixed with the light colored variety, and very rarely with the liver colored variety.

It is occasionally crystallized. I have observed tetrahedrons and combinations of tetrahedron and rh. dodecahedron associated with crystals of fluorspar.

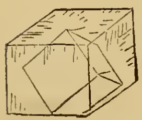
NOTE.—Very frequently thin seams of liver colored blende lie in the slate next to the vein.

Fluorspar.

The amethystine colored which is considered a good indication of silver by miners and which is more or less common in all these veins.

The green colored is very plentiful in some veins and usually found in the central portion of vein coating quartz crystals.

It is crystallized in cubes and octohedrons and cubo-octohedrons.



One specimen in my possession shows an amethystine colored cube within a green one.

An interesting mineral is *mountain tallow* as called by the miners, but which is a decomposed *talc or steatite.* Its formula $3MgO$, SiO_2, H_2O. It is very common in these veins frequently associated with asbestos or a *tremolite.* In the Beaver Mine it occurred in masses a foot or more in width, almost filling the entire vein. It is undoubtedly an alteration product of the slates which frequently present seams of *talc* in their structure. It is very soft cutting like tallow and of a variety of colors, green, bluish-green, and turning brick red. It holds considerable mechanically combined water which on evaporation destroys the color, leaving the green and bluish-green varieties a dirty white color resembling in its physical properties meerschaum. It is frequently associated, in fact usually associated with the nuggets of argentite occurring in the coarse-grained calcite.

Calcite.

This occurs usually coarse-grained and free from *met. silver*, though thin folia of sulphide of silver underlying the crystal faces are common.

The various crystal forms which the calcite assumes are interesting.

The following forms I have observed :

1. *Hexag. prism—pentag. rhomb.* planes.

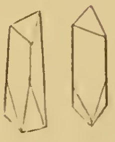
2. *Hexag. prism*—three *rhomb.* planes.

3. *Hexag. prism—rhomb.* and *basal* plane.

4. *Hexag. prism*—the hemi form predominating, and *rhomb.* planes.

5. *Hemi hexag. prism*—and three *rhomb. planes.*

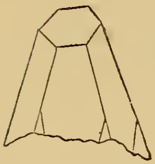
6. *N.B.*—These few figures roughly drawn are simply given to illustrate the variety of forms occurring in these veins.



7.

8. *Hexag. prism.*

9. *Hexag. tables*—rare.

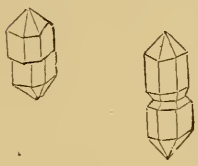


10. *Hexag. pyramid* with *basal* plane, and *prism planes*, rare.

11. *Hexag. prism* and *hexag. pyramid.*

Many other forms including several twin forms—rhombohedrons and others.

The calcite at times occupies the vein entirely. It is then usually drusy and accompanied by nuggets of *argentite.*



Quartz.

Usually massive white crystallized in short hexagonal pyramids, the prism planes being very short—*amethyst* smoky brown, pink. I observed one twin form as figured.

NOTE.—Frequently the vugs in the massive quartz contain nodules of argentite to which seams lead and through which evidently the sulphide has penetrated.

Iron Pyrites.

Present in considerable quantities in some veins, associated often with the argentite, and also with the mountain tallow. It is frequently plentiful in the slate lying next to the vein.

Crystallized cubes—cubo-octohedrons.

Baryta.

This not present in any great quantities in any of these veins.

Galena.

Usually present in all these veins in a greater or less degree.

1. Associated with the blende the darker varieties along vein wall.

2. In cubes and grains disseminated through portions of quartz.

3. Associated with the argentite but yielding no silver, so I am informed by the present assayer Mr. Brent, at the Badger Mine.

NOTE.—Crystallized in *cubes, cubo-octohedrons*, the latter frequently predominating—also *octohedrons*.

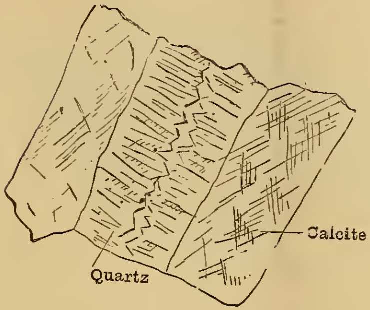
SECOND GROUP VEINS.

The dotted lines represent trails.

1. = Badger.
2. = Porcupine.
3. = Silver Creek.
4. = Little Pig
5. = Peerless.
6. = Beaver (*A*) = cross vein.
7. = Ontario.
8. = Rabbit Mountain.
9. = Big Bear.
10. = Caribou.

VEIN ROCK.

I.



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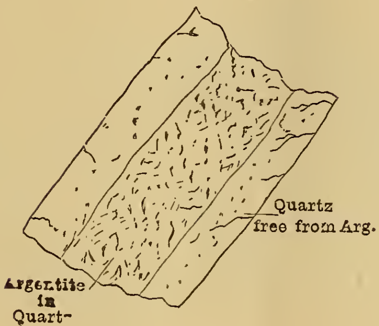

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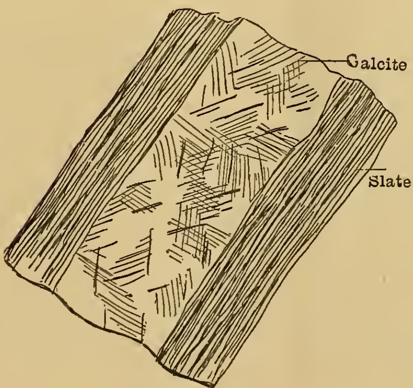

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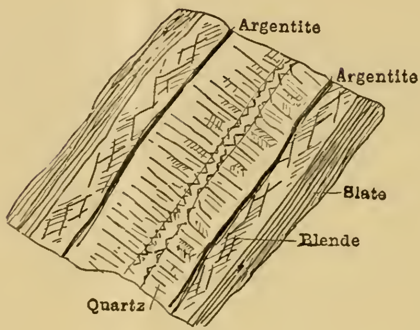

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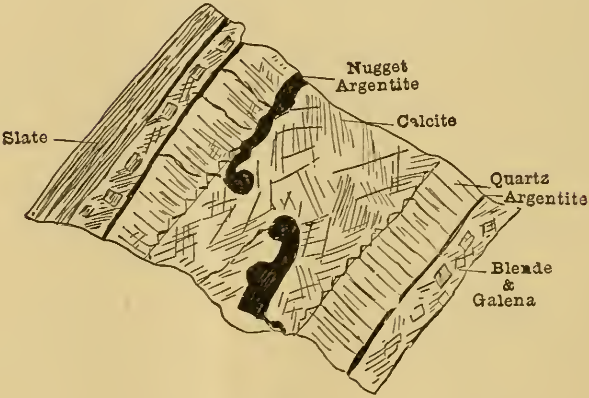

These veins have, with one or two exceptions, the same general strike, *i.e.*, north-west and south-east. They are true fissures, and have, no doubt, all been produced by the same convulsion of nature They are, roughly speaking, members of that series known as *ribanded veins*, though they assume at times a sort of brecciated character owing to the presence of bits of slate in the matrix. They dip south with a slight inclination from the vertical. The ore its richest zones, occur in pockets or limited portions of the vein—but generally speaking the vein matter is all available as average mill-rock. I believe these veins to have been filled from below by *hot siliceous* waters depositing their mineral constituents in the orders above mentioned. The richest ore it is said commonly occurs at the contact of trap and slates, while little or no silver-bearing mineral is found in the vein intersecting the trap.

The second group is undoubtedly the most interesting, but in general characters the veins of the first group, *i.e.*, *Silver Mountain Group*, lying in the neighborhood of Whitefish Lake resemble it.

The following is a brief sketch of these veins of second group :

See map—

1. *Badger Vein.*

This vein in operation for one year and has turned out very rich ore. It is from six inches to three feet in width. It splits a great deal, and at a depth of one hundred and fifty feet the pay-streak has diminished to two or three inches while the vein is three feet wide. It would seem as if the bonanza were about exhausted. One shaft has been sunk and three levels driven, two being air levels. This cannot be denominated as a very regular vein.

2. *Porcupine.*

Runs parallel with and but a quarter of a mile distant from the Badger. Is is two feet in width at surface and has been mined with excellent results, but owing to financial difficulties is abandoned.

3. *Silver Creek.*

But slightly opened by a tunnel driven in the side of the bluff. Good ore has been taken out but at present not worked.

