

GEOLOGICAL SURVEY

OF

CANADA.

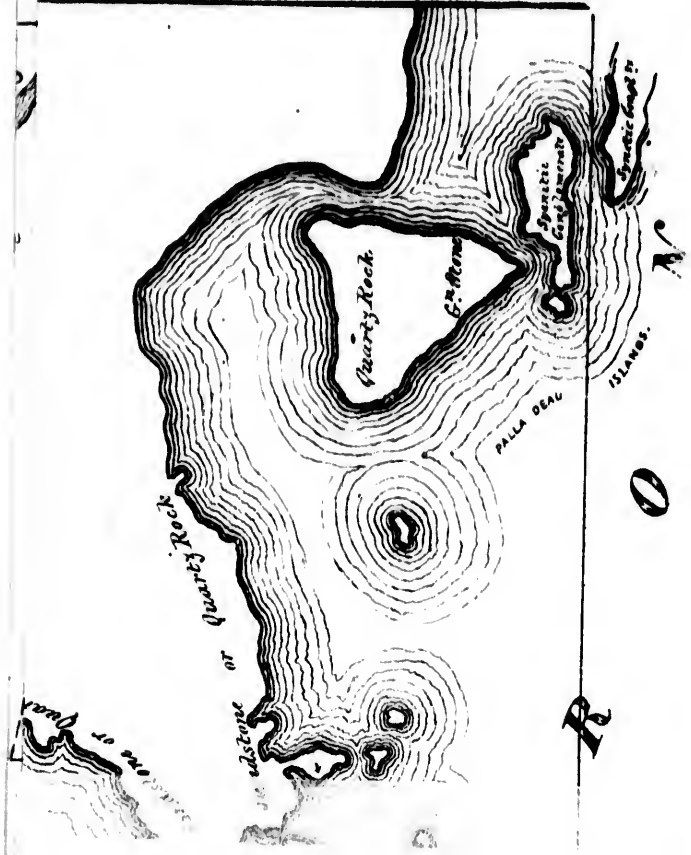
REPORT ON THE NORTH SHORE OF
LAKE HURON.



Montreal:

PRINTED BY LOVELL & GIBSON, ST. NICHOLAS STREET.

1849.



Quarry Rock

Quarry Rock

C. Stone

PALLA DEAL ISLANDS

SPECIALIST CAMP

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W. ad. Stone or Quarry

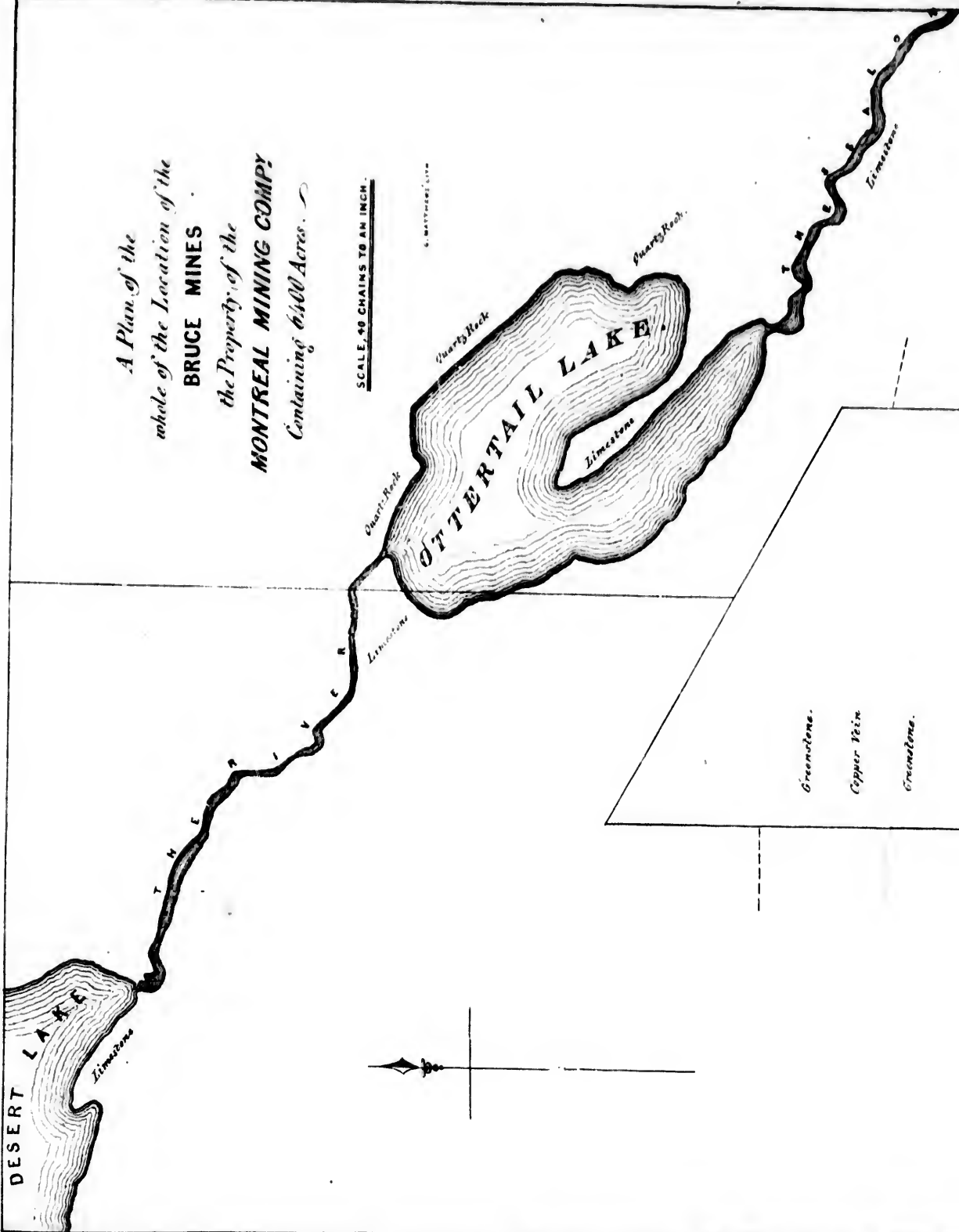
W. ad. Stone or Quarry

SPECIALIST CAMP

A Plan of the
BRUCE MINES
the Property of the
MONTREAL MINING COMPY
Containing 6400 Acres.

SCALE, 40 CHAINS TO AN INCH

6. MONTREAL LINE



Greenstone.

Copper Vein

Greenstone.

Syenitic Conglomerate

Syenitic Conglomerate

Syenitic Conglomerate

Syenitic Conglomerate

Quartz Rock

Syenitic Conglomerate & Slate

KEATING
6400 Acres

CUTHBERTSON
6400 Acres.

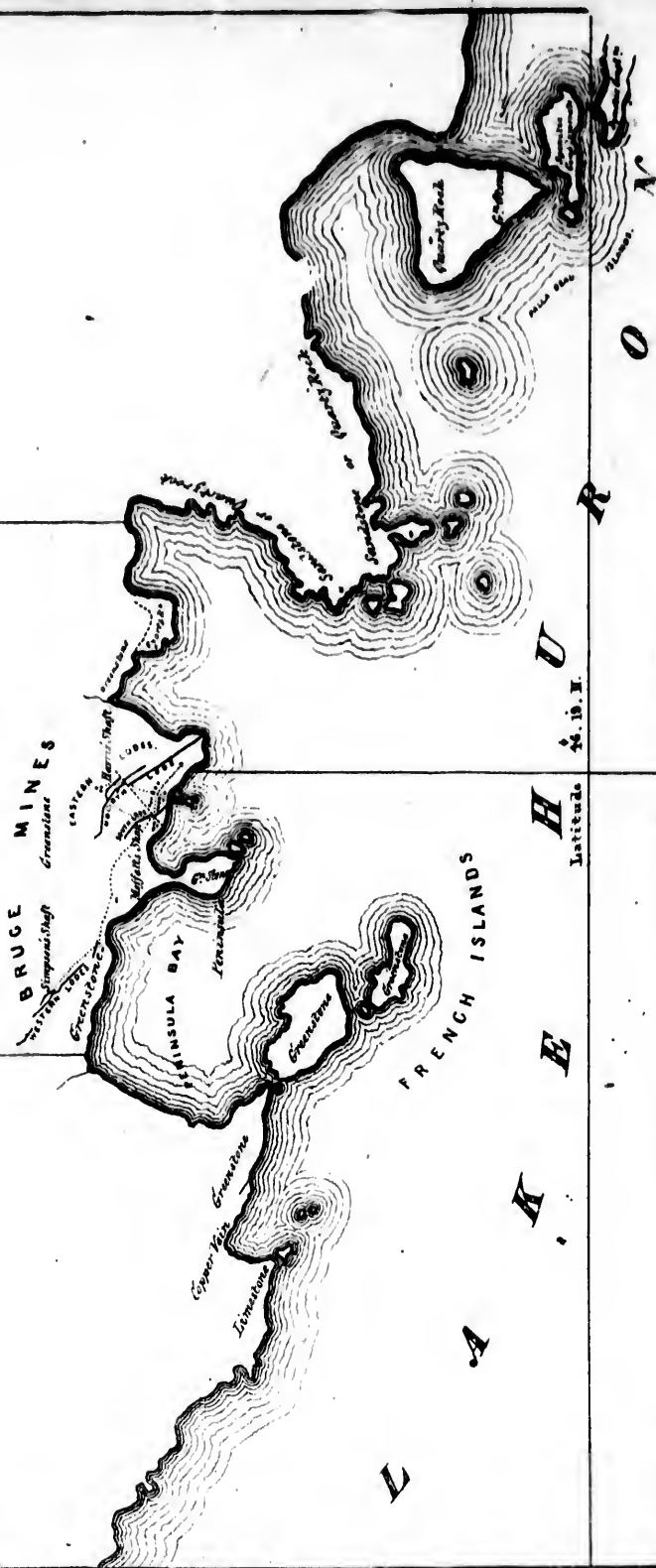
*Syenitic Conglomerate
& Greenstone*

Syenitic Conglomerate

STARNES
6400 Acres.

Greenstone

BRUCE MINES
Syenitic Conglomerate



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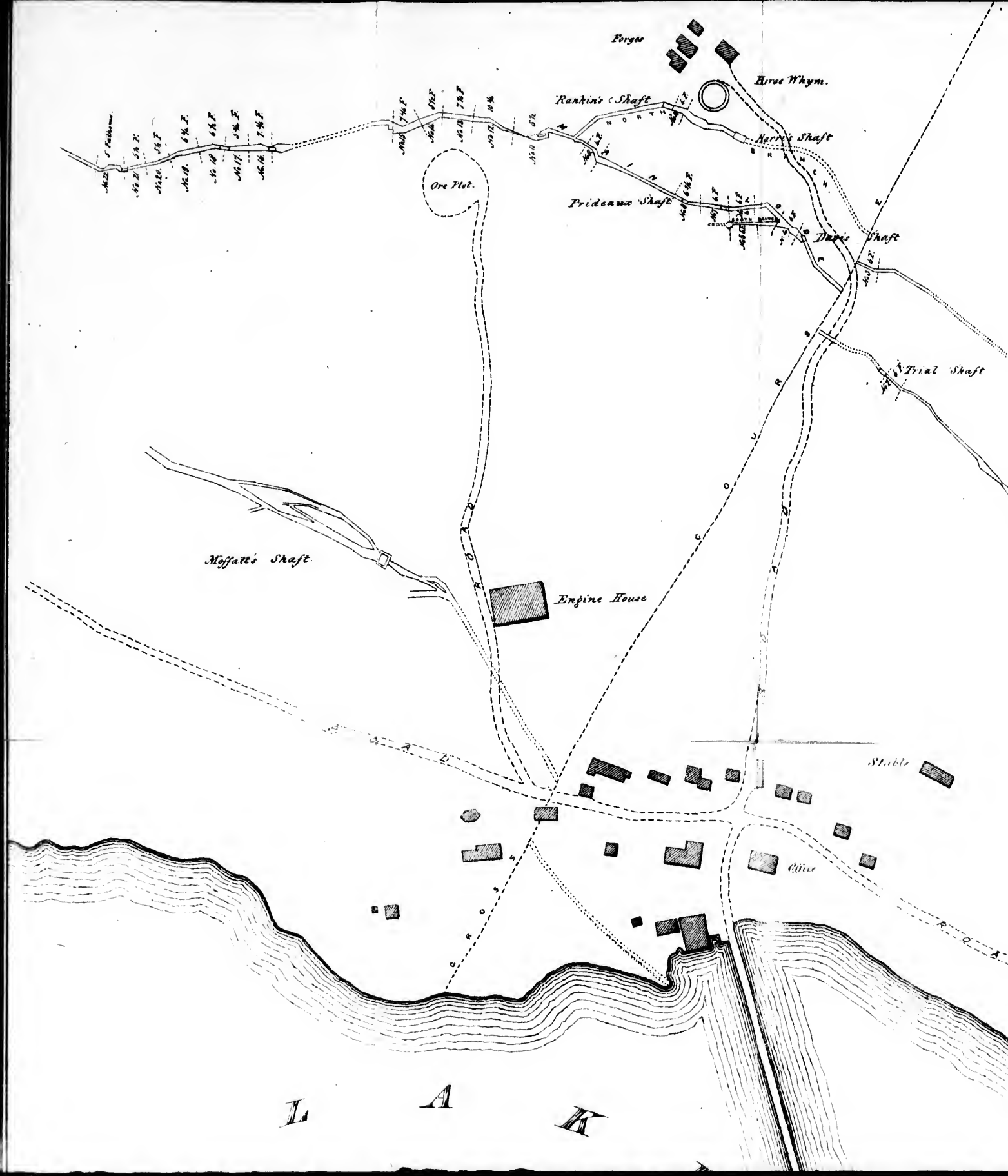
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Rankin's Shaft

Harris Shaft

Prideaux Shaft

Dugie's Shaft

Trial Shaft

Moffatt's Shaft

Ore Plot

Engine House

Stable

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P L A N
of Part of
The Bruce Mines.

