GEOLOGICAL SURVEY OF CANADA
G. M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

REPORT

ON THE GEOLOGY

OF THE

FRENCH RIVER SHEET

ONTARIO

BY

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To G. M. DAWSON, C. M. G., LL. D., F. R. S.,

Director Geological Survey of Canada.

SIR,—I beg to submit herewith my report on the French River region to accompany Map-sheet 125, showing the geology and geography of that part of Ontario.

I have the honour to be, Sir,

Your obedient servant,

ROBERT BELL.

OTTAWA, 3rd May, 1897.

NOTE.—*The bearings given throughout this report refer to the true meridian.*

REPORT ON THE GEOLOGY

OF

THE FRENCH RIVER SHEET.

By Robert Bell, M.D., LL.D., F.R.S.

This sheet (number 125 of the regular series) represents the country around the north end of Georgian Bay. The geology of this region has been worked out at intervals during many years by the writer and some other members of the Geological Survey, to be mentioned further on, and the object of this report is to condense all the information ascertained up to the present time and to state it as clearly as possible in few words. The geological facts are so fully represented upon the map itself as to render lengthy descriptions unnecessary. The sheet has the same dimensions and is upon the same scale as the others of the series, namely $\frac{1}{253,440}$ or 4 miles to 1 inch. It adjoins the Sudbury sheet on its north side and, like it, embraces an area of 72 miles from east to west by 48 miles from north to south or 3,456 square miles. The north-west corner is in the township of Hallam, the north-east at the western extremity of Lake Nipissing, the south-east at Shawanaga Bay and the south-west near the south-eastern extremity of Grand Manitoulin Island. For the sake of brevity in the following descriptions, the word "sheet" will be used for the ground which it covers.

Object of this report.

Area covered by map.

Mr. A. E. Barlow, M.A., who had been with me in the field in previous years continued to be my professional assistant in 1891, and we had also during that season the services of Messrs. A. M. Campbell, H. H. Walker, B.A.Sc., W. G. Miller, M.A., H. G. Skill and R. W. Brock. The three gentlemen last named assisted me again in 1892.

Assistants.

The topography is based upon the latest admiralty charts and the surveys by the Crown Lands Department, but considerable portions are from surveys made by the late Alexander Murray of the Geological Survey and by myself and assistants.

Topography.

The geology of different parts of Sheet 125 had been investigated to some extent by the late Mr. Alexander Murray, Assistant Pro-

Geology.

vincial Geologist, in 1847, 1855, 1856 and 1857 and by myself in 1859, 1865, 1876 and 1886. In 1860 both Mr. Murray and I visited the Cloche Peninsula and vicinity and spent some days in examining the lowest unaltered rocks of that neighbourhood with a view to ascertaining their age and their relation to the Sault Ste. Marie sandstones. Some of the results of that work are mentioned in the Geology of Canada, (1863), but no annual report for that year was published. Our attention in later years was therefore directed to adding details and filling up gaps in the geology of the area within the boundaries of the sheet, as well as to studying more carefully the geological structure and the relations to one another of both the larger and smaller divisions of the rocks.

Necessary surveys.

Considerable time was taken up in making the topographical surveys referred to in the summary reports for 1891 and 1892, which were indispensable in the construction of a sufficiently accurate and detailed map for publication. The topographical surveys which had previously been made within the sheet where those of the Whitefish and French rivers by the late Mr. Alexander Murray, the admiralty surveys by Captains Bayfield and Boulton and those by the Crown Lands Department, the last-mentioned consisting of outlines of townships along the northern edge of the sheet, the subdivisions of three townships, the greater part of which are included in the eastern part of the sheet, and of two others shown in part at the western edge. The topograpraphical surveys made by myself and assistants included Bay of Islands * and McGregor Bay with their irregular peninsulas and inlets and numerous islands†, Collins Inlet, several lakes connected with Whitefish and French rivers, both branches of the Ma-zin-in-a-zing (Pictured-water) River, the chain of lakes on its western branch, Tyson or Pai-pin-a-goshing Lake, on its eastern branch, Mitchi-zin-ishing (Big-fence) River and its chain of lakes, Trout Lake and other lakes in its vicinity, besides numerous minor lakes and streams in various parts of the sheet.

Admiralty charts.

Township surveys.

Dr. Bell's surveys.

The Killarney Belt of Red Granite.

Killarney granite belt.

The division between the Huronian and Laurentian rocks of our sheet has a general north-easterly course, but lying between the former and the gneisses to the south-eastward is a belt of red granite,

*This is the large bay into which Whitefish River discharges and which having had no name prior to my survey was called Bay of Islands for convenience of reference. See Summary Report for 1891, page 22.

†About 220 islands were located and outlined in Bay of Islands and about 240 in McGregor Bay.

which may for convenience be designated the Killarney belt, extending from Killarney Bay north-eastward to Three-mile Lake. It begins at the eastern extremity of Badgeley Island, where there is a small area of the granite in contact with the quartzites, and it includes the greater part of George Island. Behind Killarney village it has a breadth of about one mile and a half and appears to attain its maximum width opposite to the western entrance of Collins Inlet, where it is nearly three miles; but it soon diminishes to the north-eastward and appears to average only about one mile for the greater part of the remainder of its course to Three-mile Lake where it terminates in a point.

Origin and age.

This belt of granite is apparently of intrusive origin and of later date than the quartzites. The occurrence of the quartzite (elsewhere described in this report) along its south-eastern side from George Island to Collins Inlet indicates that it should come within the Huronian area. At Killarney village it shows an approach to lamination towards the edges of the mass. Here it has a medium texture and is composed of reddish felspar and bluish-white quartz with a little hornblende, which however, is often wanting. Excepting at the sides it has a massive homogeneous structure, but in a few instances a single reddish or yellowish-green shaly streak, an inch or two in thickness, was observed running in a north-easterly direction with a dip to the south-eastward of about 50°. Towards each side, the grain of the rock begins to assume a sort of parallelism or a gneissoid structure (See Report of Geological Survey for 1876, page 208.)

Incipient lamination.

Quartzite boundary.

Along its north-western side the granite belt is in contact with the Huronian quartzites or the schists which are here occasionally associated with them. The boundary between them leaves the east side of Killarney Bay at an island in the western part of section 29 of Rutherford township and runs with a general bearing of N. 60° E. (ast.) till it reaches Three-mile Lake, a distance of twenty-three miles from the extremity of the belt at Badgeley Island. This boundary marks part of the line of the great break which is elsewhere more fully described in this report and which, further to the north-eastward, forms the division between the Laurentian and Huronian systems.