4. *Little Pig.*

A very wide strong vein split in two parts at surface, one portion alone yielding rich ore which must evidently be the pay-streak. This vein is six feet wide at outcrop.

5. *Peerless.*

Typically the same, lies two miles west of Little Pig, but *strike and dip* the same.

6. *Beaver.*

This vein is apparently an exception to the general rule in this region as regards direction. It turns north-east instead of north-west, but I am inclined to think that this is a twist produced by contour of trap-nets, and as they open it with more extended levels, it will I believe assume the direction taken by the others.

Three shafts have been sunk here, but one has been closed up. They are 350 feet from bank here, the vein being from two to four feet wide though considerably split. This is a regular vein and very promising. As this vein intersects a mountain it has been comparatively easy to mine; three air levels being present, No. 3 being used as an adit. They have encountered gas here at lowest depths. It burns with a pale-blue flame and is very light, evidently light carburetted hydrogen gas. That it may be produced by the alteration of the slates into talcose rock at considerable depths is not improbable.

7. *Ontario Vein.*

Formed by the union of two stringers which unite some ten or twelve feet below surface to form a vein a few inches in width. Has not been at all developed.

8. *Rabbit Mountain Vein.*

Of unusual width and at one time extensively mined, but at present abandoned. Its strike, dip, and the general character of the mineral the same.

9. *Big Bear.*

A promising vein though it has been but slightly opened up.

10. *Caribou.*

This has also been considerably mined, but at present not worked.

I believe this region must ultimately take a foremost place among the silver mining districts of America. My reasons are these: *First,* the universal excellence of the ore; while much is extremely rich running as high as ten or twelve thousand dollars a ton, it is all good average stamp rock. *Second,* the close proximity of the ten locations in the second group, all within a radius of three or four miles, leads one to believe the belt has plenty of out-crops awaiting the prospector's pick. *Third,* as the depth of mining increases the value of the ore does not necessarily decrease, as the richest ore is in zones or pockets liable at any moment to come into view. *Fourth,* it is as yet a new mining region and but awaits the thorough and satisfactory trial of one or two mines to ensure the development of all. *Fifth,* from a geological point of view the veins should all be rich satisfactory mines. They trend with hardly an exception north-west and south-east, and are true fissures in all probability formed by the one convulsion of nature and similarly filled. The difficulties that have hitherto attended the development of this mineral region seem to have been in several cases the temerity of the capitalists unacquainted with mining and the expenditure involved in sinking into rich zones of ore. In other cases properties have become mortgaged, mismanaged, till finally abandoned. What is needed is thorough mining to take hold with lots of capital and push the mines and sink till the mine becomes a settled organization, working, yielding, and paying.

THE MAROONS OF JAMAICA AND NOVA SCOTIA.

BY J. C. HAMILTON, LL.B.

Negro slavery disappeared from the Province of Nova Scotia during the latter part of last century, without legislative enactment, by what Judge Haliburton, in his history of Nova Scotia, calls "latent abandonment beneficial to the country." There remained a number of emancipated provincial slaves and still more Africans who escaped to Nova Scotia from the United States. These latter people were called "Loyal Negroes." In 1821 a party of nearly one hundred of them emigrated to Trinidad. But before this, on the founding of Sierra Leone on the west coast of Africa, about twelve hundred went there, arriving in 1792. Four years after this, three ships entered the harbour of Halifax, laden with the most extraordinary cargoes that ever entered that port. Prince Edward, Duke of Kent, then in command at Halifax, boarded the Dover, was met by Colonel W. D. Quarrell, Commissary-General of Jamaica, with whom Mr. Alexander Ouchterlony was associated, and a detachment of the 96th Regiment drawn up on board to receive him. Black men of good proportions with many women and children, all in neat uniform attire, were mustered in lines. Other transports, the Mary and Anne, were, his Highness was informed, about to follow, and the main cargo was six hundred Maroons exiled from Jamaica with soldiers to guard them and meet any attacks from French vessels on the voyage.

The Prince was struck with the fine appearance of the black men, but the citizens had heard of how Jamaica had been harried by its black banditti, and were unwilling at first to have them added to their population. When the Spaniards first settled in the Antilles in 1509, it is estimated by Las Casas, Robertson, and other historians that the Indian inhabitants amounted to ten million souls, but by the exercise of the utmost atrocities, these were melted away until none remained to work as slaves in the mines or in the fields.

"Here," says Las Casas, "the Spaniards exercised their accustomed cruelties, killing, burning, and roasting men, and throwing them to the dogs, as also by oppressing them with sundry and various torments in the gold mines, as if they had come to rid the earth of these innocent and harmless creatures. So lavish were the Spanish swords of the blood of these poor souls, scarce 200 remaining, the rest perished without the least knowledge of God."

When conquering Cuba, Hatuey, a cacique, was captured and fastened to the stake by these emissaries of a Christian King. A Franciscan friar laboured to convert him and promised him immediate admittance into heaven if he would embrace the Christian faith. "Are there any Spaniards" said he, "in that heaven which you describe?" "Yes," replied the monk, "but only such as are worthy and good." "The best of them," returned the indignant cacique, "have neither worth nor goodness. I will not go to a place where I may meet one of that accursed race."

As a military measure this cruel murder was successful. All Cuba submitted awed by the example made of poor Hatuey. When Hispaniola was discovered, the number of its inhabitants was computed, says Robertson on the authority of Herrara, to be at least a million, certainly a large and probably excessive estimate. They were reduced to sixty thousand in fifteen years. Jamaica was not so populous, but not a single descendant of the original inhabitants existed on that island, says Dallas, author of the "History of the Maroons," in 1655, when Venables and Penn, under commission from Oliver Cromwell, landed there. Caves were found where human bones, evidently belonging to the oppressed and harried natives, covered the ground. Famine and cruelty desolated these lovely islands. Then the Spaniards decoyed natives of the Lucayo islands to Hispaniola (now Hayti) to the number of forty thousand, and these shared the fate of the former inhabitants.

The scheme for importing Africans to take the place of the natives, was then pushed on under the guise at first of mistaken philanthropy, but supported by the high prices paid for the victims stolen from Africa.

Genoese merchants were the first who began a regular commerce in slaves between Africa and America, receiving a patent for this purpose from Charles V., of Spain, in 1518. The traffic had begun however in 1501, and King Ferdinand had publicly sanctioned it in 1511. Captain, afterwards Sir John Hawkins, led the English in the slave trade in 1562. In 1567 he had for partner in such enterprize Sir Francis Drake and secured a cargo of slaves off the Guinea coast. Many charters, incorporating adventurers, with monopoly of the importation of slaves from Africa, were granted by James I., Charles I., Charles II., and their successors down to George III. In the single year 1792, twenty Acts of the Imperial Parliament could be enumerated whereby the trade was sanctioned and encouraged.

The number of Africans so introduced into Jamaica was soon in excess of the white population, and thus continues to the present day. Bryan Edwards in his "History of Jamaica," summing up the assets of this island, put down 250,000 negroes at £50 stg. each, making £12,500,000 in 1791. Let us remark the extraordinary ethnic revolution that has taken place in the Antilles since European interference therein began. As examples, take the two islands Hispaniola and Jamaica. At the time of Columbus, Hispaniola, according to Robertson, had one million souls. Before the year 1500, the aborigines had been swept away, and black and white races were taking their places. Now the population of the two States into which this island is divided, namely, Hayti and the Dominican Republic, jointly amounts to about 900,000 souls.

The Indian race, to the number of half a million, as stated by old historians, likewise disappeared from Jamaica. In 1881, its population numbered about 581,000 of whom those of pure white blood seem to have been less than 20,000, the remainder being Africans or of mixed African and European Stocks. Thus it has taken nearly four centuries, with the aid of forced African migration, to fill the places of the aboriginal people.

But to revert to the time when Spanish rule was brought to an end in Jamaica, masters and slaves were uneducated, slothful and poor. The exports consisted only of some cocoa, hogs, lard and hides.

When the officers of the great Protector conquered the island, in May 1655, most of the old white settlers fled, or voluntarily removed to other Spanish possessions. In many cases slaves were left on the abandoned plantations. They still sympathized with their old masters and communicated with them. They took to the woods and defiles called "cockpits," with which parts of the island abound. They harassed the English, decoyed away their slaves, destroyed outlying plantations, and murdered those who ventured abroad without escort. This mass of savages increased in numbers, both by natural causes, and by the addition of run-away slaves, and were known as Maroons. They lived on the game, fruits, and edible roots with which the country abounded, and on the flesh of the wild hog which roamed in the forest and fed on the mast of trees and roots. No country could probably be found more fitted to foster the wild and lawless life which this race passed for nearly two hundred years in Jamaica, with its varied natural resources.