Shewing the Mineral Veins.

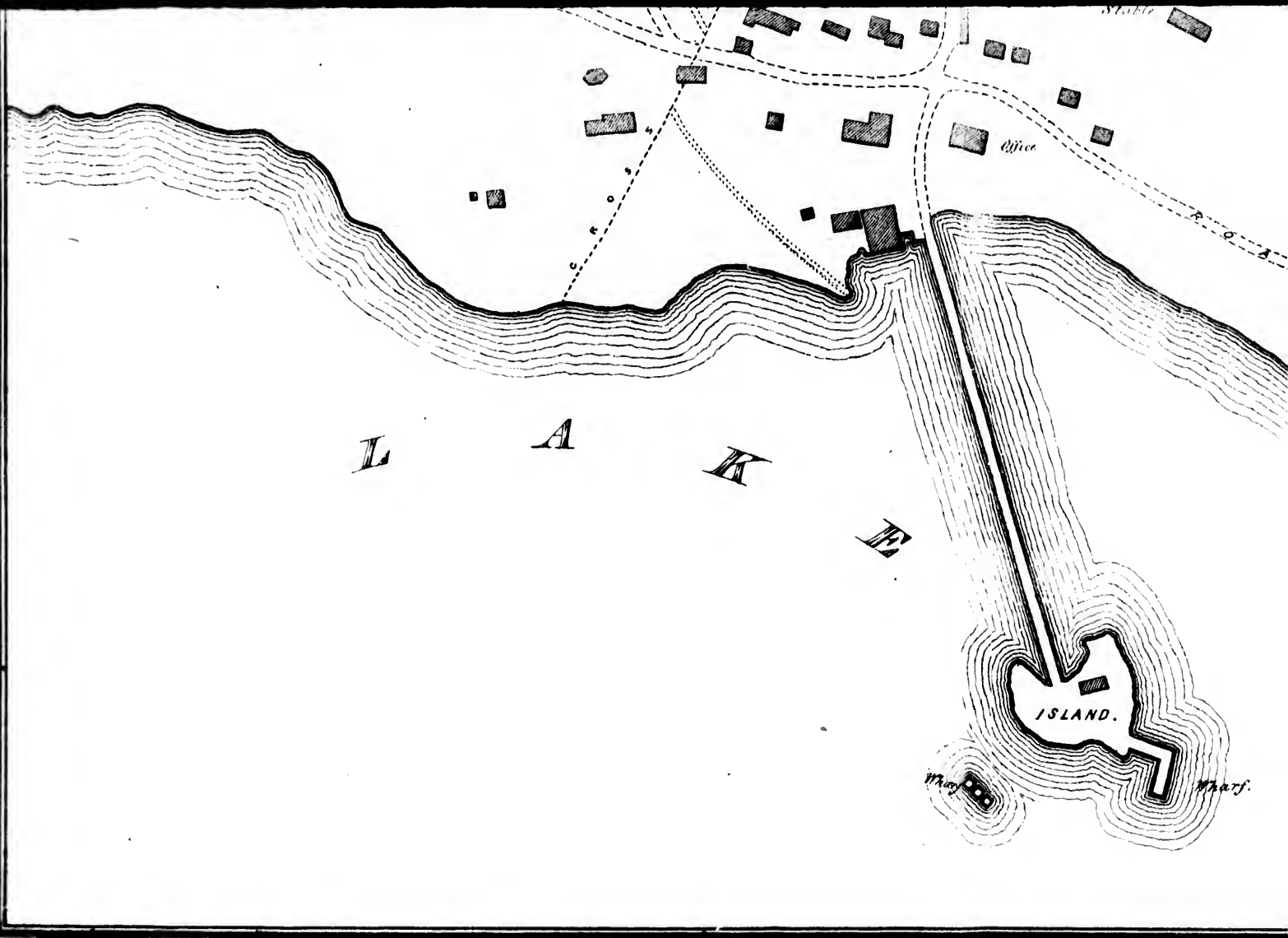
Surveyed by W. C. Logan, Esq. F. G. S.

Drawn by James Cane, C. E.

MATTHEWS' LITH.

SCALE, 2 CHAINS TO ONE INCH.





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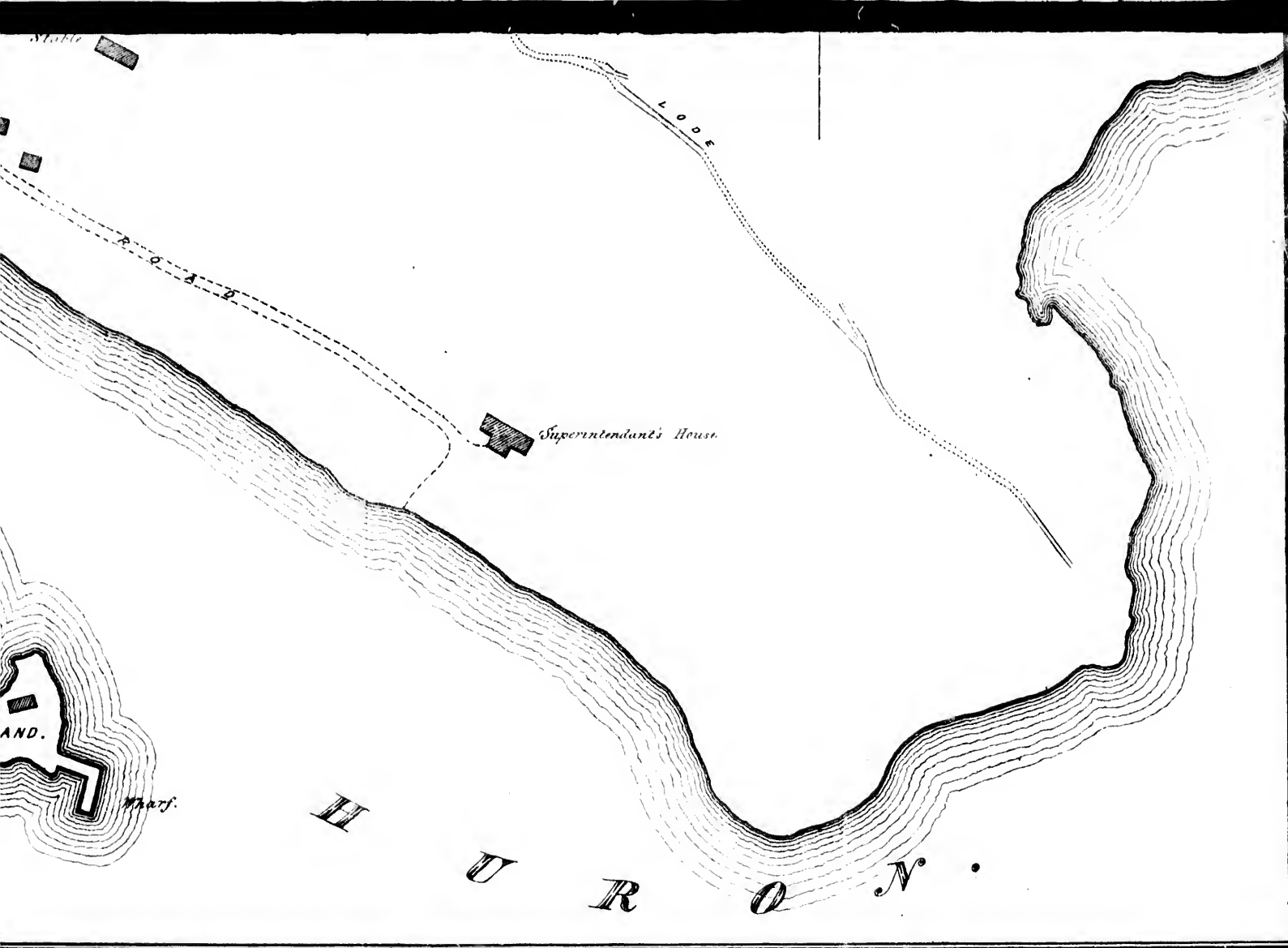
E

ISLAND.

Wharf.

Office

Stable



Stable

LOOSE

ROAD

Superintendent's House

AND.

Mankf.

H U R O N .

GEOLOGICAL SURVEY OF CANADA.

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REPORT ON THE NORTH SHORE OF LAKE HURON.  
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MONTREAL, 17th January, 1849.

SIR,—I have the honor to request you will do me the favor to place before His Excellency the Governor General, the accompanying Geological Report on the North Shore of Lake Huron.

I have the honor to be,

Sir,

Your most obedt. servant,

W. E. LOGAN,

Provincial Geologist.

To the Honorable James Leslie,

Provincial Secretary, &c. &c, &c.

TO HIS EXCELLENCY
THE RIGHT HONORABLE
JAMES, EARL OF ELGIN AND KINCARDINE, K. T.,
BARON BRUCE OF KINROSS AND OF TORRY,
ONE OF HER MAJESTY'S MOST HONORABLE PRIVY COUNCIL,
Governor General of British North America,
AND
CAPTAIN-GENERAL AND GOVERNOR-IN-CHIEF
IN AND OVER
THE PROVINCES OF CANADA, NOVA SCOTIA, NEW BRUNSWICK, AND THE
ISLAND OF PRINCE EDWARD,
AND VICE ADMIRAL OF THE SAME.

Montreal, 29th December, 1848.

MAY IT PLEASE YOUR EXCELLENCY :—

In proceeding with the Geological Survey of the Province during the season which has just terminated, it was my intention, after a further examination of the Eastern Townships and the country in general lying south of the St. Lawrence, between the Richelieu and Chaudière Rivers, in continuation of the previous summer's operations, to follow out the investigation of the rocks which run through the district in question in their prolongation to the Temisquata Road, and farther down the St. Lawrence if time should permit,—thus to join the work already done in Gaspé with that in more western parts of the Province ; but having been given to understand that it would be desirable to effect, if possible, a visit to the North Shore of Lake Huron, on which several mining locations had been claimed of the Government, and a considerable capital expended by the various parties interested in them, in order to investigate the general nature of the mineral ground of the district, and ascertain facts to elucidate the probable productiveness of the mines of that part in particular in which the development of the metalliferous veins had been carried to the greatest extent, the months of July, August, and

part of September, were devoted to these objects. Two months had been previously occupied in the Eastern Townships and the adjacent seigniories ; and, having left an Assistant on the ground, on quitting this part of the Province for Lake Huron, with instructions to trace out, as far as possible, the distribution of certain rocks and useful minerals, and to collect specimens in illustration of them, the month of October and part of November after my return from Lake Huron, were spent in verifying various facts ascertained by him, and in further personal examinations in the same vicinity, continued until the increasing severity of the weather, and a fall of snow, gave intimation that it was expedient to discontinue field work for the season, and return to winter quarters.

My Assistant, Mr. Murray, in the early part of the season, devoted his attention to the examination of the coast of Lake Huron between Penetanguishene and Sandwich, and, having joined me on the North Shore, at the Bruce Mines, I had the benefit of his aid in a survey of the Rivers Thessalon and Mississagui. We ascended the former about twenty-five miles, coasting the shores of three lakes occurring on the distance, and the latter nearly forty miles, as well as seven miles of one of its tributaries and four miles of another, in addition to two lakes on the Grande Batterie Portage, emptied by this tributary, one of them five, and the other eight, miles long, with breadths of one and two miles. Mr. Murray subsequently examined about sixty miles of the Spanish River, with about fifteen miles of two of its tributaries, and also about fifteen miles of the lakes and stream flowing into Lake Huron, in the immediate vicinity of LaCloche ; after which he visited the Wallace mine and various other parts on the coast and islands of the main lake, as he returned to Penetanguishene.

The several rivers, with their tributary streams and lakes, which have been mentioned, were not only geologically but geographically surveyed, the measurements being determined with the same expedition as on former occasions, by Rochon's micrometer telescope ; and I would take this opportunity of stating as a farther evidence of the accuracy of the instrument when carefully used, that a topographical survey of the Mattawa, a tributary of the Ottawa, having been recently completed by Mr. D. Sinclair, for the Crown Land Department, the total distance (nearly thirty-

four miles) as determined by the chain, does not, on a comparison of resulting maps, at all differ from the same as determined by micrometer on my exploration in 1845, while the details bear as striking a resemblance as can be expected from two surveys of the same ground by different persons, wherein points on distant shores of lakes, being fixed by intersections, an eye sketch is given of intermediate parts.

After descending the Mississagui and separating from Mr. Murray, my attention was bestowed on an examination of the coast between that stream and Echo Lake (discharging into Lake George, on the River St. Mary,) a distance of about seventy miles; and pedestrian incursions were made at intervals from the coast into the interior, for distances not exceeding five miles. In addition to this, a very detailed examination of the Bruce mines, on the Cuthbertson location, was made. The various lodes, as far as known, with their branches and all the workings upon them, were carefully measured and mapped. About 1500 tons of copper ores lying on the surface were sampled after the Cornish mode; drill-holes were driven across the lodes in some places at intervals of two fathoms, and in others of three and five fathoms on the surface, in the shafts, and in the under ground levels for the purpose of *sludge sampling* the same, as it is termed; and fifty-five samples resulting from these operations, were forwarded to Montreal to be assayed by Mr. Hunt, who has since made an analysis of each to determine the quantity of copper contained in them. A considerable collection of specimens was also forwarded to illustrate the rocks and minerals of the country, several of the packages containing which only arrived in the beginning of the month.