Disturbance along contact.

The actual contact of the rocks on either side of this break may be seen in many places on its course all the way from Badgeley Island to Three-mile Lake. Along this line the rocks everywhere give evidence of great disturbance. Huge portions as well as many of moderate size which have been separated from both sides have become mingled

together and intermixed with the finer débris, all being cemented into a coarse breccia. Protruding masses and branches of the granite penetrate the quartzite for short distances and large masses of the quartzites have become entirely or partially separated from the parent rock and incorporated in the granite. Some good examples of this condition may be seen in the northern part of Crooked Lake. On the west side of the inlet of this lake, a semi-detached mass of white quartzite penetrates quarter of a mile into the granite. Continuing north-eastward, the line of fault traverses two points in Brush-camp Lake, the next higher one to Crooked Lake, and here the contact-breccia is particularly well seen. The quartzite near the break has become whitened, its granular character obliterated and a hyaline lustre has been imparted to it.

Detached mass of quartzite.

Contact of granite.

On Brush-camp Lake and the lower part of Three-mile Lake, the Huronian strata abut against the granite on the other side of the dislocation and they have been altered not only at the contact, but for some distance back from it. The principal rock on the north-west side in this vicinity is a stratified arkose and it has been altered into gneiss and mica-schist.

Dislocation.

Near the middle of Three-mile Lake the almost vertical Huronian beds, striking in an east-south-easterly direction, come almost at right angles against the Laurentian gneiss, there running north-east, without the intervention of the granite belt, which apparently terminates here.

The south-east side of the Killarney belt of granite rests against the Laurentian gneiss except in the interval from the southern point of George Island to the western entrance of Collins Inlet, when a narrow belt of partially altered, fine grained, brittle, red and sometimes gray quartzite intervenes between the granite and the water of Georgian Bay. This quartzite is much divided into small triangular and rhombohedral blocks by innumerable joint-planes running in every direction which give to its surface an extremely rugged aspect. In addition to the division-planes, strongly marked, straight and sometimes deep trench-like cuts run through these rocks. Their course corresponds with the general strike, but their origin is not very apparent.

Red and gray quartzite.

Approaching the western entrance of Collins Inlet, the strike of the quartzite is N. 75° E., while that of the gneiss to the eastward has a very uniform strike of N. 40° E. with a south-easterly dip of 60°. The existence of this quartzite between the granite and the Laurentian gneiss would indicate that the former is intruded within the Huronian

rocks and may be classed with them, as mentioned by the writer in his report for 1876, page 208. Further to the north-eastward, or where the granite of the Killarney belt comes into contact with the gneiss which prevails to the eastward, it is not always separated from the latter by a very distinct boundary. The two rocks in some places pass into each other more or less gradually. Still a dividing line may be drawn between them with sufficient accuracy for the purposes of geographical geology. This line leaves the western part of Collins Inlet, as represented on the accompanying sheet, with a north-eastward course and after touching the western bay of West Lake, it crosses the outlet bay of Brush Lake and reaches the east side of Three-mile Lake, where the granite belt appears to terminate, as already stated.

Contact of gneiss and granite.

Leaving the central part of Three-mile Lake, the boundary line between the Huronian quartzites, schists, etc., and the Laurentian gneiss, curves to the northward and passes about one mile east of Lake Panache. It continues with a bearing a little east of north for about ten miles beyond Lake Panache when it resumes its former general course of N. 60° E. to Sturgeon River, as represented on the Sudbury sheet.

Boundary between Laurentian and Huronian.

The Laurentian Rocks of the Sheet.

The Huronian rocks of the north-western corner of the sheet form part of the great belt of this system which has been traced from Lake Superior to Lake Mistassini. This belt is flanked on both sides by Laurentian rocks, but those on the one side appear to belong to a different part of the system from those on the other. The rocks along the north-west side, which, however, do not come within the sheet, may, for the purpose of this report, be considered as belonging to the lower division, while those on the south-east side resemble the Grenville series which occurs along the north side of the lower Ottawa and is considered as belonging to the upper division. They consist of red and gray mica- and hornblende-gneisses in beds which can be traced with regularity for considerable distances, together with coarse hornblende and mica-schists and bands of quartz-rock with schistose partings. No limestones have yet been found among these rocks, within the boundaries of the sheet, but in the Parry Sound district to the eastward, among similar strata, the writer has traced five bands of crystalline limestone like those of the Grenville series.

Two divisions of Laurentian.

Resemblance to the Grenville series.

In order to identify more clearly the position among the Laurentian rocks to which those represented upon this map belong, the following

Character of the lower division.

note as to the general difference between the two divisions referred to may be appropriate in this place. What is here assumed to be the lower division is characterized by a great uniformity in the nature of its rocks over large areas. They consist principally of highly crystalline red and gray hornblende- and mica-gneisses of a solid homogeneous character or with only a rudely laminated structure, generally much disturbed and varying rapidly on the strike so that no particular band can be traced very far. They are composed mostly of quartz and felspar, the hornblende and mica seldom forming any considerable proportion. Economic minerals are almost entirely absent and the number of mineral species found in this division is small, whereas,

Characters of the upper division.

the gneisses and other rocks of the upper division are less disturbed and contorted and have a stratigraphical arrangement like that of altered sediments. They generally possess considerable regularity in their structural arrangement and in some regions include long and thick masses or beds of crystalline limestone, quartz-rock and stratified as well as massive labradorite. Massive and somewhat banded pyroxene rocks are also present in some regions instead of the hornblende rocks of the older division. About seventy distinct species of minerals have been found among the rocks of the upper division in various parts of Canada and among the economic minerals of the upper series of the Laurentian rocks may be mentioned, graphite, apatite, mica, serpentine and limestone marbles, limestones suitable for building and calcining, felspar for porcelain, porphyries and other ornamental stones, pyrite, sulphates of barium and strontium, asbestus, crysotile, gneiss and granite for building and ores of iron, copper, lead, etc.