The name Maroon is generally derived from the word meaning "hog hunters," but some take it from the Spanish "Simaron," meaning ape. Either derivation is significant of this people and their habits. In the year 1730, trouble with the Maroons culminated in a revolt, led by Cudjoe, a bold Coromantee negro. His brothers Accompong and Johnny were subordinate leaders, Cuffee and Quaco were his captains. Insurgent slaves, and other ill-disposed negroes joined them. The island was harassed for many months by the bold and skilful attacks of these daring men. It was impossible to take them, as they hid in the glens and "cockpits" enclosed by rocks and mountains. Loyal "Blackshot" negroes and Mosquito Indians from the American coast were hired to aid the soldiery and militia. Peace was at last secured by Colonel Guthrie and Captain Sadlier in March, 1738. It was arranged that Cudjoe and his people should settle in the parish called Trelawney, which is in the north-west part of Jamaica, the place where the Maroons lived mainly for the next forty years.

They still retained much of their African savagery, were illiterate, and no attempt was made to Christianize them. Their language was a conglomerate of African dialects and Spanish, with a sprinkling of English and French. They had fetish and obeah rites and ceremonies. Polygamy obtained, the husbands living in turn two days with each wife. As to the poor wives, the labour imposed on them and the miseries of their situation left them little leisure to quarrel with each other. A white superintendent lived in each of the Maroon towns as a magistrate and the means of communication with the whites and the Government, and he with the chief men had judicial power in ordinary cases. Cases of felony were reserved for the regular magistrates and courts with white judges.

By 1795 the Trelawney Maroons numbered about 1,400; then the second war began, Lord Balcarres being Governor. Montague was the leading Maroon chief; the English Colonels Sandford and Gallimore and many men were slain. Blackshot Indians were hired again to aid the redcoats, of whom there were more than 1,000, and the militia. Still the war lasted with much loss and expense to the island.

Col. Quarrell had heard of the Chasseurs and their famous dogs used in Cuba to track and secure marauders and runaways both white and black. After much discussion the colonel was dispatched in a vessel to Cuba, and secured 40 Chasseurs and 100 dogs, with which he returned. The effect their arrival had on the Maroons was wonderful. The dogs were not even let loose, but were paraded with the soldiers. The terror they excited, added to weariness of the struggle, led the insurgents to gradually come in and submit. All who had not surrendered by a certain day, six hundred in number were, as they came in, sent off to Montego Bay and Spanish Town under guard. The war had cost the island $1,000,000. The Legislature voted $100,000 more, and ordered the 600 to be banished from Jamaica. Colonel Quarrell and Mr. Ouchterlony were put in command of the three ships which carried them and their guard of redcoats, and so they came to Halifax. Colonel Quarrell had recently travelled in Upper Canada, in which Governor Simcoe was then extending a system of self-government. The Colonel praised the Governor's administration, and told the Jamaica people of the large cultivated districts and beautiful towns then rising in the forests north of Lake Ontario. He desired to settle the Maroons in Upper Canada, as he also thought the climate suitable to them. The Assembly, however, with the approval of the Home Government, decided on Halifax. It seems strange that the Home Government had not learned from the experience of the "Loyal negroes" to avoid the choice of a place with climate so unsuited to the race. The vessels arrived and were inspected as stated. The Maroon men were asked what they would do, and expressed willingness to work for "Massa King" and "Massa King's son." The General and Admiral and Governor, Sir John Wentworth, arranged terms with the people. The Maroons were landed from the vessels—the Dover, Mary, and Ann—on which they had come. Admiral Richery, with a threatening French squadron, was off the coast, and it was desirable to get the fortifications completed. The Maroons worked on them. They laboured mainly on earthworks since obliterated by more extensive and permanent improvements to the great citadel and harbour made when the Duke of Wellington was Prime Minister. Maroon hill near Halifax still retains their name. Their chief men were Colonels Montague and Johnston, Major Jarratt, and Captains Smith, Charles Shaw, David Shaw, Dunbar, and Harding.

For two years these people lived in Nova Scotia, but made little progress in civilization or religion. Most of them were settled on lands at Preston; some families were removed to Boydville. A schoolmaster was appointed and the religious training was entrusted to an orthodox gentleman, the Rev. B. G. Gray, and a curate with glebe house and salary supplied. Sir John Wentworth asked for a grant of £240 per annum, to be applied in religious instruction and education. He hoped this course would "reclaim them to the Church of England, and disseminate Christian piety, morality, and loyalty, among them." He also sent an order to England for many things required by them, among which were "40 gross coat and 60 gross white vest metal buttons, strong; Device an Alligator holding wheat ears and an olive branch. Inscription: Jamaica to the Maroons, 1796" He described the people as "healthy, peaceful, orderly, inoffensive, and highly delighted with the country."

The Commissioners, Messrs. Quarrell and Ouchterlony, with not less than three chief men of the Maroons, held court for the trial of smaller offences, a custom introduced from Jamaica. In time both the Commissioners resigned through disagreement with the Governor and were succeeded by Captain Howe, and he by Mr. Theophilus Chamberlain. The two winters which ensued were unusually severe, and the Maroons, unaccustomed to such weather, suffered and became discouraged. They became generally dissatisfied, refused to work regularly, and were addicted to cockfighting, card playing, and the like amusements.

The zeal of the worthy Governor who was a very sanguine philanthropist, had been well intended, but "little effect was produced from weekly sermons on doctrines of faith, delivered to old and young promiscuously in a language not understood," says Edwards. "Some smoked their pipes, and some slept during the services." The old chief Montague, whom all the Maroons honored, was asked if he had undestood the sermon, and wishing not to appear ignorant. replied : "Massa parson say, no mus tief, no mus meddle with somebody wife, no mus quarrel, mus set down softly."

The Governor assembled the men and urged them to adopt Christian marriage customs, but after much discussion they would say: "Dat white people fashion, dat no do for we poor Maroon." They referred Sir John and his good friends to their wives. "If you please, you may make the women take swear, we men can't do so," meaning the marriage vow, to hold to one wife. The women were called in but none would resign her right to her husband, or to such divided interest as she held in him. They all objected to "take swear," and went off, says Dallas, in an uproar clamouring at the men for making such a proposal. Some of these colored ladies even broke out in "insolent observations on the latitude in which some of the greatest characters known to them had indulged."

On 21st April, 1797, Sir John Wentworth, in a letter to the Duke of Clarence, said of the Maroons : "From my observation of them, neither Jamaica or any other island would be long at peace, nor secure from insurrection, were these people among them." . . . I am convinced they will be a useful and faithful corps to oppose an invading enemy. "They do not wish to live by industry, but prefer war and hunting." It had proved impossible to change the "leopard's spots." Two years under the regime of the amiable Governor with the most approved appliances and surroundings of civilization had not worked the expected miracle. The Halifax experiment had failed. It appeared too that the Maroons were divided into three tribes jealous of each other. One captain complained that he had not a well furnished house and cellar to exercise hospitality. Another longed for the yams, bananas, and cocoa of Jamaica. A third wanted hogs to hunt. The weekly sermons were unattended. Parents did not object to bring their children to be baptized, but as to marriage adhered to their old free customs with polygamy, and funerals were conducted with inherited Coromantee ceremonies. The Government still treated them with kindness, but found watchfulness necessary.

In April, 1799, two officers and fifty militia men were for a time posted near the Preston settlement to guard against threatened disorder. Before this when Halifax was threatened by the French, who had attacked Newfoundland, the Maroon men had been formed into companies, and their chiefs had received military commissions which flattered their vanity.

But they were not self-supporting and the cautious Haligonians fought shy of all responsibility for their maintenance. Jamaica had to foot their bills, adding to the original appropriation of $100,000, further sums of $40,000 and $24,000, but now the Government of that island intimated that it would no longer consider the Maroons as their wards. The mother country did not forsake them, but took their views on the situation, if so we may refer to the very limited knowledge of these people. They had heard of Sierra Leone and asked to be allowed to follow the twelve hundred "Loyal Negroes," who had gone there seven years previously.

It is not probable that the Maroons knew then that these, their predecessors, to that sultry and unhealthy peninsula on the West Coast of Africa had not shown signs of improvement in civilization or appreciation of the choice, now clearly mistaken, of this site as a partly missionary, partly commercial establishment.