The foregoing narrative will display to Your Excellency the extent to which our investigations were carried on the North Shore of Lake Huron in the short period devoted to it, and although, since my final return to Montreal, sufficient time has not elapsed for a perfect arrangement of the facts ascertained, and, perhaps, the number of these facts is scarcely sufficient to fully elucidate the geological structure of the area thus partially examined, yet as a desire may naturally be felt on the part of the Government to be put in possession, with as little delay as possible, of some account of a district in which private enterprise

has recently expended a considerable amount of capital on what may hereafter become an important branch of trade, I have the honor to place before Your Excellency such a Report as circumstances permit, reserving for a future occasion what is to be said on the general progress of the Survey in other parts.

The North Shore of Lake Huron, on which twenty-two mining locations have been claimed of the Government, in so far as it has come under my observation, presents an undulating country, rising into hills which sometimes attain the height of 400 and 700 feet above the lake. These occasionally exhibit rugged escarpments and naked rocky surfaces; but in general, their summits are rather rounded, and their flanks, with the valleys separating one range from another, are most frequently well clothed with hard and soft wood, often of large growth, and of such species as are valuable in commerce; in many places giving promise of a good arable soil. Many of the slopes are gentle, and many of the valleys wide.

Five principal rivers, besides several of inferior note, flow through the country, and it appears to abound in lakes. The principal streams are the Thessalon, the Mississagui, the Serpent, the Spanish River and the White Fish, of which the mouths are from fifteen to thirty miles apart. The Mississagui and the Spanish Rivers are the largest two, the reported length of the former being 120 and of the latter 200 miles; the other three are probably not much over fifty to sixty miles each. In the distances measured, the Thessalon and the Mississagui flow from the north-west to the south-east, the Spanish River from the north of east to the south of west, and this is navigable for craft drawing not over five feet, for thirty-five miles from its mouth.

The series of rocks occupying this country from the connecting link between Lakes Huron and Superior to the vicinity of Shebawenahning, a distance of 120 miles, with a breadth in some places of ten, and in others exceeding twenty miles, it appears to me, must be taken as belonging to one formation; on the west it seems to repose on the granite which was represented in my Report on Lake Superior as running to the east of Gros Cap, north of Sault Ste. Marie; on the east the same supporting granite was observed by Mr. Murray north of LaCloche, between three and four miles in a straight line up the Rivière au Sable, a south flowing tribu-

tary of the Spanish River ; and again, about an equal distance up another and parallel tributary joining that stream eight miles farther from its mouth, in both cases about ten miles from the coast. The series is to be divided into rocks of a sedimentary, and rocks of an igneous origin.

The sedimentary portion consists of sandstones, conglomerates, slates and limestones. The sandstones are sometimes grey, but more generally white, they are almost purely silicious, and principally fine grained, but the granular texture is often lost, and great masses assuming a vitreous lustre present the character of a perfect quartz rock, which is met with of both the colours mentioned ; and when white, it sometimes exhibits precisely the aspect of the milky or greasy quartz of mineralogists. The quartz rock, in addition to white and gray, is not unfrequently of a reddish colour, and sometimes a decided red, seemingly derived from minute and thickly disseminated spots, or a diffused tinge of an orange red, probably due to the presence of iron ; but the spots are sometimes of a larger size, and so arranged as to give the stone a speckled appearance. In the granular varieties considerable masses of the rock sometimes present a white with a faint tinge of sea-green, which seems to arise from a small quantity of finely disseminated epidote. The rock often becomes coarse grained, assuming the character of a conglomerate, the pebbles of which vary from the size of duck shot to that of grape and canister. These pebbles are almost entirely either of opaque white vitreous quartz or various coloured jaspers ; some few are of lydian stone, and some of hornstone and other varieties. The pebbles are often disposed in thin layers at the top or bottom, or in the midst of finer grained beds ; but they are sometimes arranged in thicker bands, which swell into mountain masses, and blood-red jaspers often disseminated in these to a preponderating degree on a nearly pure white ground, giving a brilliant, unique and beautiful rock, appear to characterize some ranges of considerable importance. When considerable masses of a fine-grained or vitrified quality are met with, it is often difficult if not impossible to determine the bedding ; and the rock in such cases, having usually a jointed structure, with planes of division in several directions, some of which are frequently nearly horizontal or moderately inclined, it would not be safe to assume any of them as indicating the dip, un-

til bands distinguished by differences of colour, or changes in the texture from fine to coarse grained, or the occurrence of a line or surface of pebbles, may give the means of deciding. The bedding, however, is often well defined by such indications as these, and it not unfrequently happens that surfaces present ripple-mark, and strata display elementary layers oblique to the general plane. The sandstones sometimes, but rarely, exhibit a slaty or flaggy structure, and they appear then to hold a small quantity of mica.

In addition to those already mentioned, conglomerates of a distinctly different character belong to the formation. They are composed chiefly of syenitic pebbles, held in an argillo-arenaceous cement of a gray, and more frequently of a greenish colour, from the presence of chlorite. The pebbles, which are of reddish and gray colours, vary greatly in size, being sometimes no larger than swan shot, and at others boulders rather than pebbles, measuring upwards of a foot in diameter. The quantities too in which they are aggregated vary much; they sometimes constitute nearly the whole mass of the rock, leaving but few interstices for a matrix, and sometimes, on the contrary, they are so sparingly disseminated through considerable masses of the matrix as to leave spaces of several feet between neighbouring pebbles, which are still in such cases often several inches in diameter; with the syenitic pebbles, are occasionally associated some of different coloured jaspers. The matrix appears often to pass on the one hand into the gray quartz rock by an increased proportion of the arenaceous particles, and on the other into a thin-bedded greenish fine-grained slate, which is sometimes very chloritic. A third form the matrix sometimes assumes is one in which it is scarcely distinguishable from fine-grained greenstone trap. In the slate the stratification is often marked by slight differences of color, in the direction of which it is occasionally cleavable: the bands in other instances are firmly soldered together, but in both cases joints usually prevail, dividing the rock into rhombohedral forms, which are sometimes very perfect.

The limestones belonging to the formation are probably confined to one band, the thickness of which in different parts may range from fifty to 150 feet. The texture of the rock is usually compact, but sometimes partially granular, and its colours are green, buff and dark gray, the two former prevailing; some of the beds are

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occasionally met with of a dull white with a waxy lustre, which weather to a yellowish brown on the exterior and appear to be dolomitic. The whole band is in general thin bedded, and a diversity of quality in the layers, probably arising from the presence of more or less silicious matter, causes the surface of weathered blocks to present a set of bold but minute ribs of various thicknesses, which, when the beds are much affected, as they often are, by diminutive undulations, contortions and dislocations, exhibit on a small scale, a beautiful representation of almost all the accidents that occur in stratification, affording very excellent ready-made geological models. Interstratified beds of chert are very frequently met with in the band, and they vary in thickness from mere lines, to the measure of several inches. The same diversity of colour belongs to the chert as to the limestone.

The igneous rocks, which, from what appears to me their peculiar relation to the stratification as overflows, it will be convenient to consider constituent parts of the formation, may be classed as a whole, under the denomination of greenstone trap. The masses they present are sometimes very great, and in such cases, the trap usually consists of a greenish-white feldspar, and dark-green or black hornblende. The feldspar, however, is sometimes tinged more or less with red, and the trap then occasionally appears to pass into a syenite by the addition of a very sparing amount of quartz. These two forms of the trap are almost always highly crystalline, and in general not very fine grained: the greenstone, however, sometimes displays a fine texture, and in such cases, a large amount of it frequently holds much disseminated chlorite, giving a very decided green colour, and patches are found containing so great a proportion of the mineral as to yield with facility to the knife, affording to the aborigines of the country an excellent material for the manufacture of their *calumets* or tobacco pipes. In addition to the chlorite, epidote is a prevailing mineral in this quality of the trap. Associated with the chloritic greenstone, amygdaloid was in one place seen, some of the cellules of which contained quartz, others calc-spar, a third set held bitter spar, and some few specular iron. The amygdaloidal trap was very distinctly arranged in layers, which, though they did not exceed two or three in number, gave with beds of porphy-

ritic greenstone, containing large crystals of feldspar, occurring near the amygdaloid, a stratified aspect to the whole of the mass of trap associated with them. No such decided appearance of stratification was met with in the more crystalline greenstones. They usually displayed, however, parallel planes of division in several directions, and it frequently happened, that some of these parallel planes were only moderately inclined; but there were observed no distinguishing marks on the surfaces, or in the quality of the rock, to lead to the certain inference that one part was placed prior to another; and no columnar structure at right angles to any set of planes, such as so clearly indicates the overflows of trap on the north shore of Lake Superior, though carefully looked for, was anywhere found. In respect to the last species of evidence, however, it must be remarked, that the trappean hills of the Huron region under description, are so generally rounded into *mouttonné* forms, by supposed glacial action,—the parallel grooves resulting from which are seen on almost all exposed surfaces, with bearings seldom exceeding or even reaching forty-five degrees on one side or the other of north and south—that few bold naked vertical precipices are met with in which the display of such a columnar structure, if it exists, might be expected. It is, therefore, in most instances, only by a reference to its immediate relation to the sedimentary rocks on each side, that the general attitude of any band of the greenstone can be made out. In very few places, indeed not over two or three, were there met with exposures, such as to show the trap in actual visible stratigraphical contact with the sedimentary rocks; but in many transverse sections on the different lakes and rivers visited, in rising inclined flanks of hills in the strike of the stratification, while sedimentary rocks, with a very moderate dip, constituted the base, greenstone was found to compose the summit; and exposed parts of the two rocks in this relation were frequently brought so near together, though not seen in contact, while there was no evidence of dislocation between them, that little doubt was left of the one resting on the other.

Of the members thus constituting the formation, the sandstones, or quartz rock, with their subordinate conglomerates, both in individual ranges, and in the aggregate, appear to possess the largest volume; the greenstones seem to be next in importance, some of

the bands attaining 600 to 1,000 feet; the syenitic conglomerates and their associated slates follow, and the limestone band, of which the thickness has been stated, though very persistent, is of trifling comparative amount.

The stratigraphical position of the several descriptions of rock, in their relation to one another, as parts of a whole, has not yet been well determined, and although it may turn out that a preponderating amount of each may occupy some specific place in the series, it seems probable that none of them, with the exception of the limestone, will be found wholly absent from any considerable grade of the vertical thickness, in some part of that grade's geographical distribution. With the exception of the limestone, the different descriptions of rock, whether of small or great measure, appear to dovetail among one another, individually thinning down to an edge both ways on the strike. This thinning down was more particularly observable in the syenitic conglomerates, and in the greenstones; their extension appearing to bear some proportion to their thickness. Between great neighbouring masses of the quartz rock, and the syenitic conglomerates, there usually appeared a passage from the one to the other, by the interstratification of smaller bands; but this did not seem to be the case between great neighbouring masses of igneous and sedimentary strata: small bands of trap, however, when obscurely exposed, may perhaps occasionally have been mistaken for dykes, which exist in very great abundance. The limestone band is neither at the base nor summit of the formation, but how far it may be from the one or the other, it is not yet possible to say: from a section at LaCloche, it appears probable, it may be farther from the bottom than the top. Whenever seen, it was found in contact either with syenitic conglomerate or quartz rock, both above and below, with the former oftener than the latter; and there appeared to be a greater transverse continuance of these rocks, particularly the latter, under than over. The limestone has not yet been seen in contact with any of the greenstone overflows; but on Echo Lake, there is a great body of greenstone over it to the south, with a thick band of syenitic conglomerate associated with quartz rock interposed between them, and a range of quartz hills above. On the Thessalon Lakes, great mountain masses of quartz rock, with subordinate jasper conglomerates, appear to underlie the limestone, and at LaCloche, a band of 3,000 to 4,000 feet rests upon it.

Independent of the overflows, igneous rocks are connected with the formation as intrusive masses, in numerous parts of the area occupied by it. These intrusive rocks consist of greenstone and granite. The intrusive greenstones do not seem to differ much in mineral character from those composing the overflows. They constitute dykes which run in so many directions, that it is difficult to determine the prevailing ones. These dykes vary in breadth, from a few inches to several hundred feet. They cut all the interstratified rocks of the formation, igneous as well as sedimentary, and splitting into branches, which often join one another and enclose great fragments and masses of strata, constitute an intricate labyrinth. The intrusive granite, in so far as it has come under my observation, is in general of a decided red colour, arising from the presence of a largely preponderating quantity of red feldspar, which is mingled with translucent white quartz; mica is not very abundant, and hornblende sometimes accompanies or replaces it. From large masses of the rock, both these minerals are frequently wholly absent, but epidote in general forms a constituent, sometimes in great abundance, whether with or without mica and hornblende. The intrusive granite appears to occupy some considerable areas, fracturing, tilting, thrusting aside, and metamorphosing the strata around them, and cutting them by a complexity of dykes which emanate from the nuclei, and reach to considerable distances. The quartz rock in its immediate vicinity becomes more perfectly vitreous, and sometimes assumes the red colour of the granite; thinly interstratified quartz and slate become gneiss; and numerous fragments of the strata caught and enclosed by the granite, and thus changed, are penetrated with epidote, and exhibit as much of it as the granite itself. The different intrusive rocks, as related to one another, display a succession of events in the history of the formation. There are, of course, a set of dykes—greenstone no doubt—cutting the sedimentary rocks, and giving issue to the greenstone overflows: it is difficult, however, to identify these. But another set of greenstone dykes are seen cutting both the sedimentary and igneous strata; intrusive granite thrusts all these antecedents aside, dykes as well as strata, sending forth dykes of its own order, intersecting all; and then another set of greenstone dykes cuts through the intrusive granite, its dykes, and all that

previous causes had placed. Evidences of disturbances and dislocations accompany all these successive intrusions, those connected with the granite being the most violent. But there is in addition, another set of disturbances of still posterior date, and it is to these that are due the presence of those metalliferous veins which give the country its value as a mineral region.