On the map, which shows only the upper division of the Laurentian rocks, or those lying south-east of the great Huronian belt, the strike of the gneiss is everywhere indicated by the broken red lines and from these it may be seen that in the western part of the area represented, its prevailing direction is north-eastward, while towards the east side of the sheet the general course is south-eastward. Throughout the whole region the gneisses are of the typical upper Laurentian varieties.

Regularity of stratification.

They are evenly stratified and regularly arranged in anticlinal and synclinal forms according to the structural laws governing stratified rocks, as shown by their contours in plan. The average angles of dip are not high and in some localities they approach the horizontal. As a rule, the stratification is not disturbed or contorted but runs straight and evenly for considerable distances, so that, as far as their structure goes, these gneisses have the characters of altered sedimentary deposits. The reddish and grayish shades are represented in varying proportions in different localities and they frequently alternate with each other,

both as to thin beds and thick sheets. All along the east-and-west shore of Georgian Bay, from the western part of Collins Inlet to the eastern mouth of French River, the gneisses are remarkable for the regularity of their strike. From the former locality to the western mouth of French River the strike is almost everywhere N. 40° E. and the dip S. E. at an angle of 60°.

Lower channels of French River.

The French River is noted for its straight reticulating rocky channels which may be said to be unique in the geography of Canada. Its lower channels traverse a rocky delta-shaped area, fifteen miles broad at the coast. The upward course of these channels is from north-east to north. They form three groups, each of which unites into one channel a short distance up and the three main channels thus formed all fall into an east-and-west one at seven miles from the coast. All the channels except this transverse one are excavated in beds of gneiss which everywhere strike parallel to them. The long east-and-west channels are transverse to the strike in the lower part of French River and they appear to follow either lines of crushing accompanied possibly by dislocation, which occur at intervals parallel to the system of jointing in these rocks, or they are situated upon groups of parallel joints occurring close together and running for long distances. Prior to the glacial epoch these lines permitted the deep penetration of the surface water and the decay of the rock through a long period of time, and during that epoch the decomposed rock was easily removed and thus the existing channels were formed. They are unlike ordinary river-courses and are in reality only long and very narrow lakes, with rapids or chutes of a few feet at considerable distances apart.

Origin of channels.

Relation of topography to geology.

From the mouths of French River, south-eastward, all along the coast of Georgian Bay, the rocks are almost continuously exposed, so that the relation between the geological structure and the configuration of the shore is well illustrated. The strikes of the gneisses are brought out in strong relief, owing to the greater or less amount of decay and subsequent glacial erosion which the different strata have undergone. This circumstance is graphically demonstrated by the improved charts of this coast recently completed by Captain Boulton of the British Hydrographic Department. In the report of the writer for 1876, page 195, it is stated in regard to this coast that "locally the run of the stratification is often indicated by the form or direction of the points and bays, the larger islands and the chains of smaller ones. The curving outlines of the islands, channels and inlets opposite to Penetanguishene, the twisted appearance of Parry Island and

of the channel on its south-east side, as well as the singular straightness of Partridge Bay, the Long Inlet, the points on the west side of Parry Island and about Shibaishkong Island all correspond with the local strike of the rocks and are due to the effects of denudation which has formed channels along the course of the more yielding strata, and left ridges or higher ground where the rocks resisted decay and erosion. Along this shore there is, however, a class of channels and inlets due to another cause, namely the existence of dykes of trap and breccia, and of granite veins and also of parallel joints or cracks, along which the rocks have been rendered more decomposable; or these latter may have acted merely as starting points or guiding lines for the action of glaciers or other denuding agencies which constantly enlarged and deepened the depressions, once they had been commenced. The channels and inlets of this class usually run nearly east and west and have steep sides, while those which follow the stratification have usually some other course and are not so abrupt."

Channels due to dykes.

Among the distinctly stratified and regularly arranged gneissic rocks of the lower parts of the French River, coarse mica- and hornblende-schists and evenly bedded quartz-rocks occur also in considerable bands. Examples of the former may be seen along the north-eastward continuation of the Middle Outlet and of the latter in township 43.

Bedded quartz-rocks.

Quartz veins. In the Laurentian area south of the Huronian belt, veins of quartz were observed in many places running in different directions, but they were all of a vitreous character or of the kind which miners call "hungry" and none of them were observed to carry promising quantities of metallic ores.

Granite veins. Coarsely crystalline veins of red and nearly white granite, having various courses, are not uncommon among the mica- and hornblende-schists and the schistose gneisses in the region about the mouths of the French River, but such veins appear to be more rare at a greater distance inland from Lake Huron.

Granite area. Between the western and middle outlets of French River, there is an area of coarse dull olive-gray granite, which has a breadth of about two miles on the lake-shore, and it probably runs inland for about four miles.

The Laurentian Rocks North-west of the Huronian Belt.

North-west of the great Huronian belt the Laurentian rocks, as already explained, are considered to belong to the older division of the

system. They form part of the great body of the series and extend to an indefinite distance to the north-westward. A considerable, but varying breadth, bordering on this side of the Huronian belt, consists mostly of non-foliated granitic rock, but those merge into the foliated varieties which prevail at greater distances in a north-westerly direction from this belt. Reddish granite-like rocks border these Huronian strata all the way from Lake Wahnapiti to the township of Cascaden. But notwithstanding this outward granitic appearance, on closer examination the textural arrangement of the component minerals is more like that of a quartz-diorite and they are certainly of eruptive origin. The late Professor George H. Williams examined, under the microscope, a thin slice of a fine grained variety of these rocks from Kin-ni-wabic Lake in the township of Levack and pronounced it micropegmatite and undoubtedly eruptive.

Foliated and eruptive granites.

Red hornblende-granite is largely developed and appears to be continuous all the way from the Sudbury district, where it is shown on Sheet 130, westward to the Mississagi River, and it probably extends still further west.

Great extent of granite.

Huronian.—Quartzites.

It was stated in my report in the Annual Report of 1890-91 and again in my summary report for 1891, that the Huronian rocks of the north-western part of Sheet 125 have a general synclinal structure, and that the quartzite ridges forming the long peninsulas to the north-west of Killarney are on the southern side of this geological basin, while those of the Cloche Mountains form the opposite side. The investigations of 1892 seem to have demonstrated the correctness of this view. The large islands in McGregor Bay would lie about the centre of this trough. Along the southern side of the general synclinal structure are several subordinate folds which appear to be intimately connected with the peculiarities of the topography of this region.

Synclinal structure of quartzites.