They probably had but limited knowledge of the tornadoes that prevail in some seasons, and of the fog and rain that wrap that land in frequent gloom.

Some of these facts were no doubt known to the Duke of Portland, the Crown Minister, whose wisdom had directed them, against Colonel Quarrell's advice, to Halifax with its winter snow and fog. His Grace decided to remove them to equatorial heat and fog, and hoped that their military spirit and training in Nova Scotia would be instrumental in keeping the surrounding savages in order, and useful even as an example to the "Loyal Negroes," so called, who lacked discipline and character. Governor Wentworth, now that his missionary zeal had cooled, and Admiral Richery with the French fleet was no longer off the coast, seemed to be possessed of but one desire; to see them depart from Nova Scotia without exception. On the sixth day of August, 1800, Sir John Wentworth informed the Duke that five hundred and fifty-one Maroons had embarked on the *Asia* and set sail from Halifax. Four had deserted to avoid going. Many, Sir John stated, regretted to leave, and all expressed gratitude to Nova Sçotia. They arrived in Sierra Leone, in October, 1800. As caged animals let loose, seek again their native wilds, so did these brave people return to the land of their ancestors, holding fast to their old inbred customs and superstitions.

The spirit of Saxon civilization passed lightly over them, but did not penetrate their breasts. But a kindly feeling prevailed, and the Maroon has not since raised his hand against the white man. The children and grand children of the Maroons of Trelawney, may now be found on the West Coast of Africa.

They are reported to have aided the Government in repressing revolts of savage tribes, and in opening to the advance of freedom and civilization the Dark Continent, from which their ancestors were torn by the cruel Saxon. Doubtless the brave deeds of their forefathers, who defied the redcoats and held their own so long in the defiles and cockpits of Jamaica, and the terrors of ice cold Nova Scotia are still the theme of song and story in the cottages of Freetown by the Sierra Leone rivers and Isles de Loss. Doubtless there tired mothers still crying babes to rest with tales inherited from their parents of the terrible Chasseurs and their savage dogs of war.

NOTE.—Since the above abstract was put in print I have received an interesting communication from Hon. E J. Barclay, Secretary of State of Liberia. He gives gratifying information as to the progress made and position taken by some of these people on the West Coast, stating: "The only family that I have known to come direct from the Dominion was Henry Rankin and wife, who came from a place called Muskoka. They arrived in 1873 or '4. Mr. Rankin has since died." . . As regards the "Loyal Negroes," yclept Nova Scotians, on the coast, who were sent to Sierra Leone, and the Maroons who followed, I have, through the kindness of Mr. Boyle, Liberian Consul at Sierra Leone, heen furnished with a list of the most prominent of these persons in the British West African colonies:—

Nova Scotians.—John B. Elliott, J.P., J. W. Elliott, and John Priddy, of Sierra Leone; Rev. S. Trotter Williams and Mr. Porter, government contractor, of Waterloo; J. F. Eastman, M.D., Assistant Colonial Surgeon, Gold Coast Colony.

Maroons.—Dr. T. Spilbury, Colonial Surgeon, Gambia; J. Gabbidon, Commissariat clerk; and Hon. Francis Smith, Assistant Judge, Gold Coast Colony; Nash H. Williams, B.L., of Freetown; and Mr. Samuels, Trelawney Street, Freetown, Sierra Leone.

There is a Maroon church at Freetown called St. John's, of which the Rev. J. A. Cole—an able native African—is the pastor. It will be noticed that the old home in Jamaica is remembered in the name of a Freetown street.

A PRELIMINARY LIST OF ALGÆ COLLECTED IN THE NEIGHBOURHOOD OF TORONTO.

BY

J. J. MACKENZIE, B.A.

The following is a list of Algae which I collected and identified during the summer of 1889, with the localities in which they were found. I purpose continuing my observations, and will endeavour to add to this list from time to time.

The classification and nomenclature is that used in Wolle's "Fresh Water Algae of the United States" and "Desmids of the United States."

CHLOROPHYCEÆ.

CONFERVOIDEÆ.

COLEOCHAETACEÆ—

Coleochaete, Breb.

C. scutata, Breb.; Humber.

OEDOGONIACEÆ—

Oedogonium, Lk.

Oe. crassiusculum, Wittr.; Ashbridge's Bay.

Bulbochaete, Ag.

B. intermedia, D. By.; Humber.

B. gigantea, Pringsh.; Humber.

CONFERVACEÆ—

Draparnaldia, Ag.

D. glomerata, Ag.; Humber.

Stigeoclonium, Kg.

S. nanum (Dillw.), Kg.; Humber.

Chaetophora, Schrank.

C. endiviaefolia, Ag.

var. ramosissima, Rab.; Humber.

Aphanochaete, H. Br.

A. globosa (Nord.), Wolle; Humber.

Cladophora.
C. fracta, Kg.; Don Valley.
C. glomerata, Kg.; Humber.
Ulothrix, Kg.
U. zonata (W. and M.), Aresch.; common everywhere.
Conferva, Lk.
C. vulgaris, Rab.; Humber.

SIPHONEÆ.

VAUCHERIACEÆ—
Vaucheria, D.C.
V. sericea, Lyngb.; Don Valley.
V. Dillwynii, Aq.; High Park.
V. sessilis (Vauch.), D.C.; High Park and Don Valley.
V. geminata (Vauch.), D.C.; Don Valley.

PROTOCOCCOIDEÆ.

VOLVOCACEÆ—
Volvox, Ehrb.
V. globator, Linn.; Don Valley.
Eudorina, Ehrb.
E. stagnale, Wolle; Ashbridge's Bay.
Pandorina, Ehrb.
P. morum, Bory.; Ashbridge's Bay.
Gonium, Mueller.
G. pectorale, Mueller; High Park. This plant I have only found once; it seems to correspond to the European species.
Chlamydococcus, A. Br.
C. pluvialis, A. Br.; rain-water pools; common.

PROTOCOCCACEÆ—
Pediastrum, Meyen.
P. Boryanum, Menegh; Ashbridge's Bay.
P. Ehrenbergii, A. Br.; High Park.
P. tetras, Ehrb.; High Park.
Scenedesmus, Meyen.
S. caudatus, Corda.; High Park, Humber, Ashbridge's Bay.
S. acutus, Meyen; same localities as preceding.
Characium, A. Br.
C. Naegelii, A. Br.; Don Valley.
Protococcus, Ag.
P. viridis, A.; common everywhere.
Polyedrium, Naeg.
P. gigas, Wittr.; Ashbridge's Bay. Possibly this is not an independent species, but simply a stage in the development of Hydrodictyon.

PALMELLACEÆ—

Raphidium, Kg.

R. polymorphum, Fres.; Ashbridge's Bay and High Park. It is claimed by some authors that Raphidium is a stage in the development of Pediastrum.

CONJUGATÆ.

ZYGNEMEÆ—

Spirogyra, Link.

S. flavescens (Hass.), Cleve.; Don Valley.

S. longata (Vauch.), Kg.; Ashbridge's Bay.

S. nitida (Dill.), Link.; Don Valley.

S. jugalis (Dill.), Kg.; Ashbridge's Bay.

S. majuscula, Kg.; Ashbridge's Bay and Humber.

S. orthospira (Naeg.), Kg.; Don Valley.

S. quadrata (Hass.), Petit.; Don Valley.

Zygnema, Kg.

Z. anomalum (Hass.), Kg.; Humber.

Pleurocarpus, A. Br.

P. mirabilis, A. Br.; Humber and High Park.

DESMIDIEÆ—

Hyalotheca, Ehrb.

H. dissiliens (Smith), Breb.; Humber.

Desmidium, Ag.

D. Swartzii, Ag.; Humber.

Penium, Breb.

P. digitus (Ehrb.), Breb.; Humber.

P. closterioides, Ralfs ; Ashbridge's Bay.

Closterium, Nitsch.

C. gracile, Breb.; Humber.

C. Cucumis, Ehrb.; Humber and Don Valley.

C. turgidum, Ehrb.; High Park.

C. striolatum, Ehrb.; High Park, Humber, and Don Valley.

C. Dianæ, Ehrb.

var. arcuatum, Breb.; Ashbridge's Bay.