The metalliferous veins intersect all the rocks that have been mentioned. They are probably themselves intersected by cross courses, breaking their regular continuity; but that slips or displacements of the country on opposite sides of the veins have occurred, when the fissures were formed that constitute their mould or receptacle, is not left in doubt. Numerous instances were observed, where both granite and greenstone dykes, cut by the metalliferous veins, were suddenly heaved considerably out of their course. This fact may by some be deemed valuable, as shewing the probable great depth and distance to which the veins may run. The metal which these veins hold in the greatest quantity is copper, and the ores in which it occurs are vitreous copper, variegated copper and copper pyrites. Iron pyrites is sometimes associated with them, but in general not in large quantity. Copper pyrites in one instance was accompanied by rutile, and in another by the arsenuretted sulphuret of iron and nickel containing a trace of cobalt. The gangue or vein stone in which the copper ores are contained is in general white quartz, and there is very often present, but not in very great quantity, white compact dolomite, which in druses assumes the forms of pearl spar, and brown or bitter spar; calc-spar also appears occasionally in druses in dog-tooth crystals.

The veins vary in breadth from a few inches to sometimes thirty feet, but when of this last great breadth, or even much less, they usually contain a considerable amount of brecciated wall rock mixed up with the gangue; many of them range from one to three and four feet, and their slope or underlie varies from about 50° to 90° . From such as might be considered master lodes, innumerable branches of various sizes start, some of which visibly diminish before proceeding far, and dwindle to nothing, while others maintain moderate widths, with much regularity, for considerable distances, and may run to a junction with parallel lodes. The lodes have a bearing agreeing with the general strike of

the formation, which roughly coincides with the general trend of the coast. They are thus, in a rude way, parallel to one another, and run in a direction between west and north west, more nearly approaching the latter.

The quantity of copper contained in the lodes is very various, ranging from what might result from mere specks of ore in some to the contents of large workable quantities in others. But to ascertain what an approach to an average might be would have required more time than we had at command, and more expenditure than the funds devoted to the Survey would authorize, as it would have necessitated the determination of the produce of several—a work requiring the labour of many practical hands in a totally uncleared country. Specimens of ore were taken from many lodes; but it would be a very distant approach to the probable contents of a lode that would be ascertained by means of mere hand specimens, with whatever fair intentions they might have been selected. It appeared to me a preferable plan to ascertain, with all the precision possible, the produce of the lodes which had been most uncovered and worked on the locations, being persuaded that though some of them vastly surpass in richness any that came within my observation in the interior, others will yet be found to equal them. In no part of the country visited, from the vicinity of Sault Ste. Marie to Shebawenahning, was any great area wholly destitute of cupriferous veins, and it would appear singular if a region extending over a space of between one and two thousand square miles, and so marked by indications, did not in the course of time yield many valuable results.

In regard to the productiveness of the lodes, it is to be remarked that it appears probable it will be different in the different qualities of rock they may intersect. From the described arrangement of the strata, it will be perceived that the lodes must vertically pass from one quality of rock to another; and as they keep a rudely regular course, they must do the same thing horizontally, from the effects produced in the geographical distribution of the rocks, by undulation or denudation of the strata. So far as my observation went, it appeared to me to be a fact that the copper was most abundant in the greenstone, least so in the sandstone or quartz rock, and more copious in the slates than in the syenitic conglomerates. In the quartz rock the white quartz

veins often appeared nearly destitute of ore, presenting but a few straggling specks of the yellow sulphuret, at great intervals from one another; and when a vein charged with ore in the greenstone could be traced to the quartz rock, it seemed gradually to lose what richness it might have had, as it approached the latter, finally presenting when it reached it, little else than veinstone, its breadth remaining undiminished. When by dislocation or the presence of a dyke, quartz rock was brought opposite to greenstone, a cupriferous vein would occasionally be found between them, and what might be considered an encouraging quantity of ore was sometimes met with in it. But if a rule is to be derived from what the rocks appeared to shew, it will probably be where the lodes cut the greenstone and have that rock in both walls, or greenstone in one and slate in the other, that their contents will become economically available. How the productiveness of the metalliferous veins may be affected when they may meet with any considerable body of the intrusive granite, it is not yet in my power to state. None of them were observed cutting the granite nuclei, though they were the granitic dykes emanating from them; but these dykes were usually too narrow to produce any perceptible difference in the quantity of the copper ore.

It would perhaps be premature to say much respecting the general geological form of the area under description, though something may be gathered from the attitude noticed in the strata on the coast and up the rivers, and particularly from the position and attitude of observed masses of the limestone band. The dips of the formation over extensive tracts appear to be more moderate than might be anticipated from the presence of so much igneous rock. The forces originating the greenstone dykes do not seem in general to have exerted any very great influence on the slope of the strata, and it is mainly on approaching the underlying or intrusive granite that a precipitous inclination is perceived. But there is no doubt, whether the result of intrusive forces, or other causes, that there are indications of the existence of several undulations of some importance. A trough connected with one of these appears to occupy longitudinally a tract extending from Root River, near Sault Ste. Marie, to within a short distance of the mouth of the Thessalon; the evidences of it are found in the distribution of the limestone, and the dip of the strata between the

Thessalon and the coast. Ascending the river in a general course N. 40 W. the limestone band is met with about nine miles up. It shows a dip towards the coast, and it follows the river and two of its lakes for a distance of ten miles, with a strike of N. 55 W. pointing in the direction of Echo Lake about seven miles further on. The band crosses Echo Lake, which has a breadth of one mile, and curving a little more to the westward it is again seen, as I am informed, about eleven miles still further on, removed about a mile from the shore of Little Lake George near Root River. In the whole of this distance, about thirty miles, the south-westerly inclination of the band ranges between 15° and 20° . On the other side of the synclinal axis the rock emerges from Lake Huron under three quarters of a mile westward of the French Islands, and it is traceable along the coast westwardly for about a mile and a half, when it again returns to the water. In this part, the distance between the two opposite outcrops is about seven miles: but as the limestone is not again met with striking into the land farther west, and a space measuring fourteen miles across from a point, midway between Echo Lake and the Lakes of the Thessalon, to the head of St. Joseph Island, is occupied by other rocks of the formation, it is probable the trough widens westwardly until lost beneath higher unconformable strata in that direction, on the west side of River St. Mary. The calcareous band was not met with coming out on the coast between the Thessalon and the Mississagui, but it was found about a mile from the left bank of the Little White River, a west-south-west flowing tributary of the latter, three miles up in a straight line from their junction, which occurs twenty miles in a north-west straight line from the lake. The dip was about east, or a little south of it, with a slope of 10° , and supposing the band to sweep round from this point to its lowest position on the Thessalon, it would cross the Mississagui somewhere below the Little White River; but in such case though we must have passed over its intersection with the main stream, it was not observed. Its dip in the valley of the Little White River appears to intimate the probability of another undulation. In a third locality, the outcrop of the band was seen on the north side of a trough in the vicinity of La Cloche, where it was traced for five miles on the north limb of La Cloche Lake, between two and three miles from the coast. It there plunges southwardly

under a great mass of quartz rock and intermediate syenitic conglomerate, which again rise into the mountains ranging along Lake Huron, but the south outcrop of the limestone is lost in the water. There appear, however, to be traces of it in a small island off the coast. The axis of this synclinal seems to run in the middle of the south limb of La Cloche Lake, a mile and a quarter from the coast, and the south rise appears to result from an intrusion of granite, which is seen in several of the islands along the coast in front of La Cloche; but what relation this synclinal may have to others, has not yet been ascertained, the coast between the Spanish and the Mississagui Rivers being still unexamined; and although a patch of intrusive granite extending fourteen miles along the coast west of the Mississagui, to the Grande Batture, throws the strata into an anticlinal form at the mouth of the river, which the granite crosses at the lower falls, I am not able to state whether it runs to a junction with the intrusive mass at La Cloche. Probably the Mississagui granite starts from a wedge point eastward of the river; for although narrow on the river, it appears to widen westwardly, as what may be taken for the north side of it was met with on the right bank of the lower of the two lakes surveyed on the Grande Batture Portage, where it would thus have a breadth of about three miles. These transverse miles, however, were not examined, and the granite on the tributary lake may be an independent mass.

In respect to the geological age of the formation, the evidence afforded by the facts collected last year by Mr. Murray on the Grand Manatoulin, La Cloche, Snake, Thessalon, Sulphur, and other Islands, points ranging along a line of ninety miles out in front of the coast, is clear, satisfactory, and indisputably conclusive. On these islands, the Potsdam sandstone, the Trenton limestone, the Utica slates, and the Lorraine shales, successive formations of the lowest fossiliferous group of North America, were each in one place or the other found, in exposures divested of all vegetation, resting in unconformable repose, in a nearly horizontal position, upon the tilted beds, and undulating surface of the quartz rock, and its accompanying strata, filling up valleys, overtopping mountains, and concealing every vestige of dykes and copper veins; and it would appear that some of these mountains have required the accumulation of the whole thickness of the lowest three, and

part of the fourth fossiliferous deposit, equal to about 700 feet, to bury their summits; which were then about the same height over that part of the Huron base of the first known recipient of organic remains, as the present neighbouring mountains of the formation are over the surface of the lake.

The chief difference in the copper bearing rocks of Lakes Huron and Superior, seem to lie in the great amount of amygdaloidal trap present among the latter, and of white quartz rock or sandstone among the former. But on the Canadian side of Lake Superior, there are some considerable areas, in which important masses of interstratified greenstone exist without amygdaloid, while white sandstones are present in others, as on the south side of Thunder Bay, though not in the same state of vitrification as those of Huron. But notwithstanding these differences, there are such strong points of resemblance in the interstratification of igneous rocks, and the general mineralised condition of the whole, as to render their positive or proximate equivalence highly probable, if not almost certain; and the conclusive evidence given of the age of the Huron, would thus appear to settle that of the Lake Superior rocks, in the position given to them by Dr. Houghton, the late State Geologist of Michigan, as beneath the lowest known fossiliferous deposits, a position which, as will be seen by a reference to the Report of Progress I had the honor to submit to Your Excellency in 1846, appeared to me to derive some support from evidences on the Canadian side of Lake Superior itself.

Bruce Mines.

Of the twenty-two mining locations claimed of the Government, on the north shore of Lake Huron, that which, in the Map of the Crown Land Department bears upon it the name of Cuthbertson, being at present the eleventh from Root River, and the sixth from the exit of Lake St. Joseph, displays a collection of mineral veins, which have been more thoroughly tested by the works of the parties interested in them, than any others on the lake. These, therefore, were selected for examination.

In the Report I had the honor of addressing to your Excellency, on the mineral region of Lake Superior, some general remarks were made, which I am desirous should be borne in mind, on the

uncertainties that must unavoidably attend the search for such metals as occur in mineral veins, particularly in a new country. These uncertainties arise chiefly from the difficulty of estimating before hand, with exactness, the quantity of the metal sought, that any area in the plane of the vein may produce. This results from three circumstances, the varying proportions in the thickness or form of the vein, the varying proportions of the pure ore in its distribution in this irregular form, and the varying proportions of the pure metal in the irregularly distributed ore. The form of the vein may be compared to that of a very extensive and profound rough-surfaced fissure, (without known limits either way,) the opposite sides of which having slipped on one another, do not fit, but touch in some parts, stand asunder in others, and approach and recede in endless fluctuations, while multitudes of fragments, cracked off and fallen from the walls, caught and suspended in the crevice, and often resting upon one another in a loose mass, block up various parts, leaving a general space, so irregular, as to defy all attempt to determine it with precision by any rule. The swelling and attenuating, knotted, perforated and ragged sheet which would fill this mould is the vein, and it is composed of a mechanical mixture of earthy and metallic minerals, as irregular in their proportional distribution as the sheet is in the measurements of its thickness. In some few spots it may be wholly pure ore; in many large and small areas, it may consist of the earthy minerals without any ore at all; and in the remainder, it may consist of any indefinite proportion of the two that lies between all and nothing. The pure ore or metallic minerals are definite chemical compounds, in which the metal is held in fixed proportions, according to the species of the minerals, as found described in mineralogical works; and the irregularities in regard to them arise from two or more species being frequently mechanically mingled together, in proportions as indefinite as those relating to the earthy and metallic minerals. It is evident from this, that the quantity of pure metal, in any given area in the plane of a mineral vein, can be only approximately ascertained, by arbitrarily assuming as data for calculation the results of experiments on parts. The more numerous and extensive the parts selected the nearer will be the approximation to the truth; and those portions of a lode available for such a purpose, are the outcrop when uninjured by atmospheric influences,

horizontal galleries or levels, and vertical or inclined shafts. The edges of the concealed metalliferous sheet, as displayed in these natural and artificial exposures, may be assumed to represent the whole included within them to moderate distances, and by measuring and sampling them, data for practical purposes arrived at. Nine times out of ten, the results may bear out the calculations from such data; but it should be borne in mind, that any particular case may turn out to be the tenth one, and give results much beyond, or very much below the computation.