The Cloche Mountains consist of two principal ridges of quartzites, which, running parallel to each other at an average distance of one mile apart, have a course almost due east, all the way from the western edge of the sheet to the township of Goschen. The outermost or more northern of these ridges, continues its eastern course across this township to Three-mile Lake, where it abuts against the granite at the line of the great dislocation; while the quartzites of the inner or southern ridge are apparently folded sharply upon themselves in getting round he eastern end of the trough on the south side of Lake David. Their

Two quartzite ridges.

continuation on the southern side of the fold runs south-westward towards the north side of Trout Lake. In attempting to work out the structure in this neighbourhood, we were guided to some extent by means of a belt of sea-green quartzite on the northern flank of the outer ridge and by belts of different shades of green occurring in other parts of the series.

Quartzite ranges of points.

The quartzite ranges of McGregor and Frazer points, lie at about the same distance apart as the two ridges of the Cloche Mountains and they may perhaps represent the same belts on the opposite side of the main syncline. They are, however, separated by a belt of gray sericite schist, out of which Narrow Bay has been excavated, and instead of being the equivalents of the two ridges of the Cloche Mountains, as just stated to be probable, they may both belong to one band on the opposite sides of a subordinate syncline with the sericite schist resting in it.

Trout Lake region.

On the south side of Trout Lake the quartzites rise into comparatively high peaks and perpendicular cliffs. The strike is here from S. 75° to 80° E. and the dip northward at angles from 85° to 90°. This lake, and also the smaller ones and the streams between it and the head of Narrow Bay, lie in a continuation of the depression occupied by the latter, which, as already stated, has been excavated in a wide belt of gray sericite schist. A narrow margin of the schist, striking nearly east-and-west, skirts the north shore of Trout Lake. The low ground between this sheet of water and Ka-ka-kise Lake appears to owe its origin to a continuation of this broad band of schist.

Lines of dislocation

There appears to be some evidence that a dislocation at about right angles to the general strike crosses this valley in a north-westerly direction, following nearly the course of the outlet and the lowest bay of Sturgeon Lake, which are at right angles to that of the main body of the lake. The line of the great north-east and south-west dislocation, which, in this vicinity, separates the quartzites from the granite to the south of them, enters the west end of Lake George and passes out at its eastern extremity, where it may be seen at the little rapid between the lake and the large marsh just above it. It strikes the south shore of Ka-ka-kise Lake half a mile from its outlet and leaves it at the eastern extremity, from which it follows the foot of the bold quartzite hills, here called the Killarney Mountains, north-eastward to Brush or Brush-camp Lake.

Structure of the quartzite bands.

Between Trout Lake and Brush Lake, the pure quartzites are very largely developed. The outline of their structure seems to be in the

form of a section of a double convex lens with a length of ten miles, in a direction nearly parallel with the northern boundary of the granite to the south. These rocks may represent a great thickening of the quartzites of the outer ridge on the south side of the general synclinal trough, or they may be a distinct addition to them, lying stratigraphically lower in the series. On the other hand, the lens-shaped outline referred to, may be owing to another subordinate trough with nearly perpendicular dips, so that the total thickness of its beds may be only half the width of the lens, which is three miles. If it be a synclinal trough, then the main body of Sturgeon Lake and the smaller lakes in the mountains to the east of it would lie along its axis. They are surrounded on both sides by high quartzite hills, which curve round in the form described and constitute the most elevated ground in this part of the country. North Peak, one of the points in the range forming the north side of the lens, rises to an elevation of 1180 feet above Lake Huron or 1762 feet above the sea, being thus, so far as known, one of the highest summits in the province of Ontario, and only about 200 feet lower than the Niagara plateau in the township of Osprey.

Thickness of quartzites.

The addition of the quartzites of the lens just described to those of the general syncline gives us here the greatest development of these rocks to be found in the Lake Huron region. A straight line drawn north-northwest over the hills from Ka-ka-kise Lake on the south side of the great lens, would pass nearly at right angles across six miles of quartzites, with only a few schistose bands, all standing nearly on edge. North of the lens just described, this line crosses the eastern part of the main syncline which is contiguous with it, so that if the former be a synclinal trough as supposed, the actual volume of the strata would be doubled in both cases and the real thickness of the quartzites would be only half the above measurement, namely three miles, or 15,840 feet.

Syncline in quartzites.

Ridges and bosses of quartzite protrude through the horizontal Silurian limestones of Great and Little Cloche Islands and Cloche Peninsula. Between Trout Lake and Great Cloche Island the structure of the older rocks is apparently in the form of an elongated basin or trough running nearly east-and-west, with almost vertical dips. The eastern extremity of this trough appears to be near the outlet of Sturgeon Lake and the outliers of quartzite which come up through the Silurian strata to the westward of McGregor Point, seem to lie along the westward continuation of its axis. These exposures appear to occur in the general course of the axis of the syncline of Narrow Bay and

they probably make their appearance along this line on account of the local thickening due to the folding of the belts in getting round the synclinal axis. The western part of McGregor Point is crossed diagonally by some of the inner quartzite bands of the syncline, while the eastern part of Narrow Bay would appear to lie near the central line of the trough.

Anticline and syncline.

If the foregoing interpretation of the geological structure of this region be correct, Frazer Bay would lie upon an anticline, the axis of which would run up the south side of the bay and diagonally through the north-eastern part of Badgeley Point, while Badgeley, Centre and Partridge islands would belong to the south side of another narrow synclinal trough, with Heywood Island lying in the course of its axis to the westward. The quartzite ridge which runs westward from the head of Sheguiandah Bay on Grand Manitoulin Island, may belong to this syncline or it may form part of the next structural fold to the southward.

Area between Bay of Islands and McGregor Bay.

Quartzites occur, but not continuously, along the northern sides of Great Cloche Island and of Cloche Peninsula and they have served to protect the more yielding Silurian rocks, that flank them on the south, from erosion during the glacial period. The quartzites extend eastward from Cloche Peninsula along the south shore of the northern peninsula of the Indian reserve which lies between Bay of Islands and McGregor Bay. The commonest rocks of the points and numerous islands of the bays just named are light coloured quartzites, probably belonging to a number of different bands ; but greywackes, sericitic and other schists, conglomerates, breccias, dolomites, greenstones and other Huronian rocks, also form a considerable proportion of the strata over the whole area which includes these two bays.

Greenstones.