C. acuminatum, Kg.; High Park.

C. Jenneri, Ralfs.; Humber.

C. Venus, Kg.; Humber and High Park.

C. Ehrenbergii, Menegh ; Humber.

C. rostratum, Ehrb.; Ashbridge's Bay.

C. Brebissonii, Delp.; Humber.

Docidium, Breb.

D. crenulatum (Ehrb.), Rab.; Humber.

D. Trabecula (Ehrb.), Naeg.; Ashbridge's Bay.

Calocylindrus, D. By.

C. Cucurbita (Breb.), Kirch.; Humber.

C. Thwaitesii, Ralfs.; High Park.

Cosmarium, Corda.

C. ovale, Ralfs.; Humber.
C. Cucumis, Corda.; Humber.
C. granatum, Breb.; Humber.
C. tumidum, Lund ; Humber, High Park.
C. nitidulum, De Not.; Humber, High Park, and Don Valley.
C. Naegelianum, Breb.; High Park.
C. pseudopyramidatum, Lund ; Humber.
C. anisochondrum, Nord.; Humber.
C. Botrytis, Menegh ; Humber, Don Valley, and Ashbridge's Bay.
C. Brebissonii, Menegh ; Humber.
C. conspersum, Ralfs ; Ashbridge's Bay.
C. intermedium, Delp ; Humber and High Park.
C. reniforme (Ralfs), Arch.; Humber.
C. brierme, Nord.; High Park.
C. protractum (Naeg.), Archer ; Humber,
C. subcrenatum, Hantzsch ; High Park.
C. Broomei, Thwaites ; Humber, Ashbridge's Bay.
C. biretum, Breb.; Humber, High Park.
C. Beckei, Wolle ; Humber

Xanthidium, Ehrb.

X. antelopaeum (Breb.), Kg.
var. polymazum, Nord ; Ashbridge's Bay.

Arthrodesmus, Ehrb.

A. Incus (Ehrb.), Hass.; Ashbridge's Bay.

Euastrum Ehrb.

E. inerme, Lund ; High Park.
E. rostratum, Ralfs ; Humber.

Micrasterias, Ag.

M. furcata (Ag.), Ralfs ; Ashbridge's Bay.

Staurastrum, Meyen.

St. dejectum, Breb.; Humber.
St. Margaritaceum Ehrb.; Humber.
St. creuulatum, Naeg. (Delp.) ; Humber, Ashbridge's Bay.
St. rugulosum, Breb.; Humber.
St. alternans, Breb.; Humber, Ashbridge's Bay.
St. cyrtocerum, Breb.; Humber.
St. gracile, Ralfs ; Humber.
St. nanum, Wolle ; High Park.
St. pseudosebaldi, Wolle ; Humber.
St. hirsutum (Ehrb.), Breb.
St. furcigerum, Breb.; Ashbridge's Bay.

CYANOPHYCEÆ.

NOSTOCACEÆ—

Mastigonema (Fisher), Kirch.

M. aerugineum (Kg.), Kirch.; Humber.

Rivularia.

R. dura, Kg.; High Park.

Tolypothrix, Kg.

T. flaccida, Kg.; Humber,

Nostoc, Vauch.

N. commune, Vauch.; High Park and Don Valley.

N. coeruleum, Lyngb.; High Park.

Anabaena, Bory.

A. flos-aquae, Kg.; Humber and High Park.

A. stagnalis, Kg.; High Park.

Cylindrospermum, Kg.

C. macrospermum, Kg.; High Park.

Lyngbya, Ag. et Thur.

L. vulgaris (Kg.), Kirch.; Humber.

Oscillaria, Bosc.

O. percursa, Kg.: High Park.

O. Froelichii, Kg.

var. fusca, Kg.; Humber.

O. princeps, Vauch ; High Park.

CHROOCOCCACEÆ—

Merismopedia, Meyen.

M. glauca, Naeg.; High Park.

Chroococcus, Naeg.

C. turgidus, Naeg.; High Park.

ON THE USE OF FAUNAL LISTS.

By Ernest E. Thompson.

The following is a brief abstract of Mr. Thompson's paper:

" A Faunal List is a full catalogue of the animals known to inhabit any given area, and is usually understood to include remarks on the relative abundance in that area, on any irregularities of distribution, and on seasonal or other changes. It is, therefore, a work founded on (first) correct identification of the animals, and (second) correct particular identification of the time and place of their occurrence.

The evident object of a faunal list is the exact mapping out of a country in such a way that the distribution, etc., may be compared with other physical maps, *i.e.* arranged facts, and the reasons of that distribution understood. The end of enabling students to know what to look for is quite subsidiary and incidental.

The only possible means of preparing a proper list is by a certain very small area being watched daily for a number of years by a thoroughly competent observer, who must appreciate the necessity for scrupulous exactness and for keeping separate his ascertained facts and his theories. Let him theorize all he likes, but he must never mix his theories with, or put them forward as, facts.

It will be seen at once that the worst faults a list can have are— actual misstatement, hasty generalisation, which is partial misstatement, and vagueness, which is equivocal misstatement. No one will, I presume, deny the total depravity of actual misstatement, whether intended or not. A wrong fact is a long time in being corrected, and has marvellous power for evil. Hasty generalisation is less noxious only because it bears on its face more or less clearly the imprint of unreliability. Vagueness is a very common vice, and many otherwise good observers have, by this unfortunate failing, nullified a great deal of their work.

Thus far I have referred to original observations only, used in the formation of a list; but, in addition, it is not only allowable, but binding on a worker, that he use all previously published or otherwise accessible reliable information to make his own list complete. In doing this he is to adhere to two rules:—First, give full credit *in print* to his authority; second, do not put into his mouth words or meanings that are not his, or, in other words, don't plagiarise and don't misrepresent.

Now, with these tenets before us, let us examine the process of making a list, and later we will enquire as to the ultimate use of so much labor.

It should be borne in mind that the settled habitation of the animal is the most important item in its distribution; notes on its migration are valuable, but must be carefully kept separate from matters relating to its true home, or, as we say more especially of birds, their summer habitat. The reason of this importance is evident, for while animals pass over all kinds of countries in migrating, they are sure, when settled down to breed, to be surrounded by just that nice adaptation of external circumstances which is their proper environment, and to understand which we are chiefly aiming.

Our naturalist, then, is supposed to have set about his list duly impressed with the necessity of giving the truth, without generalities or vagueness. The pernicious effect of untruthfulness need not be enlarged on; those of vagueness will be more or less evident to all, but hasty generalisation is not so evidently dangerous, and its *modus operandi* may be shewn.

In all ages this very error has been the parent of much degrading superstition and misery. Take an example: A shrew was seen to run over a cow's leg as she lay in pasture. The next week this cow, alone, dies of a strange disease! Obviously, the logical generalisation is that shrews infect cows with a deadly disease through mere contact!

Again: In building a heathen temple in the South Seas a man is accidentally killed. It so happens that the building proves "lucky," as we would say. Evidently it is to the death of this man that the good fortune is due. Hence the origin of a fearful custom!

Again: Two children were suffering from a wasting disease. One of them happened one day to hold the bridle of a piebald mare. This recovered; the other died. Clearly, then, the child was cured by the breath of a piebald mare!

Seeing that in these cases it was not possible to trace the course of cause and effect, as the persons concerned were without the knowledge requisite, the only logical process available for them is to look for sequent phenomena and assume them to be cause and effect, and the only fault in this logic is that too few cases were taken as a basis of the theory, *i.e.* they were too hastily generalised."

Mr. Thompson, then returning to the immediate subject, gave examples of birds and mammals, shewing how totally wrong would be sweeping generalisations founded on a few instances. He further illustrated this principle by a detailed map of the peculiar distribution in a small section of Manitoba of the *Pipilo erythropthalmus*, and having thus shewn how erroneous would be the statement that the bird is found throughout this region, he proceeded:—

"Of course, a common expedient for avoiding the necessity of so much care in giving details is the use of the expression "in suitable places" throughout the area treated. I consider the phrase a miserable evasion. We might as well and truly say of each and every species, dead and alive, "in suitable places throughout the earth;" for it is very certain that if it is not so found it is because the area was not suitable, either actually, or unsuited through the presence of stronger competitors, or else not suitably contiguous to the birthplace of the species.

The simple facts, then, as ascertained and here shewn, are what I should offer to the public, accompanying the same with a map of the area in question, without giving any reason for this apparently erratic distribution, except as a matter of opinion—for it will be long before any one can speak positively on the subject—and also without heeding the fact that in other regions the distribution of this same bird may be quite different, in accordance with different surroundings."