As affording the best criterion of the quality in the present instance, the ores and vein-stuff which had been brought to the surface from the various levels, shafts and excavations, were sampled as near to the Cornish mode as circumstances would permit. When copper ores are sampled for sale in Cornwall or at Swansea in Wales, the whole parcel having previously been broken up into pieces not exceeding an inch or half an inch cube, is arranged into a square, even-surfaced pile, not exceeding two or two and a half feet in depth. Two trenches at right angles to one another are then cut from side to side opposite through the centre. The sides of these trenches are next scraped down into the bottom, and what is thus obtained is mixed together and bruised much finer than before, being passed through a seive to insure the fineness, and then made up into a small flat pile which is split as before. This operation is repeated three times, a smaller-holed seive being used at each, and a requisite degree of fineness and mixture thus obtained. If the resulting quantity is too large for a sample, it is made up into a small flat circular pile, marked into quadrants, and two opposite quadrants removed. The remainder is mixed up again and the operation repeated generally about five times, when the resulting quantity is about small enough to be sent to the assayer for his purposes. In the present instance it would have been too expensive and tedious a process to break up the ores to a uniform size. The piles were consequently split as they stood on the ground, but the resulting quantity was carried through all the other operations. The weights of the piles were roughly estimated by measurement. When there were no parcels of ore to experiment upon for produce, the lode having been previously measured for average width generally at every fathom was drilled across at an angle of about 45° at regular measured intervals, and the powder coming from

the bore-holes taken as samples ; when, from great width in the vein, one hole would not reach from wall to wall, then two or more were drilled as the case might require. Two gangs of men of three each, with one to superintend and collect the borings, were employed at this work for upwards of a month. At first the distances were appointed at every two fathoms apart, subsequently at every three, and as my time drew to a close, they were extended to five fathoms ; but even thus, the lodes were in some places so wide and the exposures so long, that it was found impossible to drill-sample the whole satisfactorily, particularly on the west side of the location.

The position of the location will be well indicated by stating that the 84th meridian of west longitude from Greenwich passes lengthways through the middle of it nearly. It is one of those which belong to the Montreal Mining Company, and in it are situated the Bruce Mines so well known throughout the Province. The size of the location, or *sett* as it would be termed in Cornwall, like that of most of the other locations is two miles in front by five in depth running exactly north. The surface is gently undulating, the ridges ranging from S. E. to N. W. The rocks which compose them are greenstone, syenitic conglomerate with its associate slate, and quartz-rock. The rear and nearly the whole of the front are occupied by greenstone spread out to some breadth ; quartz-rock, syenitic conglomerate and slates, with bands of greenstone (probably dykes) are met with in the intermediate space. The limestone band which has been mentioned in the general description has not been observed on the location, but it approaches to within about half a mile of it on the Thessalon in the rear ; and a similar rock occupies the water-line of the farthest off half-front of the next location westward, in the position already mentioned as three quarters of a mile above the French Islands. If continued south-eastwardly in its strike until abreast of the south-easterly extremity of the second Island, the band would be about a mile and a half in a transverse direction from the Bruce Mines' wharf, apparently in about the same relation to the greenstone of the front, as the Thessalon rock is to the greenstone of the rear. There are copper lodes in both the ranges of greenstone, but only those in the front part of the location have been opened.

The front lodes are several in number, and occupy positions towards both sides of the location. There is a rude parallelism to

one another in some parts of the lodes and an apparent convergence in others, and the whole are attended with a great complication of branches, which probably run from one to another and connect the whole into one system, emanating from some one great disturbance, the results of which, will no doubt traverse all the western locations in succession which cross its direction, mineralising the country through which they pass, according to the quality of the rock encountered. At the Bruce Mines the surface rock these lodes and their branches intersect, is wholly greenstone, and the branches as well as the main veins, have copper present in them in various proportions. In the configuration of the coast, there is a conspicuous peninsula joined to the main land by a narrow marshy strip, about one third of the location's breadth from the western boundary. If a north-west line, or a line with a bearing approaching to N. 55 W., be carried through the neck of this peninsula, and another be drawn parallel to it across the location, at the distance of twenty-five to thirty chains farther in, they will probably include all the mineral ground related to the front lodes; and the belt thus formed, starting from the western boundary with its full breadth, will come obliquely upon the coast, its north-east side terminating on the lake, inside of a point which is about three quarters of a mile from the east boundary line of the location, and limits a deep bay occupying the distance. The length of the belt would thus be about one mile and a quarter, and it constitutes a low ridge rising to between sixty and seventy feet above the level of the lake.

From the immediate vicinity of the point just mentioned, one of the main veins runs nearly a straight course, N. 40 W., for rather over three hundred fathoms. The first one hundred and seventy-five of these fathoms not offering an encouraging quantity of ore, have had no work bestowed upon them; natural exposures of the lode occur at intervals only in three places, making up seventy fathoms, and the intermediate spaces are still covered with trees and vegetation. The average breadth of the lode in these exposures is six feet, but the traces of copper in them were so scarce that it appeared to me useless to sample them by drilling. In the succeeding thirty fathoms, there was but one exposure; it occupied the first eight fathoms and shewed a breadth of four to six feet. About four fathoms of it displayed a surface bunch of ore promis-

ing about half a ton of 15.00 per cent ore per fathom. The Company, however, having set miners to *stope*, (or excavate) these four fathoms, the estimated quantity soon diminished to a little over half the amount; these four fathoms are marked on the Company's Map as *Stope No. 24*. A few drill-holes (from the position of the exposures at irregular intervals) were bored in the 205 fathoms. The sample resulting, gives a produce of only 0.61 per cent.; the chief part of the copper being probably from the last portion of the distance.

The succeeding eighty fathoms, reaching up to the east end of what is called the *Trial Shaft*, were drilled across at intervals of five fathoms along the outcrop, the borings from the drill-holes of each twenty fathoms, being kept separate for assay, and the average width of the lode in the same spaces determined. The results are as follows:—

	Width.	Produce.
	Ft. In.	Per cent.
1st... 20 fathoms	4 4	2.52
2nd... 20 "	6 11	3.84
3rd... 20 "	2 8	4.56
4th... 20 "	2 11	3.48

The remaining fifteen of the 300 fathoms, including that part of the lode occupied by the *Trial Shaft*, were not sampled, but they will probably not differ much either in produce or width from the last section of the eighty fathoms, in the whole of which the species of copper ore prevailing appears to be almost altogether the pyritous, neither the vitreous nor the variegated having been met with in any quantity. The second score in the above list includes four fathoms, situated near the powder magazine, and marked as *Stope No. 1* in the Company's Map. Before my departure from the mines these four fathoms had been excavated to the depth of about six feet, and the ore presented on the bottom a much better appearance to the eye than it had done on the surface. The last six fathoms of the fourth score constitute *Stope No. 2*, and being situated next to the *Trial Shaft*, may probably without much error, be taken to represent what the produce of the shaft was at the top. If such be the case, the lode must have improved downwards in the shaft. About forty tons of vein-stuff, taken from the shaft, and lying on the surface, when the depth was between four

and five fathoms, just as it had come from the lode (nothing having been separated from it with the exception of such fragments of wall rock as had been detached in blasting and accidentally fallen among the material of the lode,) having been sampled and assayed give a produce of 7.68 per cent. When the shaft was subsequently inspected by me, its depth was five fathoms and a half, the average width of the lode at the bottom four feet one inch, and there did not appear to be any material difference in the aspect of the ore raised in the meantime. The *underlie* or slope of the lode in the shaft is northwardly about eighty degrees.

About twenty fathoms to the north-east of the lode, which has thus far been partly described, there is another, apparently running almost exactly parallel with it throughout the last seventy-five fathoms, and it may continue in the same parallel course in a direction towards the lake. It has been, however, but partially examined, and its position is merely surmised, from a natural exposure of fifteen fathoms at the south-east end of the distance specified, where it has a breadth of two feet six inches, and nineteen fathoms, with a breadth of two feet, which have been stripped at the other; but though the intermediate forty-one fathoms are much covered with trees and loose blocks of trap, a few fragments of veinstone are met with in one or two spots among them. The fifteen fathoms contain some spots of copper pyrites, but not in large quantity, and were not sampled. The nineteen fathoms were drilled at intervals of twelve feet, and the sample resulting yields a produce of 9.76 per cent. The last north-western six fathoms of this part constitute *Stope No. 3*, which displays variegated copper ore, mingled with the pyritous.

At the point to which these parallel lodes have been thus far followed, they appear to be interrupted, neither having been yet traced in a continuous course farther to the northwest; but about fifteen to sixteen fathoms removed to the right, (facing north-west,) two parallel lodes are met with about the same distance apart as before, which have not yet been traced in a direct course to the south-east. It seems to me probable, therefore, that they are the same lodes heaved to the north-east by a cross course, the bearing of which would be about 25° to the east of north and west of south. The bearing of these lodes, beyond the cross course, remains about N. 50 W. for twenty fathoms of the right and thirty

fathoms of the left hand one. They then bear more westward, and keep parallel in a direction about N. 70 W. leaving out minor terms, for nearly forty fathoms, beyond which the left lode continues in the same direction for ten fathoms farther, when the right, (which may be called the north branch,) bending to a course first west, and then south of west, joins it.

Commencing at the cross course, the left or main lode has been stoped to the depth of five feet, up to what is called *Davis' Shaft*. The excavation, however, being full of water and rubbish, it was impossible for me to obtain a sample, but I was informed, good ore had been raised from it. The width of the lode in the distance, which is a little over fourteen fathoms, in so far as it could be judged from the open channel, appeared to be about five feet. *Davis' shaft* is sunk to the depth of five and a half fathoms, the underlie is slightly northward, the breadth of the lode, in the bottom is five feet; but at the top it is eight feet in the east and twelve feet in the west end; both ends, however, contain much wall rock. The whole of the east end, and the lower four fathoms of the west, as well as the bottom, appeared to hold but a small quantity of ore, but in the upper part of the west end there was a fine bunch, which, from its absence in the east, would seem to be sloping downwards westwardly on its lower edge at the rate of about four feet in nine feet, which is the distance from end to end in the shaft. The succeeding six fathoms in the lode constitute *Stope No. 4*, beyond which the lode *horses*, as it is termed, or bifurcates, giving off a branch on the south side. The average width of *Stope No. 4* is six feet nine inches, and the sample derived from drilling yields 6.80 per cent. About eight tons of ore raised from this part of the lode yields 8.56 per cent. The south branch, which has a bearing a little north of west, has been found available for only thirteen fathoms, in the last six fathoms of which *Stope No. 5* is placed; variegated and vitreous copper are much mingled with the pyritous in the lode, the average breadth of which, in the thirteen fathoms, is one foot six inches, while the produce of the drill sample from the same is 6.96 per cent. In the main lode from the point of the *horse*, or bifurcation, the first eight fathoms, in which the turn of the lode occurs, were considered too poor to deserve sampling; the average breadth was two feet three inches, and the average produce would probably not exceed 1.00 per cent. Beyond

this, there occur seven fathoms, with an average width of one foot ten inches, and a produce of 2.80 per cent; then eleven fathoms, including *Prideaux' Shaft*, with an average breadth of three feet three inches, yield a produce from drill-holes at every twelve feet of 9.60 per cent. ; and in continuation there are seven fathoms, with a breadth of three feet, and a produce of 8.24 per cent., vitreous and variegated copper still mingling with the pyritous. In the last twenty of these fathoms, saving three, are comprehended *Stopes Nos. 6, 7, and 8*; *Prideaux' Shaft* being in the middle of No. 8. The shaft is four fathoms deep, the lode in it is very nearly vertical, but may have a slight underlie southwardly; in the bottom it is four feet nine inches wide, and contains good yellow ore calculated to yield three tons of 15.00 per cent. per fathom; but the top must have been of a very rich quality, containing vitreous and variegated copper, as a sample resulting from twenty tons of ore which I was informed were raised from the shaft, gave a produce of 20.00 per cent. To the junction of the north branch and main lode there still remain twenty-four fathoms; these with seven fathoms beyond, in general appear to be of a poor quality; their average breadth was about three feet, but they were not sampled. Before my departure, however, the Company's Agent gave a trial to four fathoms, not far removed from the end of the twenty-four, placing on them *Stope No. 9*. The yield was at first estimated at one ton of 15.00 per cent. ore to a fathom, but after three weeks working, it diminished to less than half the amount, and the stope was abandoned.