The greenstones, associated with the quartzites, which form so prominent a feature of the Huronian rocks of the Sudbury sheet, become less conspicuous among the corresponding quartzites shown on the present sheet immediately to the south. Those which exist within the limits of this sheet are more largely developed in the tract on the south side of Lake Panache than elsewhere. Here they occur in the form of belts running east-and-west, one of which measures eight miles and another five miles in length. Along the south shore of the channel between Bear Lake and Walker Lake and from Van Winkle Lake to the west side of Leech Lake there is an uneven belt of ordinary

Greenstone belts.

greenstone. Another belt of this rock appears to be continuous from Cat Lake to the western part of Murray Lake. The large island in the southern part of Bear Lake consists of the same rock and there are also various other small areas of greenstone in this part of the sheet. Some areas of this rock occur on Lake Panache, a short distance northward of this district, as shown on the Sudbury sheet. A few occurrences of greenstone on Bay of Islands and McGregor Bay are mentioned in this report in connection with the geology of that part of the sheet.

Greenstone patches.

The Arkose Series.

In the space between the Cloche Mountains and the range which runs eastward from McGregor Point to Sturgeon Lake, including Bay of Islands, McGregor Bay and the land thence eastward to the junction of the two chains, the rocks belong to a local division of the Huronian which may for present convenience be called the arkose series, with its associated rocks. Structurally this area would appear to occupy the central part of the synclinal form between the above-mentioned conspicuous quartzite ranges. Although various forms of arkose or greywacke are the prevailing rocks within this space, there are in different parts of it considerable quantities of gray quartzites and fine quartz-conglomerates, mixed agglomerates and breccias, sericitic and micaceous schists, impure dolomites and eruptive greenstones.

McGregor Bay region.

The sericite-schist is most conspicuously developed as a strong east-and-west band running through the northern parts of Bay of Islands and McGregor Bay. Dolomites and agglomerates are found in a parallel zone not far to the south of this band, while quartzites are most strongly developed along the centre of the arkose area including the southern part of the Indian peninsula north of Birch Island. The greenstones are in greatest force on the south-eastern sides of both Bay of Islands and McGregor Bay and on the islands about three miles east of Birch Island.

Band of sericite-schist.

Associated rocks.

The rock above referred to as arkose or greywacke, resembles sandstone in some respects, but it does not usually occur in well defined beds with parallel faces, but rather in heavy bands traversed by joint-planes or a rudimentary sort of cleavage. It breaks readily and may be easily bruised or scratched, showing that it is largely composed of materials softer than quartz. The colour in fresh fracture is usually some shade of ash-gray, but the weathered surfaces may be stained to various shades. When closely examined it is found to consist of comminuted granitic débris mingled with many small and some larger

Character of arkose.

angular and rounded fragments of the granite from which it has been derived. These fragments are usually of the same character and consist of red or gray binary granite or quartz-felspar rock of medium texture. Fragments of other crystalline rocks are also occasionally incorporated in the arkose. On microscopic examination the finer matrix of this rock is found to consist of somewhat rounded grains of quartz and more angular ones of felspar, with a filling of fine sericite and some dark amorphous mineral.

Origin of arkose.

As to the origin of these rocks, the thick unstratified and brecciated greywacke or arkose may represent consolidated masses of volcanic ashes or mud with stones, which were thrown upon the land or into shallow water, while the stratified varieties may have consisted of similar ejectamenta thrown into deeper water where they became arranged into layers as we find them. Some of these rocks whether stratified or otherwise may represent volcanic products which were originally thrown into the sea in a molten or heated condition and became broken up and almost completely disintegrated.

A study of the different phases of the greywackes and their associated rocks in this region, would appear to prove that the former constituted the crude material from which both the quartzites and clay-slates were derived by the modifying and separating action of water. Again, by the action of time, pressure, heat and other metamorphosing agents upon different varieties of greywacke, some of our granites, syenites, gneisses and possibly other crystalline rocks were probably formed. In the Sudbury district, many instances were noted where the more massive greywackes exhibited a proneness to revert to granite again, while some of the stratified varieties showed different stages of their passage into gneiss.

Reversion to granite.

Near the western bay of Lake Evelyn a rock allied to arkose has assumed the appearance of red granite, although on microscopic examination it proves to be of clastic origin.

Eastward ending of quartzites.

In the township of Goschen, the heavy quartzite bands in getting round the main anticlinal axis, which has a general north-easterly bearing, have a deeply notched arrangement, as shown upon the map, owing to subordinate flexures and in the "bays" thus formed and flanked by the solid white quartzite, other rocks come to the surface. Some of these resemble sandstones, others arkose, while schistose rocks, mostly micaceous, also occur.

Clay-Slates and Slate-Conglomerates.

Clay-slates and conglomerates.

These rocks do not form a large proportion of the Huronian series within this sheet. Solid and slatey argillites are found along Long Lake, an expansion of Whitefish River, and slate-conglomerates occur in considerable force on both sides of Bear Lake and between Cat and Leech lakes. Around the south-western part of Bear Lake and also along its eastern side much of the conglomerate is very darkly coloured. The pebbles are unevenly distributed and frequently occur closely aggregated in groups or "clouds" with smaller numbers between them.

Association of slates and quartzites.

In the continuation of the Huronian belt to the north-westward of the present sheet, the clay-slates are intimately associated with the quartzites. Both appear to have been derived from the materials of arkose or disintegrated granite by the modifying action of water, which has separated the quartz grains from the clayey portion and deposited them in separate places at the same time, so that in a general way they may be regarded as contemporaneous. In some localities, as on the Montreal River, the two rocks may be seen interstratified with each other.

Huronian Limestones.

Huronian limestone horizon.

Bluish-gray or dove-coloured impure magnesian limestones occur on several of the islands along the southern side of the sericite belt in the northern part of Bay of Islands. They may not form parts of a continuous band, but they appear to be confined to a horizon parallel to the sericite belt. A few spots of similar limestone were found among the islands in other parts of this bay.

Limestone of Lamirandière Bay.

Chert-rock.