Mr. Thompson then proceeded to enumerate the better-known elements of environment that tend to modify geographical distribution, and gave a large number of illustrations of these modifications.

Temperature, as varied by latitude, elevation, slope, exposure, etc., he considered of prime importance, and particularly dwelt on the accuracy with which birds adhere in their summer habitat to the exact isotherm that affords the nice balance of surroundings which is most favorable to the species.

Barometric pressure, rainfall, formation of surface, character of soil, proximity of bodies of water and of currents, exposure to certain winds, presence of competitors or of parasites, hygienic conditions, and vegetation were all instanced and illustrated in their bearing on distribution. The last, he stated, was of evident importance, and probably ranked next to temperature, on which, however, it is largely dependent.

"These," he continued, "are among the known factors of environment, but there is evidence that many other more obscure influences are in operation, and there can be little doubt that every force that is or ever will be found in the whole range of the solar spectrum will be ultimately proven an important element in the various problems of distribution, so that the question finally resolves itself into a serearch after the total environment of each species.

I have been thus minute in tracing the known causes and aspects of distribution in order to give a fair idea of the intricacy of the problem presented, and I think it the more necessary because of late I have been compelled to make a stand for the principles of work herein maintained. I do not think any one will gainsay them; I have, at least, the best authorities of the day in harmony with my views in general, if not in detail, and it is on these lines that I have had so often to condemn Canadian work.

It will be seen that, since so much care and detail is required, no one man can possibly gather, even in a lifetime, from his own observation, facts enough to fully and accurately map out the faunal areas of more than a few square miles. Obviously, then, if the work is ever to be done, it must be by hundreds, or thousands even, of observers uniting their efforts, *i.e.* each contributing his little mite of ascertained fact, unmarred by generalisation, and put down in such a way that it will always mark a step in advance and may ultimately be used, without revision, as material for preparing the fullest and most accurate account; and then, after a sufficiency is gathered, the whole plan, with its many complex reasons, will unfold itself to our eyes like a magnificent pattern, so intricate that no one could have imagined it, and so beautiful that its mere contemplation will be found more elevating than many a noble work that is credited with shaping the human mind in a right direction.

And what is the object of expending so much effort on so small a matter? Setting aside the incidental benefit accruing to agriculture from a right understanding of the balance of nature, also the fact that science in general, of which this is an important part, is a material benefit to mankind, as well as the not very tangible, but not the less incontrovertible fact, that a common purpose, answered by all such studies, is the cerebral development of the whole race through action on a large number of its individuals; and it is not unworthy of consideration, also, that the many who are actually taking part in the study are thereby provided with a delightful, healthy, and elevating occupation.

Apart from all this, I say: We now come to the final and great end of the study itself. When by this means we have completely worked out the geographical range of our fauna the reason for such distribution will be clear. The effect of each slight change of surroundings will be manifest, and then not only will we be able to turn to the best account the various domesticated animals and their products, but we will thereby arrive at a vastly more complete knowledge of ourselves. Discomforts and diseases hitherto inexplicable will be dispelled in a short time, perhaps, finally, by some master hand playing deftly on the constitution with a skilful combination of certain of these ascertained factors of environment. The proper authorities then will meet a plague like that of the mosquitoes in Manitoba not by advocating the building of smudges, thereby replacing the evil by one only a grade less—a method just a step higher than the old-fashioned plan of fighting a disease by incantation—but by simple effectual scientific means. An epidemic like *la Grippe* will be unable to begin its career of death. At the very outset the cause of its appearance will be understood, and by a touch, perhaps, or a word to the people at large, the delicate machinery of its environment will be readjusted in such a way as to summarily end it at the very beginning. In this way almost all the pests that are of the nature of an epidemic on man, beast, or vegetable may be met at once and annihilated, along with the circumstances that gave rise to them.

Thus, as I have briefly endeavoured to indicate, to a greater extent probably than we have any idea of, the race will be elevated and benefitted by the pursuit of what is, after all, simply a delightful recreation."

REPLY TO MR. THOMPSON'S CRITICAL NOTE.

By J. B. Tyrrell.

In the last number of the *Proceedings*, which was received about the middle of December, 1889, there is what purports to be a "Critical Note," by Mr. E. E. Thompson, on my "Catalogue of the Mammalia of Canada," and, as the statements there made may be misleading to some of the readers of *The Proceedings*, I must ask to be allowed the privilege of a short reply, though I am surprised that the courtesy was not extended me of allowing me to make this reply in the same number in which the "Critical Note" appeared.

The first of the three pages of the "Note" is almost entirely occupied with a general vilification of the "Catalogue," and this diatribe may very well go unanswered. In the following two pages my statements regarding seven species of mammals are impugned, these statements, doubtless, being considered my most glaring errors :—

I. On the occurrence of *Felis concolor* in Southern Quebec. That the Cougar does, or did until very recently, occur in Southern Quebec is very well known, and at the present time there are two mounted specimens in the Museum of the Natural History Society in Montreal, both of which are stated to have been shot in the adjoining country.

II. On the occurrence of *Cervus Canadensis* in Eastern Canada. It is a well-known tradition that in recent times the elk was an inhabitant of the Ottawa valley, and my friend Mr. W. P. Lett, in a paper read before the Ottawa Field Naturalists' Club on March 13th, 1884, and published on pp. 101-116 of No. 5 of its *Transactions*, gives authority for the statement that within the last seventy years it has been seen within four miles of the present site of the city of Ottawa. There are also numerous records of horns of this deer having been found in different parts of Ontario, both on the surface and just below it, many of them in quite a perfect state of preservation, precluding the idea of any great antiquity.

III. and IV. Referring to my notes on *Hesperomys leucogaster* and *Synaptomys Cooperi*, Mr. Thompson flatly accuses me of plagiarising whole paragraphs, quoting them "verbatim or nearly so" from his "List of the Mammals of Manitoba," leaving it to be inferred that he had made some original observations on these rodents that I had copied without giving him credit for them.

The facts, however, are as follows :—Mr. Thompson, in his "List," has copied from Coues and Allen's "Monographs of North American Rodentia" statements concerning the finding of the first of these species in Minnesota close to the international boundary, and the second both in Minnesota and Alaska, and he has drawn the inference that they would be found in Manitoba. I had drawn the same simple inference before Mr. Thompson's paper was published. My paragraph referring to the former species is a line and a half long and contains eighteen words, only nine of which (five of them being proper names) are to be found in Mr. Thompson's note on the same animal. My paragraph on *S. Cooperi* contains the same number of words, ten of which (two being proper names and five prepositions or conjunctions) are also found in Mr. Thompson's note. His ideas of what is meant by the expression "verbatim or nearly so" are, therefore, evidently broader than those held by people generally.

V. Regarding the distribution of *Lepus sylvaticus* in Ontario, Mr Thompson is probably correct in saying that in the northern nine-tenths of the province the species is unknown. It is advancing northward through the southern more thickly settled portions of the province.

VI. Commenting on my "ignorant" remarks on *Geomys bursarius* Mr. Thompson says that this species "is an animal of the Mississippi valley," and then even he himself goes on to say that it has been found in Southern Manitoba—a fact of which I was not before aware. As he knows perfectly well that neither the Mississippi nor any of its tributaries flows through Manitoba, he doubtless means by the term "Mississippi valley" the great central basin of the continent, a large portion of which is drained into the Mississippi river. He ought also to be aware that the south-western peninsula of Ontario, as regards both its fauna and flora, approaches more nearly to the central basin than to any other part of America—in fact, from a biological point of view, may be said to form part of it. *Geomys bursarius* was originally described by Shaw in the Linnæan Transactions in 1800, and his statement regarding its habitat is not that quoted by Mr. Thompson, but: "This quadruped was taken by some Indian hunters in the upper parts of interior Canada, and sent down to Quebec." (Linn. Trans., vol. v., 1800, p. 228 and tab. 8.) The fur trade of the West was then in the hands of the North-West Company, &c., who brought their furs *in bales* to Montreal and shipped them to foreign markets, so that it appears improbable that the skin was brought loose from west of Lake Superior. I have, therefore, interpreted Shaw's statement as meaning Eastern rather than Western Canada.

VII. For my "surprising statement" as to the northerly range of the black squirrel *(Sciurus Carolinensis)* I have no less an authority than Sir John Richardson, who states that specimens of his *S. niger*, which is a synonym for this species, had been sent in to him both from Penetang and Fort William.