Returning to the cross course in order to state the facts connected with the north branch, it is to be remarked, that on the first thirty-six fathoms up to what is called *Harris' Shaft*, there has been no surface working at all; and the lode has been made out in natural exposures only in two places, in which it had a breadth of between three and four feet; but the exposures are so short that I do not feel authorised to assert anything in regard to the quality of the lode, beyond the fact that spots of copper ore were present in it. The nearest of these exposures is upwards of twenty fathoms from the shaft, approaching which, in the intermediate space, the vein is so split up into strings that it would have been difficult to determine which of them, or which group of them, should be measured for the lode, or what breadth experimented

upon for produce. Harris' shaft, with *Rankin's Shaft* beyond, and the interval between them, occupy a space of about twenty fathoms. Of the interval eight and a half fathoms next Harris' shaft had been excavated, and again filled up with rubbish previous to my arrival, and could not be seen; but I was informed that only the first two fathoms displayed a good quality of ore, the remainder being poor. The eight fathoms up to Rankin's shaft had also been worked a few feet down, but the bottom of the excavation was visible. The first half was too poor to deserve sampling; the remainder, which constitutes *Stope No. 10*, with an average breadth of two feet nine inches, gives an average drill-hole produce of 8.40 per cent. Descending Harris' shaft, the average width of the lode, exclusive of *horses* or interposed wall rock, and the average produces are as follows:—

	Width.	Produce.
	Ft. In.	Ft. In. Per cent.
Top, exclusive of a <i>horse</i> of 1, 9.....	3 5	10.24
Middle, exclusive of a <i>horse</i> 1, 11.....	2 8	9.28
Bottom.....	5 0	7.68

The bottom of the shaft is five feet below the ten fathom level, which has been driven about eight fathoms eastward and ten and a half fathoms westward in the lode. The width of the lode in the level, which is about six feet high, was averaged, from measurements at every three fathoms over-head and under-foot, and from three measurements in the ends, at the top, middle and bottom. The produces result from two parallel rows of drill-holes along the bottom, one towards each side, the object of keeping them separate being to ascertain whether one side of the lode was in any way better than the other; the results are as follows:—

In the 8 fathoms Eastward of Shaft—

	Width.	Produce.		
	Ft. In.	N. Side.	S. Side.	Average.
End	2 9	8.72
Level.....	4 6	5.36	7.28	6.32

In the 10½ fathoms Westward of Shaft—

	Width.	Produce.		
	Ft. In.	N. Side.	S. Side.	Average
Level.....	4 0	7.92	7.68	7.80
End..	3 1	7.20

Rankin's shaft is eleven fathoms deep ; the lode in the bottom is four feet wide, presenting good spots of ore, calculated to yield about two tons of 15.00 per cent. ore per fathom ; at the ten fathom level, the average width in the east end, which is six feet in, is three feet eleven inches, and in the west three feet five inches, the estimated yield being much the same as before. Beyond Rankin's shaft, the crop of the lode before my arrival was stoped away to the distance of about eleven fathoms, and the excavation was partly filled up, but I was informed that about half the distance yielded good pyritous ore, mixed with variegated, while the remainder was poor. Several parcels of ore and vein-stuff taken from Harris' and Rankin's shaft, and also from Davis' shaft, but chiefly from the former, and the levels and stopes connected with them, were lying near on the surface. Some of the parcels I was informed were composed of ore taken from more parts than one ; it was, in consequence, impossible to ascertain the exact source of the ore in every case. The parcels and produces are as follows:—

	Per cent.
600 tons from Harris' Shaft and the old stopes to the westward. The parcel was said to be in the condition in which it came from the lode, and the ore appeared to be composed almost wholly of the pyritous species.....	7.92
65 tons from Harris' Shaft ; the parcel was said to be from the 10 fathom level, east end.....	9.36
28 tons from Harris' Shaft, said to have been taken from the 10 fathom level, west end.....	8.32
30 tons from Rankin's Shaft, east surface stopes.....	10.04
50 tons from Rankin's Shaft.....	8.64
40 tons from the top of the lode in the vicinity of Rankin's Shaft. I was informed that this parcel had been turned once and picked twice, the ore selected from it having been sent to Boston and Montreal...	6.08
75 tons, from which shaft uncertain. This parcel, it was said, had been turned once and picked twice, and the selected ore sent to Boston and Montreal.	5.20
40 tons, from which shaft uncertain. This parcel, I was informed, was turned and picked once, and the selected ore burnt or roasted in the open air.	6.64
12 tons, from which shaft uncertain. This parcel, I was informed, was burnt and turned and picked, two barrels of the selected having been sent to Montreal.....	9.28

Per cent.

50 tons, from which shaft uncertain. I was informed the parcel was selected from two of the others, and then roasted in the open air.....	5.84
21 tons, from which shaft uncertain. This parcel lay on the Wharf Island having been selected and brought down for shipment; but I was not informed from which of the previous parcels it was taken	9.60

The ore mentioned above, as having been selected, and sent to Boston and Montreal consisted, I am informed, of the following parcels :—

200 tons sent to Boston before the mines came into the possession of the present proprietors, and there sold for \$25 per ton. This, at \$2½ per ton for every 1 per cent., would give a produce of 10 per cent.; but my informant could not speak with precision in regard to any of the facts..... 10.00

200 tons sent to Montreal. A part was there roughly sampled and an assay made by Mr. Hunt. At Montreal the ore was dressed into three parcels, sent to Baltimore, and there sampled and sold, the parcels, produces and prices being as follows :—

36 tons of 23.75 per cent.....	£17 16 3	
24 tons of 22.25 "	16 13 9	
13 tons of 20.00 "	15 0 0	
<hr/>	<hr/>	
73	22.59	£16 18 10 9.60

Pursuing the examination from the extremity of the seven fathoms beyond the junction of the north branch and main lode, the general bearing of the vein gradually turns to about due west, and continues so as far as it has been uncovered. The first eleven fathoms show an average width of two feet five inches, and a produce of 10.72 per cent., there being a considerable quantity of variegated and vitreous copper in the lode. The average breadth of the next eight fathoms is four feet, and the produce will be best determined by the assays of the samples taken from the parcels of ore extracted from the lode in this part. They are as follows :

4 tons of variegated and vitreous copper, picked quality.....	40.80 per cent.
5 tons of the same description of ore, with more quartz in it	20.64 "
6 tons of the same quality of ore, with still more quartz in it.....	11.52 "

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 9.36
 8.32
 10.04
 8.64
 6.08
 5.20
 6.64
 9.28

16 tons of <i>smalls</i> or finely bruised refuse resulting from dressing the previous three parcels.....	9.84 per cent.
16 tons of <i>spallars</i> or rough ore remaining from the dressings	6.56 "
<hr/>	
47 tons of the average produce of	12.70 "

Upon the last nineteen fathoms are placed *Stopes Nos. 11 and 12*, and the succeeding three *Stopes, Nos. 13, 14 and 15*, occupy a little over the following twenty fathoms. The average width of Nos 13 and 14, comprehending about twelve fathoms, is six feet, and the average drill-hole produce 9.84 per cent. The width of No. 15, occupying under eight fathoms, is twelve feet, and the produce of forty-eight tons of ore, of the the pyritous species, raised from the space, is 12.96 per cent.

At the time of my arrival, and while sampling this part of the lode, a considerable interval, immediately to the westward, still remained under about six feet of clay which had originally covered the rock to depths varying from six to three feet for thirty to forty fathoms to the eastward; but before my departure, about six fathoms had been trenched just beyond Stope No. 15. They were not sampled, but the average breadth of the lode was ascertained to be six feet. The distance which ultimately continued covered was between eighteen and nineteen fathoms; beyond this a trench had been cut and the lode stripped of six to twelve feet of clay, for a distance of about fifty-three fathoms; but at the period of sampling, about fourteen of these fathoms in the middle and four fathoms at each end were still untouched. The average width of the thirty-one fathoms then exposed, was three feet ten inches, and the average produce from drill-holes at every twelve feet 10.08 per cent; and, it appears to me, this may be taken to represent the width and produce of not only the whole fifty-three fathoms, but the eighteen fathoms still covered. On these fifty-three fathoms, taking four and a half fathoms from one end, and eight fathoms from the other, are placed *Stopes Nos. 16 to 22*, both inclusive.

In nearly the whole distance to the junction of the north branch and main lode, and in the main lode even to the cross course, variegated and vitreous copper ore, but particularly the former, exist at the surface, and are more or less mingled with the pyritous. They were observed to be in the greatest profusion at about mid-

distance, where bunches, in nearly a pure state, were occasionally met with, six to fifteen inches in thickness. But it seems to be a fact, that the pyritous gradually replaces the other species descending in the lode, and it appeared in parts completely to supersede them at the depth of ten to twelve feet.

What the quality of the lode may be further to the westward has not been ascertained, nor is its course very certain; a space of between sixty and seventy fathoms intervenes before any rock of the country emerges from beneath the argillaceous deposit which has been mentioned, and the exposure is not much marked by quartz veins. A deep and narrow channel across this ledge, nearly due west, and in the usual general course of the last ascertained one hundred fathoms of the lode, was tried for it without success; but in the exact direction of the last eight fathoms of the lode, which turn up to a course N. 65 W., a quartz vein, marked with spots of copper pyrites, is met with at the distance of seventy fathoms. A few fathoms of it have been stripped; neither in width nor in copper does it look very promising; but it is difficult to say whether it is a continuation of the lode, or only a branch emanating from it.

About 135 fathoms, in a transverse direction (S. 45 W.) from that part of the main lode already described, which is near the powder magazine (say Stope No. 1) a vein is seen emerging from the water of the lake, at a point about thirty-five yards above the neck of the wharf. Where the vein touches the water, it is between four and five feet wide, and rather sparingly marked by spots of copper pyrites. It had been traced about forty-five fathoms, in a direction about N. 45 W.; but not appearing to promise abundance, its investigation was not continued further. If the cross course, of which there is some evidence in the lodes previously described, were prolonged in its south-westerly run, it would intersect this third lode just about the spot at which it was abandoned. It would, no doubt, heave this to the north-eastward as it had heaved the others; and if, after the supposed heave, the lode were carried forty-five fathoms farther in its previous bearing, or near to it, (say, N. 30 W.) to a point about eighteen yards west of the engine house, it would there join a lode which is well displayed on the surface, and on which some work has been expended. It appears to me, therefore, probable, that the exposures at the water's edge and at the

point last indicated are on one and the same vein. From the vicinity of the engine house, this vein is visible on the surface for about eighty-five fathoms, running a course about N. 60 W., and carrying an average breadth of about nine feet. It is marked by spots of pyritous copper in the whole distance, but the quantity did not appear to me to be such as to assure a profitable return, and the lode was not considered worthy of being sampled by drilling. A good bunch of pyritous ore, however, had been met with about eighteen fathoms from the point where the lode becomes exposed near the engine house, and *Moffatt's Shaft* was sunk upon the spot to the depth of twelve fathoms, the breadth of the lode at the place being between six and eight feet. The ore which had been raised from the shaft, I was informed, was wholly the produce of the part between the surface and the bottom of the ninth fathom. The results of the samples taken for assay are as follows:—

32 tons.....	5.12 per cent.
20 tons.....	3.12 “
70 tons.....	2.80 “

A large pile of refuse vein-stuff, chiefly the produce of the lowest four fathoms, lay at the mouth of the shaft; but it was not considered worthy of sampling, not being estimated to contain more than 0.50 per cent. of copper.

Comparing the bearing of this lode with that of the more northern one already described, it will be observed that the two rapidly converge. From *Moffatt's Shaft*, the transverse distance between them would be about 104 fathoms; from the extremity of the eighty-five fathoms, it would be about sixty-eight fathoms; but if the southern lode were supposed to be prolonged thirty-five fathoms farther, the transverse distance to the point at which the northern still remains concealed would diminish to fifty-five fathoms; and notwithstanding the turn the northern lode takes just before reaching the point of concealment, indicating a farther course nearly parallel with the southern one, it yet appears not unlikely, from the general convergence, that other turns will ultimately carry them to a junction. It would require more particular examination to suggest the probable point of union; but wherever it occurs, it seems not unreasonable to expect, as often happens in such cases, a more than usually fruitful source of ore.

About 340 fathoms, in a line rather to the south of due west from the point to which the north lode has been uncovered near Stope No. 22, quartz veins, marked with copper pyrites, shew themselves in the western part of the location. Proceeding in that direction, the first collection met with occurs four chains north of the western corner of a cove about 500 yards beyond the neck of the peninsula already mentioned, where the lake and the road to the west approach nearest to one another. These veins, however, appear more like branches than parts of a main lode; and though one of them was traced about fifty-five fathoms in a direction about N. 80 W., and was found to be from one to two feet wide, the spots of ore in it were not in sufficient abundance to make it of importance. In a bearing approaching to N. 55 W. from the most western visible part of this vein, and rather over thirty fathoms beyond it, a lode, which there is little doubt is a main one, has been stripped for about thirty-four fathoms in the same direction. Its breadth varies from fifteen to twenty-five feet; there is a considerable quantity of brecciated wall rock mixed up with the quartz gangue; and there runs through about the middle of it a new feature in the presence of a continuous rib of dolomitic limestone, which is sometimes an inch, and sometimes nearly two feet wide. The lode is much spotted with copper pyrites; but this did not appear to me to be sufficiently concentrated in any one part to give profitable work on the surface. After an interval of 103 fathoms in the same bearing as before, at present covered with trees and a considerable depth of soil, a continuance of the same lode traverses an exposed bluff, and is displayed running the same course for upwards of seventy-six fathoms. A breadth of 100 feet of the bluff is so intersected with veins that it is in some parts difficult to say what should be called lode and what branches; but towards each side of the stated measure there is a course of quartz, in which the ore is more concentrated than in the rest; the dolomite, which is of the same breadth as before, runs on the south side of the whole, and as it appeared in the middle of the previous exposure, while, in the present instance, the rock on the south side of the dolomite is concealed by soil, it may be the case that there exists a further quantity of ground in that direction of the same character as the denuded portion on the north. Of the two *orey* courses on the north side of the dolomite, the more

northern one has an average breadth of about five feet five inches ; it has been tried in three places, one in the middle, and one at each end. About seventeen tons from the east end, give 6.72 per cent. ; and six tons from the west, 4.08 per cent. *Simpson's Shaft* has been sunk in the middle to the depth of about seven and a half fathoms ; and two parcels of ore which, I was informed, were raised from the first five to six fathoms, yielded the following results :—

40 tons.....	6.80 per cent.
28 "	5.84 " "
68 "	Average... 6.40 " "

A pile of inferior vein-stuff from the bottom of the shaft, estimated to yield not over 0.50 per cent, was not sampled. A drill-hole sample was taken only in one part of the lode, being about half-way between Simpson's shaft and the east end, where the lode was over the average breadth ; the assay gives a produce of 2.77 per cent. The southern quartz vein, which is probably the main lode, was found to vary in width from two to thirty-four feet, containing in its greatest thickness a considerable quantity of wall rock ; the average breadth appears to be about thirteen feet. No trial had been made by stoping any part of it, and it would have required more time to determine its average produce by drilling, than my stay at the mines permitted me to devote to it. Only one line of holes was carried across in the widest part ; the result of the sample derived from which was 1.57 per cent. This, however, it appears to me, is below the average ; it is probable that a much higher produce might be obtained in narrower breadths than the average thickness, and that a considerable quantity of ore might be *quarried* from the top of the lode to give what is termed good *stamp work*. These two courses of ore, though occupying in the middle, and for the chief part of the length exposed, the extreme sides of the 100 feet intersected by the veins and branches connected with them, are comprised within fifty-five feet at each end, by the deflection of the northern vein towards the southern one, and it may be the case that they come to a junction both ways. Such points of union are in general considered favorable positions for the discovery of ore.