A finely crystalline limestone occurs among the Huronian rocks in the north-western part of the township of Rutherford. The locality is upon the slope of the hill about 100 yards back from the north shore of Lamirandière Bay at a distance of about half a mile from its narrow entrance. The limestone "has a vertical attitude and runs about N. 70° W. at the part examined. Its total thickness is about 75 feet, of which the 25 feet along the northern side consists of a single solid band of nearly white finely crystalline limestone, clouded with light greenish and grayish patches. The remaining 50 feet are mixed with shaly patches of hornblende, together with a little shining granular magnetic iron ore. Adjoining the limestone on the north side is a band, only a few feet in thickness, of dark smoke-coloured chert-rock, ribboned with streaks of a dull red colour. It breaks easily with a

fine conchoidal fracture and appears to be identical with a rock which was used by the mound-builders for making some of their arrow-heads. This is followed to the northward by a dark-coloured dioritic conglomerate in which the pebbles are mostly small and generally widely scattered, and further on by a very dark-gray soft massive-looking micaceous schist, most of which is full of small pebbles. Measured from the limestone band, a thickness of from 100 to 200 feet of these rocks is exposed."*

Conglomerates.

Limestones of Lake Panache

A short distance northward of the sheet, several exposures of impure gray limestones occur among the Huronian rocks of Lake Panache. Some specimens of these limestones were ascertained by Dr. T. S. Hunt to contain about fifty per cent of carbonate of lime.

Relations between Topography and Geology.

The base rocks are so largely exposed in the region covered by our map that an opportunity is furnished for studying the dependence of the topography upon the geology. The effects of cleavage and bedding, fissures and joints, rock-crushing, dislocations, intrusive dykes, etc., on the production of geographical features are here so well marked as to make it worth calling attention to some points in connection with this subject. In any part of the district we may select, it will be found that the joints, fissures and dislocations, generally run in two sets intersecting each other at large angles, but those of either set are parallel to each other. Usually one set is more strongly marked than the other and exercises an important influence in the decay and disintegration of the rocks, and this in its turn affects the contours of hill and valley and determines the positions of streams, inland lakes and of the inlets, etc., of Georgian Bay.

Origin of geographical features.

Lines of Erosion.

The dykes which traverse both the Laurentian and Huronian rocks of the district and the fissures and lines of crushing which occur more particularly in the former, have given birth to some of the more striking features of the map. The greenstone dykes cutting these rocks are often remarkable for their persistence in length, even when of no great thickness. Sometimes these dykes run parallel to one another in groups and in such cases they are apt to produce marked effects on the topography. Large dykes are more coarsely crystalline than small

Channels along dykes.

*Report of Progress, Geol. Surv. Can., 1876-77 p. 209.

ones and they have decomposed more rapidly along their centres than towards the sides. Their decay and erosion have given origin to the channels of many inlets, long narrow lakes and straight sections of river in various parts of the Archæan regions of Canada, and, as already mentioned, examples of these are to be found within the limits of the present sheet.

East-and-West Inlets and Channels.

E. and W. inlets of Georgian Bay.

A striking feature in the character of the shore-line of Georgian Bay in this sheet is the straight east-and-west channels, such as Collins Inlet, Key Inlet, and Byng Inlet, which have been excavated in the gneiss independently of its strike or dip. The straight channel, having nearly the same course, which separates George Island from the mainland at Killarney has been similarly excavated in granite and quartzite. In the direct bearing westward of the Killarney Channel, a notch is cut through Badgeley Point almost to the level of the lake and the low neck of land which here intervenes between Killarney and Frazer bays is called Rat Portage. Here eleven parallel dykes of greenstone occur in the breadth of a quarter of a mile. A dyke of greenstone parallel to Killarney Channel traverses the granite which forms its south wall. Some of the dykes which occur on the islands off the entrance to Narrow Bay, and again in the bays on the opposite sides of the southern part of Cloche Peninsula, appear to be the continuation of the Rat Portage set. The physical depression following the course of this belt of dykes is no doubt in some way connected with it.

Collins' Inlet.

Collins Inlet was found to follow one or more dykes, accompanied by a fracture, the inequalities in which are filled by a friable brown breccia. The bottom of the inlet probably lies upon one or more dykes of greenstone, patches of which may be seen adhering to the walls and filling angles and fissures in them at numerous places on both sides. Along the south side of the eastern part of this inlet a friable brown breccia very much like that occurring at the head of Byng* Inlet may be seen near the level of the lake. It appears to fill a space between the walls of a dislocation following the course of the arm itself. The existence of this inlet is therefore probably due to the rock-decay which took place along both this break and the dyke or the closely parallel dykes above referred to.

Key Inlet.

Key Inlet is upon the course of a large diabase dyke, while Byng Inlet lies upon a geological break in which soft breccia,

* Report of Progress, Geol. Surv. Can.,1876-77 p. 202.

like that of Collins Inlet, also occurs. The dykes would suffer deep decay in pre-glacial times and the great fractures referred to would also facilitate the disintegration of the adjacent rocks along their course, thus allowing of their subsequent easy erosion by glacial action. A line of deeper water, following in the same direction, marks the continuation of these rock-channels in the bottom of the lake. The rocky sides of Collins and Key inlets instead of sloping gently to the water like the shore in other parts of the lake, in this quarter are marked by long perpendicular, but not high, walls which cut across the strike of the gneiss at any angle.

Cambro-Silurian and Silurian Rocks.

Cambro-Silurian.

The eastern part of Grand Manitoulin Island and the islands of the La Cloche group which come within Sheet 125, consist of unaltered fossiliferous rocks belonging to the Silurian (Ordovician and Silurian). They are quite undisturbed and dip slightly to the southward, the rate being estimated at about 40 feet to the mile. Further details as to some aspects of the geology of Grand Manitoulin Island are given by the writer in the Report of the Geological Survey for 1865. His Report for 1866 refers to the westerly part of the same island, and to Cockburn, Drummond and St. Joseph Islands.

Report for 1865.

Chazy (?) Formation.

Chazy formation.

The lowest beds of the unaltered rocks are exposed in the northern parts of Great Cloche Island and in Cloche Peninsula. They consist of from 50 to 100 feet or perhaps more, of reddish and chocolate coloured calcareous marls with greenish layers and mottlings, together with some beds of fine-grained white and reddish sandstones. These rocks have yielded no fossils by which their precise age can be determined, but they underlie the limestones of the Trenton group and may be Chazy. Overlying the marls and interstratifying the upper portion of them are beds of hard, compact, dark-gray magnesian limestone which weather to various yellowish and reddish shades.

The Trenton Group.

Trenton group.