On the question of the Indian names of the different species Mr. Thompson complains that no special alphabet is used, whereas I state in the Catalogue that the vowels are given the Continental sounds, and, being a member of the staff of the Canadian Geological Survey, I have used the simple alphabet that has been used by that corps in their reports for years past. That no marks are used representing the lengths of the vowels is a matter of considerable regret to me. The manuscript sent to the printer, which by the way is still in my possession, has the lengths of any doubtful vowels marked throughout, as in Appendix IV. to my Report on Northern Alberta; and, although in the Algonquin languages each syllable is accented or not according to the length of its vowel sound, accents were occasionally inserted for the greater convenience of pronunciation. These marks have in some way been omitted in printing.

From the above it will be seen that although a desire for brevity has forced me to omit long lists of synonyms, specific references under each species, and interesting details throughout, the errors in the Catalogue, in view of our present imperfect knowledge, are not so glaring as Mr. Thompson would like to have believed.

OTTAWA, March 13th, 1890.

REPLY TO MR. TYRRELL'S NOTE.

By Ernest E. Thompson.

Mr. Tyrrell has made a reply to my criticism of his paper that is in most respects, apart from certain preliminary adjectives, just what it ought to be. The reader, however, will be amused if he turns to my letter and reads the paragraph which Mr. Tyrrell characterizes as a "diatribe," "vilifying," etc., but which he admits to be logically unanswerable.

Mr. Tyrrell responds to my demand for the grounds on which he bases several interesting records by giving the data which should have appeared at the time, but he errs in saying that I impugned their truthfulness, as he will see on re-reading my note.

I withdraw the charges of plagiarism.

On the next question, that of *Lepus sylvaticus*, he admits he is wrong.

On the next, *Geomys bursarius*, he endeavours, by a curious juggle of words, to prove that he is right, when he himself knows he has made an egregious mistake, and would shew to much better advantage by admitting and correcting it. If he takes the trouble to look the matter up he will find that I did *not* quote "Shaw."

Mr. Tyrrell does not appear to be aware that the authenticity of the Fort William specimens has been challenged; but, even supposing it were not so, the idea of ascribing this species to the vast region that he names, much of which lies further north than Fort William, shews such a melancholy ignorance of the whole subject of faunal areas and distribution as can only be accounted for on the ground that we have here the ambitious effort of a geologist who has suddenly turned mammalogist, and thinks to finish at a stroke a work which he would not have ventured to attempt if he had had the experience of a lifetime to guide him.

In his last item Mr. Tyrrell admits the grave omission which I pointed out, and explains that for this the printer is responsible.

It is greatly to be regretted that his desire for brevity induced Mr. Tyrrell to put observations in such a shape as to deprive them of nearly all value.

But I would again assert that the specific errors pointed out are not so much the grounds for my objection to the publication of the paper as are the wrong principles on which it is based.

Such methods of work might have passed unchallenged a hundred years ago, but are decidedly behind the age now. The author's ideas on distribution are nebulous in the extreme, he does not realize the magnitude and importance of such a work as he has undertaken, and while, as already intimated, I admit him to be a person of, at least, great enterprise, it is to be greatly regretted that he has attempted so much and done it so superficially and ill. Had he limited his field and exercised proper care and research he might have rendered to science a really valuable service.

TORONTO, 19th March, 1890.

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Anthropological Institute of Great Britain and Ireland	"
Royal Colonial Institute	"
Linnean Society of London	"
Geological Society of London	"
London Mathematical Society	"
Institution of Civil Engineers	"

Financial Reform Association	London.	
British Museum	"	
British Museum, Natural History Section	"	
Palestine Exploration Fund	"	
Patent Office	"	
Trübner's Record	"	
Physical Society of London	"	
National Association for the Advancement of Social Science.	"	
Sanitary Institute of Great Britain	"	
"Chemical News"	"	
Imperial Federation League	"	
Iron and Steel Institute	"	
"Iron"	"	
The "Electrician"	"	
Royal Institution of Great Britain	"	
Aristotelian Society for the systematic Study of Philosophy.	"	
Society of Arts	"	
Society of Antiquaries of London	"	
Literary and Philosophical Society of Manchester	Manchester.	
Manchester Geological Society	"	
Manchester Association of Engineers	"	
Manchester Geographical Society	"	
Society of Antiquaries of Newcastle-upon-Tyne	Newcastle-upon-Tyne.	
North of England Institute of Mining and Mechanical Engineers	"	
Midland Institute of Mining, Civil and Mechanical Engineers	Barnsley.	
Somersetshire Archæological and Natural History Society	Taunton.	—53.

SCOTLAND.

Aberdeen Philosophical Society	Aberdeen.	
Dumfriesshire and Galloway Natural History and Antiquarian Society	Dumfries.	
Royal Society of Edinburgh	Edinburgh.	
Society of Antiquaries of Scotland	"	
Royal Scottish Society of Arts	"	
Royal Physical Society	"	
Edinburgh Botanical Society	"	
Edinburgh Geological Society	"	
Royal Scottish Geographical Society	"	
Library of the University of Edinburgh	"	
Royal Philosophical Society	Glasgow.	
Glasgow Geological Society	"	
Natural History Society of Glasgow	"	
Institution of Engineers and Shipbuilders of Scotland	"	
Greenock Philosophical Society	Greenock.	—15.

IRELAND.

Royal Irish Academy	Dublin.	
Royal Dublin Society	"	
Royal Geological Society of Ireland	"	
Institution of Civil Engineers of Ireland	"	
Naturalists' Field Club	Belfast.	
Belfast Natural History and Philosophical Society	"	—6

(2.)—AUSTRIA-HUNGARY.

Société Archéologique	Agram.	
Société Hongroise de Géographie	Budapest.	
L'Académie des Sciences	Cracovie.	
Historischer Verein für Steiermark	Graz.	
Siebenbürgischer Verein für Naturwissenschaften	Hermannstadt.	
Institut für österreichische Geschichtsforschung	Innsbruck.	
K. Böhmische Gesellschaft der Wissenschaften	Prag.	
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Naturhistorischer Verein "Lotos"	"	
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Wissenschaftlicher Club in Wien	"	
Oesterreichischer Ingenieur-und Architekten-Verein	"	
Internationales Permanentes Ornithologisches Comité	"	—23.

(3.)—BELGIUM.

Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique	Bruxelles.	
Société Royale de Botanique de Belgique	"	
Société Royale Belge de Géographie	"	
Musée Royal d'Histoire Naturelle de Belgique	"	
Société Royale Malacologique de Belgique	"	
Société Liégeoise de Littérature Wallonne	Liège.	
Société Royale des Sciences	"	
L' Université Catholique	Louvain.	
Prof. E. Pasquier	"	—9.

(4.)—DENMARK.

Kongelige Bibliotheket	Copenhagen.
Kongelige Danske Videnskabernes Selskab	"
Kongelige Nordiske Oldskrift Selskab	"
Nordisk Tidskrift for Filologi	"

—4.

(5.)—FRANCE.

Société Linnéenne du Nord de la France	Amiens.
Société de Géographie Commerciale de Bordeaux	Bordeaux.
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Revue Biologique du Nord de la France	"
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Bulletin d'Histoire Ecclésiastique et d'Archéologie Religieuse des Diocèses de Valence, Gap, Grenoble, et Viviers. Romans. —39.

(6.)—GERMANY.

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Gesellschaft für Erdkunde................................ "
Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte .... "
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Archiv der Mathematik und Physik .... "
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Deutsche Geologische Gesellschaft .... "
Naturhistorischer Verein für die Preussischen Rheinlande und Westphalen ... . Bonn.
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Naturwissenschaftlicher Verein für Schleswig-Holstein.... "
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Königlich-Sächsische Gesellschaft der Wissenschaften . .. "
Verein für Erdkunde zu Leipzig .... "
Museum für Völkerkunde .... "

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Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte	"	
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Geographische Gesellschaft	"	
Westfälischer Provinzial-Verein für Wissenschaft und Kunst......................	Münster.	
Naturhistorische Gesellschaft zu Nürnberg	Nürnberg.	
Germanisches Nationalmuseum	"	
Verein für Naturkunde	Offenbach-am-Main.	
Historische Gesellschaft für die Provinz Posen	Posen.	
Zeitschrift für Physiologische Chemie	Strassburg.	
Kaiserliche Universitäts- und Landes Bibliothek	"	
Verein für Vaterländische Naturkunde in Würtemberg ..	Stuttgart.	
Nassauischer Verein für Naturkunde....................	Wiesbaden.	—52.