About twenty-one fathoms beyond the previous exposure in the same bearing as already stated, the lode has been partially

stripped for thirty-one fathoms. Along the bottom of the trench excavated in the direction of the lode, the rib of dolomite is visible, with about the same average width as in the other instances; but the trench, which is only six to eight feet across, does not display the details of the lode, and it is only in a narrow *costeening* trench which has been cut transversely about mid-length of the other, that an entanglement of quartz veins, spotted with copper pyrites, can be discerned, occupying seven feet on the south and twenty feet on the north side of the dolomite, which has at the spot a breadth of three feet. The details of the exposure are thus too meagre to give much information beyond the fact of the lode's continuance.

Still farther westward, there is another and last exposure on the location. The distance from the previous one is about thirty-nine fathoms, and the bearing of the line running over the concealed rock surface between them is only a little to the north of west. On the south side of a bluff intersected by several ore-marked branches, the lode can be followed for forty-seven fathoms; in the first half of which it runs about N. 80 W., and on the other bends gradually round to N. 45 W. The average breadth of the lode is about six feet. It has been tried at both extremes of the exposure, and the parcels of ore resulting from the stopes, after being freed from wall rock, give the following per-centages of copper.

33 tons from the west end.....	13.04 per cent.
55 " " west "	9.68 "
—	—
88 " of the average.....	11.78 "

From the general aspect of the lode, however, the average which these parcels yield would, it appears to me, exceed that of the forty-seven fathoms, and if the lower of the two produces be taken, it will perhaps be more than amply sufficient.

The vein of dolomite is not here seen in connection with the lode, and it is uncertain whether it passes to the north or south side of the bluff. To bring it to the south, it would be necessary to suppose that from the point at which it was last left, a sudden change in its course to due west occurs in the covered interval, or that a cross course heaves it and the veins connected with it to the south-west, neither of which cases is improbable. It is to

be remarked, however, that the dolomite appears in the previous instances to maintain a much more straight and regular run than the quartz veins and ore courses, which were observed to approach and recede from it in several places. Continued in the general bearing of all of the other positions in which it was met with, and particularly in the bearing it presented in the thirty-one fathom trench, which is the nearest, it would keep beneath the soil on the north side of the bluff, maintaining a distance of twenty-five to thirty fathoms from the lode; and if on trial it were found in this relation, it would not be unreasonable to suppose that good mineral ground might be found on the south side of the dolomite in other parts, and the same on the north side of it in this.

This last exhibition of the lode approaches to within about sixty-five yards of the western boundary of the location; and there appears no reason to doubt that this, and such other lodes as come up parallel with it, will carry into the succeeding location the same characteristics they bring to the vicinity of the boundary. The same greenstone as exists on the one location, is carried into the other in the prolongation of the belt that has been given as the area holding the lodes; and while this would lead us to expect no change in the mineral condition of the metalliferous veins, it would at the same time seem to point out (the stratified nature of the whole formation taken into account) that no dislocation of uncommon magnitude has occurred to heave them to any unusually great extent on one side or the other of their continued course and general bearing, such as would render the search for them in the vicinity unavailing; and though no traces of the lodes have yet been met with on the naturally exposed rock surfaces on the west side of the boundary, nor in any of the trenches which have been there cut in the clay, sand and gravel, there is a probability that a continued and properly conducted search by *costeening* will ultimately be successful.

The general parallelism of the set or aggregation of veins on the west side of the location with that on the east (taking one of the two lodes there to be subordinate to the other), and the apparent absence of the dolomite from this part, seems to make it probable that the two sets will be found distinct across the location and give two separate sources of ore. In regard to the eastern set—assuming as data for calculation the results derived from the facts

ascertained—it would appear necessary for the present, in estimating the quantity of copper that may be expected, to put on one side as unavailable what has been called the southern lode, on which Moffatt's shaft has been sunk. On the north lode, from the waters' edge, to the extremity of the main lode, as far as uncovered, there are, exclusive of the branches, 502 fathoms. Of these, 205 fathoms appear to be nearly barren on the surface, and are therefore also to be left out. Of the remaining 297 fathoms, about one eighth or thirty-nine fathoms appear to be dead ground, and there thus are left 258 fathoms available. The average breadth of these is 4.28 feet, the average produce 7.57 per cent. In regard to the north branch, there are 153½ fathoms from the most south-eastern point at which it has been met with, to its junction with the main lode. Of these, seventy-two fathoms being left out as not having yet been in any way proved, and forty-eight fathoms as positive or probable dead ground, there remain 33½ fathoms, of which the average breadth is 2.44 feet and the average produce 9.18 per cent. The south branch, as has already been stated, may be available for thirteen fathoms with an average breadth of 1.50 feet and a produce of 6.96 per cent. Taking the whole together, there is thus an available length of 304½ fathoms, averaging in breadth 3.96 feet and in produce 7.67 per cent. It is very difficult to state with precision what the proportion of variegated and vitreous copper may be in the top of the lode, in comparison with the pyritous, and I know of no experimental method of arriving at a conclusion. The only resource appears to be the very unsatisfactory one of judging by the eye; and assuming the proportion to be one-fifth in the whole length, and the produce of the pyritous to be 30.00 per cent, with a specific gravity of 4.16, and the other species 60.00 per cent with a specific gravity of 5.00, while the specific gravity of the quartz vein-stone is 2.65, then the weight of a cubic foot of the mixture, making an allowance for druses, would be about 185 lbs. From these data there would result as the quantity of pure copper in one fathom in depth of the whole 304½ fathoms in length, 262 tons. It has been stated, however, that the variegated and vitreous copper appear to be superseded by the pyritous at the depth of about two fathoms. It would therefore be necessary for the part below this to substitute one fifth of pyritous at 30.00 per cent for one fifth of the other species at 60.00 per cent, or, what would be the same

thing, deduct one sixth from the produce, thus reducing it to 6.40 per cent. The weight of a cubic foot of the lode would in this case be about 183 lbs., and the quantity of pure copper in one fathom deep of the whole length 216 tons.

As far as can be judged from the shafts that have been sunk, the lode seems to maintain its lower yield for the first ten fathoms in depth. It is true that in the bottom of Davis' shaft, and, very probably, from that shaft to the cross course, the quality, taking the shaft as the criterion, has so far deteriorated, as to be worth nothing; but in Harris' shaft, the lode is good at the ten fathom level, for eight fathoms under surface dead ground on the east, and nearly as much on the west, with good promise in both ends of the level. The improvement, in the one case, compensates for the deterioration in the other, while in the remainder of the shafts, as far as they have been sunk on this lode, there does not appear any great change, beyond the substitution of the pyritous for the variegated and vitreous copper. There is no doubt, however, as is the case in all copper mines, that changes or alternations of yield will occur descending in the lode, as it will be seen they do proceeding horizontally; but in so far as the facts ascertained guide us, there is no reason to suppose that one kind will not make up for another, and that we may not take the quantity of dead ground in the first ten fathoms, as represented by what appears on the surface. It would thus seem probable, that in the first ten fathoms there would be the following quantity of copper:

2 fathoms	giving	262 tons each.....	524 tons
8	“	“ 216 “ “	1728 “
10	“	“ “ “ “	2252 “

The produce of the samples in the present experiment have been ascertained in the humid way; whereas in the practice of the copper smelting trade, all purchases are guided by assays made in the dry way, by which the whole of the copper is never extracted. Though dry assaying assimilates in some degree to the process of smelting, yet the smelters expect, in operating in the large, to obtain an increase equal to about 3.00 per cent, on the total quantity of copper shown by the assayers, and there is still a small quantity thrown away in the slags or scoriæ, equal to about a sixteenth, or from that to a thirty-second of one per cent. of their

weight. A deduction must, therefore, be made on this account from the available quantity of copper.

It is the case, too, that in dressing ores to a percentage beyond a natural one, a circumstance rendered imperative when a high charge is to be encountered for transportation to a smelting establishment, a waste of a portion of the copper will unavoidably be sustained. Before practical experiments have been made on the ores of the locality, to ascertain how much this may be, I feel at a loss to state an exact quantity. The simplicity of the mixture in the lode, with the decided difference between the specific gravity of the ore and the gangue, which is of a very homogeneous nature, induce me to think, that a tolerably clean separation of the two can be effected; and it may, perhaps, be sufficient to give one fifth to one sixth, or about $17\frac{1}{2}$ per cent. for the combined allowance to be made for the mode of assay and the loss by dressing. This would reduce the available quantity of copper in ten fathoms to about 1860 tons, which distributed through ore of 15.00 per cent would give about 12400 tons dry weight, or rather over four tons of such ore per fathom.

But supposing about one-half of the ore to be raised to 20.00 per cent and the remainder to 17.50 and 15.00 per cent, (a part of it being roasted in the open air, if required, to assist the produce,) and sold in the Baltimore market, the proportions and the prices might be as follows:—

5000 tons of 20.00 per cent. at £15 0 0 per ton,	£75,000	0	0
3000 " of 17.50 " " 12 0 $7\frac{1}{2}$ "	36,093	15	0
2200 " of 15.00 " " 10 6 3 "	22,687	10	0
10200	£133,781	5	0

The freight and insurance on this, adding about 4 per cent for the quantity of water that may be absorbed from the atmosphere, would probably stand thus:—

10600 tons at £3 10 per ton, say.....	£37,181	5	0
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Leaving as the value of the ore on board ship at the mines.....	£96,660	0	0
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What the expense of raising the vein-stuff from the lode and dressing it into merchantable ore might be, I cannot pretend to say with precision; nor can it be expected that

the Company, until its machinery is in regular operation, will be able to give more than a rough estimate. The following details, therefore, are stated more to show the nature of the charges to be met, than with any view to accurate calculation:—

Sinking, &c. 20 shafts of 10 fathoms:—	
200 fathoms at £16 per fathom.....	£3,200
Driving galleries or levels:—	
400 fathoms at £14 per fathom.....	5,600
Stoping and raising vein-stuff from lode:—	
2700 fathoms at £7 per fathom.....	18,900
Dressing vein-stuff:—	
34000 tons at 12s. 6d. per ton.....	21,250
Contingencies and agencies spread over 3 years	9,000
	57,950 0 0
Leaving, as a margin for profit, in Halifax cy.,	£38,650 0 0

On the west side of the location the only parts of the lode offering facts sufficiently definite to form the basis of a calculation are comprised in the last 214 fathoms. In this space there are three exposures; but the middle one, in which little is seen, and the covered ground, being left out, there remain but 123 fathoms, of which the average breadth is about 5.63 feet, while the average produce of the surface, resulting from the samples obtained, appears to be 6.90 per cent. In the present as in the previous case changes no doubt are to be expected in the yield descending, and there having been only one shaft sunk in which the percentage at the bottom has turned out to be low, it would perhaps be scarcely just to suppose that every other will prove like it. It seems to me more probable that to a certain extent improvement in one will compensate for deterioration in another, but at the same time it would be injudicious to form any confident estimate of the whole ten fathoms in opposition to this one fact, until another of a contrary tendency has been ascertained to neutralize it.

Assuming that the two sources keep separate across the location, and that what is seen of the lodes and has thus been experimented upon may be taken as an index of what is still concealed, there would be, in the case of the east lodes before reaching the western boundary, and the west lodes before entering the lake, room for more than one repetition of the same quantities as already given;

and it is only the justly proverbial uncertainties inseparable from mining adventures which should moderate the confidence with which such a repetition may be looked for.