Between the hard beds, just referred to, and the summit of the Trenton formation proper, at Little Current, there must be a thickness of nearly 300 feet. This consists of rather thinly bedded lumpy and uneven-surfaced gray limestones, with many thin shaly beds and part-

ings interstratifying them. A considerable number of rather poorly preserved fossils have been collected from these beds. These belong to the Black River and Birdseye formations of the Trenton group. The upper beds of the group, consisting of gray limestone, are seen in the south bank of the channel at Little Current and near the level of Lake Huron at the northern extremity of Strawberry Island. At these localities they are overlain by the black bituminous shales of the Utica formation. The breadth of those limestones at right angles to the strike in this part of the sheet is eight miles. If the average dip be 40 feet to the mile, as assumed, the total thickness of the Trenton group would here be about 320 feet. Resting on the flanks of the quartzite-ridges of Badgeley Point and island and of Centre, Partridge and Heywood islands, are numerous patches and margins of gray limestone containing Black River fossils and dipping at various angles form the quartzite centres into the lake. The northern half of the peninsula between Manitouaning and Smith bays and the adjacent islands on its north-east side and also Squaw Island consist of limestones belonging to the Trenton group.

Little Current

Limestone patches.

Utica Formation.

The black shales of this formation are found at the surface on the high ground in the village of Little Current. They cover the whole of Strawberry Island except the northern extremity. Small patches of this rock occur in Sheguendah village and on Heywood Island. They cross the peninsula between Manitouaning and Smith bays and form a small area at the extremity of Cape Smith. The thickness of the formation on Manitoulin Island is estimated at 60 feet.

Utica formation

Hudson River Formation.

Hudson River strata are largely developed in the township of Sheguendah and also in the area lying between Manitouaning Bay, Smith Bay, James Bay and the head of South Bay. In this region they consist mostly of bluish-gray and drab marls and shales, interstratified with thin layers of limestone and fine-grained sandstones, with a thirty or forty foot band of rather thinly bedded grey limestone at the top. The whole thickness of the formation at Cape Smith is 300 feet, but it diminishes to the westward and may not exceed 250 feet to the south of Little Current. Lonely, Club and Rabbit islands also consist of Hudson River strata.

Hudson River formation.

Clinton Formation.

Clinton formation.

The Medina formation which is so well developed between Lake Ontario and Georgian Bay does not extend to Manitoulin Island. Resting on the Hudson River strata are a set of magnesian limestones which are usually thinly bedded, somewhat hard and argillaceous and gray and purplish drab in colour, but in some parts they are buff-coloured and occasionally they are heavy-bedded. An example of the last-mentioned condition is to be seen at Gibraltar Rock at the south end of Manitouaning Bay which appears to consist of a lenticular thickening of the formation. The isolated plateau or table-land extending from Mocassets Landing half way to Smith Bay and the ridge of high ground to the north of James Bay are included in this formation. But its largest area within the sheet lies between James Bay and the Niagara escarpment which runs westward across the peninsula from Tamarac Cove to South Bay. These limestones have a thickness of about 150 feet and between them and the base of the Niagara formation there is a band of red marl with green layers and mottlings which, although only twenty-seven feet thick, is very persistent. Its geological position corresponds with that of the "iron ore band" of the Clinton formation.

Niagara Formation.

Niagara formation.

The southern portion of the peninsula between South Bay and the eastern side of Manitoulin Island belongs to the Niagara formation, which has here a thickness of about 405 feet. It consists principally of heavy-bedded, light-gray, light bluish-gray and buff dolomites. Good fossils are rare, although much of the rock is made up of comminuted fragments of organic remains. The thicker beds are rendered somewhat porous by the numerous small cavities left between these fragments. Most of the beds show a crystalline character on fresh fracture.

Guelph formation.

A break or ravine, running north-westward from Tamarac Cove, separates the north-easterly part of this Niagara plateau from the main body of the formation and it thus becomes an outlier as shewn upon the maps. On the south end of Fitzwilliam Island and on the eastern part of the south shore of Manitoulin Island there is a thickness of about 100 feet of heavy-bedded, coarsely spongy, gray and buff dolomite, which contains a few fossils like those of the Guelph formation.

General Section.

A vertical section from the mainland along the western border of the sheet, somewhat produced to the south, would show the following thickness for each of the successive formations from the base upward. Section across Manitoulin Island.

	Feet
Chocolate marls and fine sandstones (Chazy ?)	100
Trenton group	320
Utica formation	60
Hudson River formation	250
Clinton formation	177
Niagara formation	405
Guelph formation (?)	100
Total thickness	1412

Surface Geology.

Glaciation.—The region covered by the sheet everywhere bears evidence of having undergone severe glaciation, which had been preceded by long-continued atmospheric decay of the solid rocks. The Laurentian area has been worn down to a comparatively low and even surface, while the great quartzite bands stand out as high and bold ridges, having resisted alike the preglacial erosion and the wearing action of the heavy land ice. On Manitoulin Island, the successive Cambro-Silurian strata which have a nearly horizontal attitude, have been brought out in bold relief by the denuding agency of the ancient glaciers, so that when the island is viewed from the eastward, the north-facing escarpments of the successive formations may be seen like so many volumes partially overriding one another. Glaciation.

Glacial Striæ.—As elsewhere in the country northward of Lake Huron, the striæ on the mountain tops and the higher levels in general, run more nearly due south than in the valleys or on lower ground. From Bay of Islands to the mouth of French River, the course of the striæ is from S. 35° W. to S. 45° W., and the same course prevails from the lake-shore northward to Lake Panache and Tyson Lake. But there are some exceptions, evidently due to the contour of the surface. At Killarney village the course is S. 35° W., but at the west end of the channel, one mile distant, it is S. 25° W. On the north-west flank of the high quartzite ridge, on the north side of Sturgeon Lake, the course is S. 60° W. or nearly parallel to that of the ridge itself. Around Trout Lake and thence southward to French River, the direction varies Glacial striæ

in different localities from S. 10° W. to S. 35° W., and it would average S. 15° W. From the western mouth of French River to Byng Inlet, it ranges from S. to S. 40° W., but generally approximates to the latter. On Manitoulin Island, the ice grooves are seen only where the surface consists of firm limestone rock. All over the eastern part of the island they run about S. 40° W., but this gradually changes as we go west till near the opposite extremity it has become S. 10° W.