(7.)—ICELAND.

Islenzka Fornleifafélags.....	Reykjavik.	—1.

(8.)—ITALY.

Società Italiana dei Microscopisti	Acireale.
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R. Accademia delle Scienze dell' Istituto di.............	Bologna.
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Società Italiana di Antropologia, Etnologia, e Psicologia Comparata	"
Sezione Fiorentina della Società Africana d'Italia	"
Società Entomologica Italiana	"
Società di Lettura e Conversazione Scientifiche	Genova.
Società Ligustica di Scienze Naturali e Geografiche..	"
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Società Geografica Italiana	"

R. Comitato Geologico d'Italia .... Roma.
R. Accademia dei Lincei .... "
Accademia Pontificia de' Nuovi Lincei .... "
Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche.... .... "
Specula Vaticana............................... .... "
"Cosmos" di Guido Cora................ ....Torino.
Archivio di Letteratura Biblica ed Orientale .... "
R. Accademia delle Scienze .... "
Notarisia, Commentarium Phycologicum.................Venezia.
R. Istituto Veneto di Scienze, Lettere ed Arti .... " —34.

(9.)—NETHERLANDS.

Koninklijke Akademie van Wetenschappen..............Amsterdam.
Kon. Zoologisch Genootschap "Natura Artis Magistra".... "
Kon. Nederlandsch Aardrijkskundig Genootschap... .. "
École Polytechnique de Delft ....Delft.
Koninklijk Instituut voor de Taal, Land en Volkenkunde van Nederlandsch-Indië ....'S Gravenhage.
Société Hollandaise des Sciences .... Harlem.
Fondation de P. Teyler van der Hulst .... "
Nederlandsche Botanische Vereeniging ....Leiden.
Nederlandsche Dierkundige Vereeniging .... "
Recueil des Travaux Chimiques des Pays-Bas .... "
Koninklijk Nederlandsch Meteorologisch Instituut ....Utrecht. —11.

(10.)—NORWAY.

Musée de Bergen................... .... Bergen.
Polytekniske Forening ....Kristiania.
Forening til Norske Fortidsmindesmerkers Bevaring...... "
Videnskabs Selskabet.............. .. .. "
Kongelige Norske Frederiks Universitetet .... "
Nyt Magazin for Naturvidenskaberne .. .. "
Norwegische Commission der europæischen Gradmessung. "
Tromsö Museum .. ..Tromsö —8.

(11.)—PORTUGAL.

Sociedade de Geographia de Lisboa......................Lisboa.
Académie Royale des Sciences de Lisbonne .... " —2

(12.)—ROUMANIA.

Institut Météorologique de Roumanie ....Bucarest. —1.

(13.)—RUSSIA.

Société des Naturalistes à l'Université Impériale de	Kharkow.	
Société des Naturalistes à l'Université de St. Wladimir	Kiew.	
Societas Scientiarum Fennica	Helsingfors.	
Tifliser Observatorium	Tiflis.	
La Section Caucasienne de la Société Impériale Russe de Géographie	"	
Société Impériale des Naturalistes de Moscou	Moscou.	
Société Physico-chimique Russe à l'Université de	S. Pétersbourg.	
Comité Géologique	"	
La Société Impériale Russe de Géographie	"	—9.

(14.)—SPAIN.

"Crónica Cientifica"	Barcelona.	
Real Academia de Ciencias Naturales y Artes	"	
Real Academia de Ciencias Morales y Politicas	Madrid.	
Real Academia de la Historia	"	
Sociedad Geográfica de Madrid	"	—5.

(15.)—SWEDEN.

Kongliga Universitetet	Lund.	
Kongliga Fysiografiska Sällskapet	"	
Kongliga Svenska Vetenskaps-Akademien	Stockholm.	
Konglika Biblioteket	"	
Stockholms Hogskola	"	
Svenska Sällskapet for Antropologi och Geografi	"	
Geologiska Förening i Stockholm	"	
Acta Mathematica	"	
Kongliga Universitetet	Upsala.	—9.

(16.)—SWITZERLAND.

Geographische Gesellschaft von Bern	Bern.	
Naturforschende Gesellschaft in Bern	"	
Schweizerische Naturforschende Gesellschaft	Frauenfeld.	
Société de Physique et d'Histoire Naturelle	Genève.	
Société de Géographie de Genève	"	
Institut National Génevois	"	
Société Vaudoise des Sciences Naturelles	Lausanne.	
Société Neuchâteloise de Géographie	Neuchâtel.	
Naturforschende Gesellschaft in Zürich	Zürich.	—9.

III.—ASIA.

(1.)—INDIA.

Asiatic Society of Bengal	Calcutta.

Geological Survey of India .... Calcutta.
Editor of the "Record" .... "
Survey of India Department .... "
"Indian Antiquary" .... Bombay.
"Orientalist" .... Kandy, Ceylon.—6.

(2.)—STRAITS SETTLEMENTS.

Journal of the Straits Branch of the Royal Asiatic Society.. Singapore. —1.

(3.)—JAPAN.

University of Tōkyō .... Tōkyō.
Asiatic Society of Japan .... "
Deutsche Gesellschaft für Natur- und Völkerkunde Ostasiens "
Literature College of Imperial University of Japan .... "
College of Science, Imperial University of Japan .... "
Tōkyō Anthropological Society .... " —6.

(4.)—JAVA.

Bataviaasch Genootschap van Kunsten en Wetenschappen. Batavia.
Nederlandsch-Indische Maatschappij van Nijverheid en Landbouw .... " —2.

(5.)—CHINA.

China Branch of the Royal Asiatic Society .... Shanghai.
Observatory of Hong Kong, and Government Publications. Hong Kong. —2.

(6.)—COCHIN-CHINA.

Société des Études Indo-Chinoises .... Saigon.
—1.

IV.—AFRICA.

(1.)—ALGERIA.

Société Archéologique du Départment de Constantine .... Constantine.
Société de Géographie et d'Archéologie de la Province d'Oran. Oran.
Académie d'Hippone .... Bône. —3.

(2.)—CAPE COLONY.

South African Philosophical Society .... Cape Town. —1.

(3.)—EGYPT.

Institut Égyptien .... Le Caire. —1.

V.—AUSTRALASIA.

(1.)—AUSTRALIA.

Royal Society of New South Wales	Sydney.	
Royal Geographical Society of Australasia	"	
Department of Mines, New South Wales	"	
Linnean Society of New South Wales	"	
Board of Technical Education	"	
Australasian Association for the Advancement of Science	"	
Royal Society of Queensland	Brisbane.	
Royal Society of Victoria	Melbourne.	
Public Library of Victoria	"	
Government Statist	"	—10.

(2.)—NEW ZEALAND.

New Zealand Institute	Wellington.	—1.

(3.)—TASMANIA.

Royal Society of Tasmania	Hobarton.	—1.

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2. The SECOND SERIES began January, 1856; concluded January, 1878; contains 92 numbers in 15 vols. 8vo. It has for title, "The Canadian Journal of Science, Literature, and History." This series can still be supplied, except Part 5 of Vol. XV., which is quite out of print. Of Vols. X., XI. and XV. but few copies remain.

By inadvertence, No. 85 (November, 1873), Vol. XIV. of this series immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3. The THIRD SERIES, commenced in 1879, has now reached its Seventh Volume. Its title is "Proceedings of the Canadian Institute." Parts 1 and 2 of this series are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

Vol. I,	Third Series,	contains	5	Fasciculi.
" II,	"	"	3	"
" III,	"	"	4	"
" IV, V and VI, each		"	2	"

Of Vol. I., Parts 1 and 3, and of Vol. II., Part 1, are out of print. Of Vol. II, Part 2, very few copies remain. Of Vol. III., Part 1 is out of print.

4. Only two Annual Reports of the Institute have been published in a separate form, viz., for 1886-87 and 1887-88. These are out of print.

5. Missing numbers will be supplied on application, except those mentioned above as out of print. The Institute will be glad to exchange the back volumes of its publications for an equivalent of those of any Society with which it exchanges.

6. A liberal price will be given for the following:—Vol. I. First Series, Vols. X., XI. and XV., and especially Part 5, Vol. XV., Second Series, Vol. I. Parts 1 and 3, Vol. II. Parts 1 and 2, Vol. III. Part 1, Third Serie. Persons having any of the above, and being willing to part with them, will please communicate with the Assistant Secretary.