It would thus appear that, even supposing the lodes were available for no greater depth than ten fathoms, there is a reasonable ground for expecting a considerable return. But there do not yet seem to be any very definite facts ascertained which may be assigned as a cause why their productive quality may not extend deeper. As has already been said, variations in the productiveness are to be expected, but the probability appears to me to be that these will about compensate one another until some general deterioration is occasioned by a change in the quality of the rock the veins intersect. That there is an indefinite depth at which the greenstone will cease, is to be inferred from what has been said, in the general description, of the stratified arrangement of the rocks constituting the formation of the country; but without further facts, it is not easy to state at what point this may be, in consequence of several irregularities observable in the stratification of the vicinity, which disturb the elements of a calculation. The nearest coast rock eastward of a quality different from the greenstone is towards the east boundary of the location: quartz rock there occupies a point dividing the small bay in that part into two coves, and runs out on the east side of the bay into Eagle Point; the dip of this quartz rock appears to be irregular. The dip of the formation generally all along the coast to the eastward from the Thessalon, and even from the Missisagui after leaving the intrusive granite, up to the Palladeau Islands, is northward; whereas at Eagle Point the dip is west. Those beds which form the point between the two coves dip in the direction of the works on the east lodes nearly, their least slope being about 12° , which is also that of the beds at Eagle Point. If it be assumed that these beds thus plunge under the greenstone and maintain the same inclination as they proceed, they would have a depth of forty-five to fifty fathoms, where the vein touches the lake, seventy-five to eighty fathoms where the lode begins to be productive, and nearly 100 fathoms at Prideaux' shaft, less of course if the slope moderates; and one difficulty of the case is, that the greenstone does not afford any certain means of determining with the required precision, what change the slope of the rock beneath may suffer. It appears to me to be a necessary consequence, if the quartz beds be thus taken as

the rock supporting the greenstone, to suppose that the band to which they belong bends round from Eagle Point and runs with a northern dip between the French Islands and the Peninsula, both of which are greenstone. In the lowland forming the bight of the Peninsula Bay, which would thus be in the strike of the band, I am not aware of the existence of any exposure either to confirm or contradict the hypothesis. As the lodes described in the west part of the location would stand nearer the outcrop of the sedimentary rock than those from the eastern, the range of which would be further northward, it is evident that whatever might be the depth of the greenstone in relation to the latter, it would be less in respect to the former.

But if it be supposed that the bay between the peninsula and the French Islands be underlaid by a transverse continuation of the greenstone and the first visible sedimentary coast rock proceeding westward be assumed as the base, this rock would be the band of limestone occurring above the French Islands. This in strike agrees with the coast rocks on the locations to the eastward, but the dip along the water line instead of north is south. The exposure however is narrow; it is cut by trap dykes as well as a large spar vein holding iron pyrites, all running with the strike, and there is certainly one twist turning the dip northward for a short distance. These circumstances, combined with the fact that the sedimentary rocks immediately north of the greenstone cut by the copper veins, dip northward, induce me to believe the south dip on the water line to be a limited irregularity due to the disturbances accompanying the dykes and pyritiferous vein, and that the true general dip is northward; or that the limestone is on the crown of an anticlinal arch. If this limestone and its associated strata were thus the limit of the greenstone of the copper lodes, it is scarcely necessary to remark that a much more moderate general dip than that of the previous hypothesis would give a much greater thickness. The position and attitude of the Eagle Point strata must in this case be supposed to be due to some great transverse dislocation; otherwise the limestone ought to come in between them and the greenstone in the bay on the east side of the location, whereas no trace of it was seen there.

In the present condition of the evidence, until other facts are found to contradict it, I feel inclined to think the first hypothesis the more

probable, and such being the case, it appears to me worthy of remark that, judging from the drill-hole samples of the surface, the general quality of the lode, from the cross course eastward to Stope No. 1, appears to be less productive than it is to the westward; that still further eastward up to Stope No. 24, the quality still further deteriorates, and that from this point to the lake, the lode where exposed shews very little copper indeed. In this direction from the rise of the sandstone beneath, the greenstone is gradually getting shallower, and it might be a question, whether it may not be in consequence of the approach of the sandstone that the quantity of copper diminishes. If a similar condition of circumstances should accompany the lower part of the greenstone westward, it would subtract considerably from the depth of the copper bearing portion of the rock; and the supposed 100 fathoms at Prideaux' Shaft would be reduced to a productive depth of probably twenty-five fathoms below the level of the lake or thirty-five fathoms from the surface. It is only by a deep shaft that such a question can be decided. But what might thus be lost in depth might possibly be compensated for at the surface; for in regard to that part of the east lode beyond the point to which it has been uncovered the analogy would be that running nearly parallel to the supposed outcrop of the sedimentary strata outside of the Peninsula, and keeping therefore in an equal and steady thickness of greenstone it would hold a quality similar to that of the known productive part, and there would then be room for three repetitions before attaining the western boundary; whereas, if the barren character of the east end is due to some cause independent of the sandstone, one half of the westward continuation may be expected to be like it.*

*The view taken of the physical structure of the front of the Bruce Mines location is predicated upon the supposition, that the true dip of the limestone band above the French Islands, is northward, and that the band is not to be found between the Thessalon and the coast, on this location, or any to the eastward. Although it was not observed, it is so narrow that it may, notwithstanding, be concealed on the north side of the front greenstone; should it be discovered there, the problem of the structure would be very simply solved. The greenstone would then evidently appear to be on the crown of an anticlinal, and all the phenomena of the locality would be accounted for. The bend of the arch would account for the fissures which have given space for the secretion of the mineral veins, and the sandstone of Eagle Point would be the greenstone's supporting rock, approaching which, the quantity of copper in the lode diminishes. This structure would be the most favourable for the mines, as the probability would be, that the lode would maintain its productive quality westward, with an increasing depth all the way. It appears to me it would be well worthy of the Company's attention, to make diligent search for the limestone band in this position, not only on the Bruce Mines location, but on those to the eastward.

In the greenstone, on the rear of the location, a lode three feet wide, and marked with spots of copper pyrites, was inspected. The exposure continued only a few fathoms, and no experiment was made to ascertain its productiveness. From the position of the greenstone in relation to the limestone of the Thessalon, the strike of this, and the general coincident bearing of the mineral veins, it appears to me probable that this may be a continuation of one of the lodes of the South Echo location, on Echo Lake, my visit to which last locality was too short, and my examination too cursory, to authorise me to make any remark in regard to its productiveness.

The quantity of copper ore and undressed vein-stuff above ground at the Bruce Mines at the time of sampling them in the beginning of July, it will be perceived, by a reference to a table in the Appendix, was estimated at 1475 tons. The average produce is 8.01 per cent. (equal to the average of the dressed ores of Cornwall), giving about 118 tons of pure copper, which, allowing for the mode of assay and waste in dressing, would yield upwards of 650 tons of 15.00 per cent ore. At the time of my departure, much activity prevailed in working the lodes, and an expectation was entertained by the mining captains that 250 tons of such ore might be raised monthly. One hundred and sixty-three persons were employed in carrying on the operations connected with the mines, consisting of seventy-seven miners, sixty-five labourers, four boys, eleven blacksmiths, carpenters and other artisans, two mining captains, one engineer, two clerks, and a superintendent, constituting a population, including the families of the workmen, of about 250 souls. Three frame buildings and about thirty log houses had been erected for stores, workshops, and lodging accommodation; and the foundation of an engine house was commenced, in which was to be placed a steam engine of about forty horse power, for clearing the mine of water and crushing the ore for dressing. A pier, or planked platform road, had been carried out about 180 yards, to an insulated rock, on which a wharf had been constructed; and three stone-loaded cribs had been sunk in ten feet water beyond this, for an additional wharf, for the accommodation of steamers and vessels frequenting the harbour, which is a commodious one, well sheltered from most winds, and not difficult of access. There is abundance of timber for mining purposes and for fuel on the location, and in the vicinity; and on the Thessalon, good pine, hemlock and spruce were met with in some quantity. On

this river, which joins the lake nine miles east of the Bruce Mines, there are, in or near the intermediate locations, four falls, about thirteen, eighteen, eight, and three feet respectively, affording excellent mill sites; and some of the land in the valley is well fitted for cultivation. Little good land, however is met with along this part of the lake shore, and the front of the Bruce Mines location is particularly rough and rocky; but on Saint Joseph Island, opposite, there is an ample extent of excellent land, at present well clothed with maple, birch, and elm, in some parts, and good pine in others, and being underlaid by the rocks of the lower fossiliferous formations, it abounds in limestone, affording good material for either burning or building.

I have the honor to be
Your Excellency's
Most obedient servant,

W. E. LOGAN,
Provincial Geologist.

APPENDIX.

CONTENTS OF LODES.

The following table is given to shew, in a consecutive manner, the contents of the lodes, resulting from the lengths, widths and produces, ascertained by measurement and experiment. The third column is the length in fathoms multiplied by the breadth in feet, to give the means of determining the average breadth; and the fourth column is the product of the figures of the third multiplied by those of the produce, from the result of which is ascertained the average produce. The sum of the third column multiplied by 36, the number of feet in a fathom forward by a fathom vertical, will give the cubic contents in feet of one fathom in depth of the whole length of the lode (the probability being that the horizontal will represent the vertical dimensions), and this product by the weight of a cubic foot will give the weight of the vein-stuff in the same. The fourth column multiplied by the same figures, and divided by 100, will give the weight of pure copper in the same space. In the copper smelting trade there are reckoned 2352 lbs. or 21 cwt. to a ton of ore.

EASTERN LODES.

MAIN LODE.

Length. Fathoms.	Width. Feet.	Produce. pcent.		
175.00	6.00		1050.00	
30.00	5.00		150.00	
205.00	5.85		1200.00	
20.00	4.33	2.52	86.60	218.23
20.00	6.91	3.84	138.20	530.68
20.00	2.66	4.56	53.20	242.59
35.00	2.91	3.48	101.85	354.43
14.00	5.00	5.50	70.00	385.00
7.50	6.75	6.80	50.62	344.21
8.00	2.25	0.00	18.00	
7.00	1.83	2.80	12.81	35.86
11.00	3.25	9.60	35.75	343.20
7.00	3.00	8.24	21.00	173.04
31.00	3.00	0.00	93.00	
11.00	2.42	10.72	26.62	285.36
8.00	4.00	12.70	32.00	406.40
12.00	6.00	9.84	72.00	708.48
8.00	12.00	12.96	96.00	1244.16
6.00	6.00	10.00	36.00	360.00
18.50	3.83	10.00	70.85	708.50
53.00	3.83	10.08	202.99	2046.13
297.00	4.09	6.88	1217.49	8386.27
39.00	2.84	0.00	111.00	
258.00	4.28	7.57	1106.49	8386.27

NORTH BRANCH.

Length. Fathoms.	Width. Feet.	Produce. p cent.		
56.00	2.50		140.00	
19.00	2.00	9.76	38.00	370.88
16.00	3.50		56.00	
20.00	2.00	0.00	40.00	
3.50	3.41	10.24	11.93	122.16
10.50	3.00	0.00	31.50	
4.00	2.75	8.40	11.00	92.40
1.50	3.00	8.00	4.50	36.00
5.50	3.00	7.92	16.50	130.68
5.50	3.00	0.00	16.50	
12.00	2.00	0.00	24.00	
153.50	2.54		389.93	752.12
120.00	2.56		308.00	
33.50	2.44	9.18	81.93	752.12

SOUTH BRANCH.

Length. Fathoms.	Width. Feet.	Produce. p cent.		
13.00	1.50	6.96	19.50	135.72

RECAPITULATION.

	Length. Fathoms.	Width. Feet.	Produce. p cent.		
Main Lode,...	258.00	4.28	7.57	1106.49	8386.27
North Branch,	33.50	2.44	9.18	81.93	752.12
South Branch,	13.00	1.50	6.96	19.50	135.72
	304.50	3.96	7.67	1207.92	9274.11

9274.11

— \times 36 ft. \times 185 lbs.....=262 tons of Copper.

100

9274.11

— less one-sixth \times 36 ft. \times 183 lbs.=216 tons of Copper.

100

WESTERN LODES.

Length. Fathoms.	Width. Feet.	Produce. p cent.		
19.00	5.41	6.72	102.79	690.74
19.00	5.41	2.77	102.79	284.72
19.00	5.41	6.40	102.79	657.85
19.00	5.41	4.08	102.79	419.38
47.00	6.00	9.68	282.00	2729.76
123.00	5.63	6.90	693.16	4782.45
4782.45				
— 36 ft. × 185 lbs. = 135 tons of Copper.				
100				

COPPER ORES, &c., SAMPLED AT THE BRUCE MINES, IN JULY, 1845.

	Tons.	Produce	Copper.
From Trial Shaft,.....	40	7.68	3.0720
“ Harris' Shaft and West Stopes,...	600	7.92	47.5200
“ Harris' Shaft, 10 fms. level, East,	65	9.36	6.0840
“ Harris' Shaft, 10 fms. level, West,	28	8.32	2.3296
“ Rankin's Shaft, East Stopes,.....	30	11.04	3.3120
“ Rankin's Shaft,.....	50	8.64	4.3200
“ Top of lode near of Rankin's Shaft,	40	6.08	2.4320
“ Rankin's and Harris' Shaft,.....	75	5.20	3.9000
	40	6.64	2.6560
	12	9.28	1.1136
	50	5.84	2.9200
“ Davis' Shaft, West Stopes,.....	8	8.56	.6848
	21	9.60	2.0160
“ Prideaux' Shaft,.....	20	20.00	4.0000
“ Stope No. 12,.....	4	40.80	1.6320
	5	20.64	1.0320
	6	11.52	.6912
	16	9.84	1.5744
	16	6.56	1.0496
“ Stope No. 15,.....	48	12.96	6.2208
“ Moffatt's Shaft,.....	32	5.12	1.6384
	20	3.12	.6240
	70	2.80	1.9600
“ Exposure of 76 fms. East End,...	17	6.72	1.1424
“ West End,...	6	4.08	.2448
“ Simpson's Shaft,.....	40	6.80	2.7200
	28	5.84	1.6352
“ Exposure of 47 fms. East End,...	33	13.04	4.3032
“ West End,...	55	9.68	5.3240
	1475	8.01	118.1520