Pot-holes.

Pot-holes.—Large pot-holes are conspicuous along the north sides of Collins Inlet, the Key and Byng Inlet. Scattered examples may also be seen near the level of Lake Huron, on the north side of Bay of Islands, on Whitefish River and on the lakes connected with it. A large and deep one occurs at the short carrying-place which has always been known as the Pot-hole portage, at the west end of the northern expansion of McGregor Bay. Large pot-holes are also said to have been found in the middle outlets of French River, and in some places between Byng Inlet and the south-east corner of the sheet. On the top of Gibraltar Rock, at the southern extremity of Manitouaning Bay, many large and small pot-holes have been bored in the surface of the level limestone rock. Before this rocky surface had been swept by fire, clumps of small trees and single trunks might have been seen growing out of these holes, their roots being embedded in the black soil with which they were partly filled. Great perpendicular nitches, like longitudinal sections of cylinders are excavated in the walls of some ravines which occur in the upper part of Gibraltar Rock.

Gibraltar Rock.

Superficial deposits.

Superficial Deposits.—Both the Archæan and the Palæozoic regions of the sheet may be characterized as rocky, more than half the area being destitute of soil fit for cultivation. The superficial deposits are nowhere deep or extensive. Some deposits of fine sand occur on the southern slope of the great quartzite ridge on the north side of Bay of Islands. Below the first fall in ascending the Whitefish River, the banks consists of gravel, sand and sandy clay. Behind the village of Wekwemikong two ancient shore-lines have been formed partly by gravel and partly by the wearing away of the Hudson River strata. The clayey banks in the township of Shiguiandah, south of Little Current, consist of Hudson River marls, softened superficially by long exposure to the atmosphere. In shallow places among some of the islands near the north shore of Lake Huron a stiff reddish clay occurs which is seldom seen above high water mark. This may some day prove useful for puddling or other purposes in a section of country where such clay is scarce. Along the Mitchi-zin-ish-ing River from Tyson's settlement to Lake George, clay occurs under the surface sand of the valley.

Economic Minerals.

Limestones for Building, Granite, Marble.—The Silurian rocks of Manitoulin and Fitzwilliam islands afford a variety of good stones for ordinary building purposes and some kinds suitable for heavy structures The latter may be looked for among the thickly bedded buff-coloured dolomites of the Clinton formation and the gray dolomites of the upper part of the Niagara. The Guelph formation, which appears to be represented by the highest rocks in the southern parts of these islands, is heavy-bedded and would yield stone of large dimensions, but of a porous character. The red granite of George Island is of a pleasing red colour, and has generally a medium texture, but in parts it is fine-grained. In the north-western part of the island, the expos ures rise to a good height for quarrying, and, as far as can be judged without actual trial, it could be got out in large blocks. Some part of the Huronian crystalline limestone exposed on the northern side of Lamirandière Bay, referred to in a previous part of this report, may be found suitable for working as marble. Building stones, granite, marble.

Clays.—Some of the clayey shales of the Hudson River and Clinton formations on Manitoulin Island may be found suitable for making fire-clay or for the manufacture of pottery. The occurrence of stiff clay near the water-level along the north side of Lake Huron has been already referred to. Clays.

Shell Marl.—This substance is found under a few of the limited peaty swamps and marshes and also under some of the smaller lakes or their dried-up sites on Manitoulin Island. Where the soil already contains so much carbonate of lime as does that of this island, these marls will not be required as fertilizers, but they may prove useful in the manufacture of hydraulic cement. Shell marl.

Lime.—The limestones of Manitoulin Island appear to be all dolomitic, except those of the Trenton group and some of the beds in the Hudson River formation. Both the dolomites and the pure limestones have been calcined for use by the farmers in the various parts of the island where they occur and have been found to yield excellent lime. The purer portions of the Huronian limestones of Lamirandière Bay would no doubt also answer for this purpose. Lime.

Hydraulic Cement.—Some of the yellow-weathering bands of the Black River formation and also some of the thinly bedded portions of the Clinton look as if they could be converted into hydraulic cement, for which there is an increasing demand in Canada, especially for making granolithic foot pavements. Hydraulic cement.

Bitumens.

Bitumens.—The bituminous black shale of the Utica formation of Cape Smith, the peninsula between Smith and Manitouaning bays and Strawberry Island, would yield about 3 per cent of oil on distillation, but at the present prices, it could not be manufactured at a profit. Some years ago, wells were sunk for petroleum at Cape Smith and at Bass Lake behind Shiguindah and small quantities were said to have been obtained. Surface indications of petroleum were stated to have been observed many years ago on the south side of Shiguindah Bay. In 1846, the late Mr. Alexander Murray brought a specimen of bituminiferous limestone from Manitoulin Island, which would be well suited for making asphalt pavements. The locality was not stated, but the writer has been informed that such a rock occurs a short distance westward from South Bay Mouth.

Quartzite for glass-making.

Quartzite for Glass-making.—The white quartzites of McGregor, Frazer and Badgeley points and their adjacent islands, as well as of the high ridge on the north side of Bay of Islands, would furnish inexhaustible quantities of pure material for making glass. As these rocks occur on the immediate shore of Lake Huron, at numerous convenient places for shipping, they are likely to be utilized sooner or later for this purpose.

Iron ore.

Iron Ore.—Small deposits or pockets of apparently good hæmatite have been found in a few places among the Huronian quartzites. One of these, on the north-western side of Sturgeon Lake, near its western extremity, had been opened to a small extent, but abandoned some years ago. From all that could be seen at the surface, the occurrence was of limited extent.

Copper ore.

Copper Ore.—At the Wallace Mine near the mouth of Whitefish River, which was opened in 1847, but soon abandoned, copper-pyrites occurs in a quartz vein. Another vein, only a few inches wide, containing copper-glance occurs at the portage across a narrow part of McGregor Point, four miles and a-half from its extremity. Small quantities of copper-pyrites were found in a quartz vein near the north side of Cross Lake on the Whitefish River and in other veins in various places among the Huronian rocks in the north-western part of the sheet, but none of these occurrences gave promise of economic value.

Nickel.

First discovery.

Nickel.—The existence of nickel in the country north of Lake Huron, where the metal has since been produced in such large quantities in the Sudbury mining district, was first made known by the late Mr. Alexander Murray, Assistant Provincial Geologist, in 1848, from a specimen

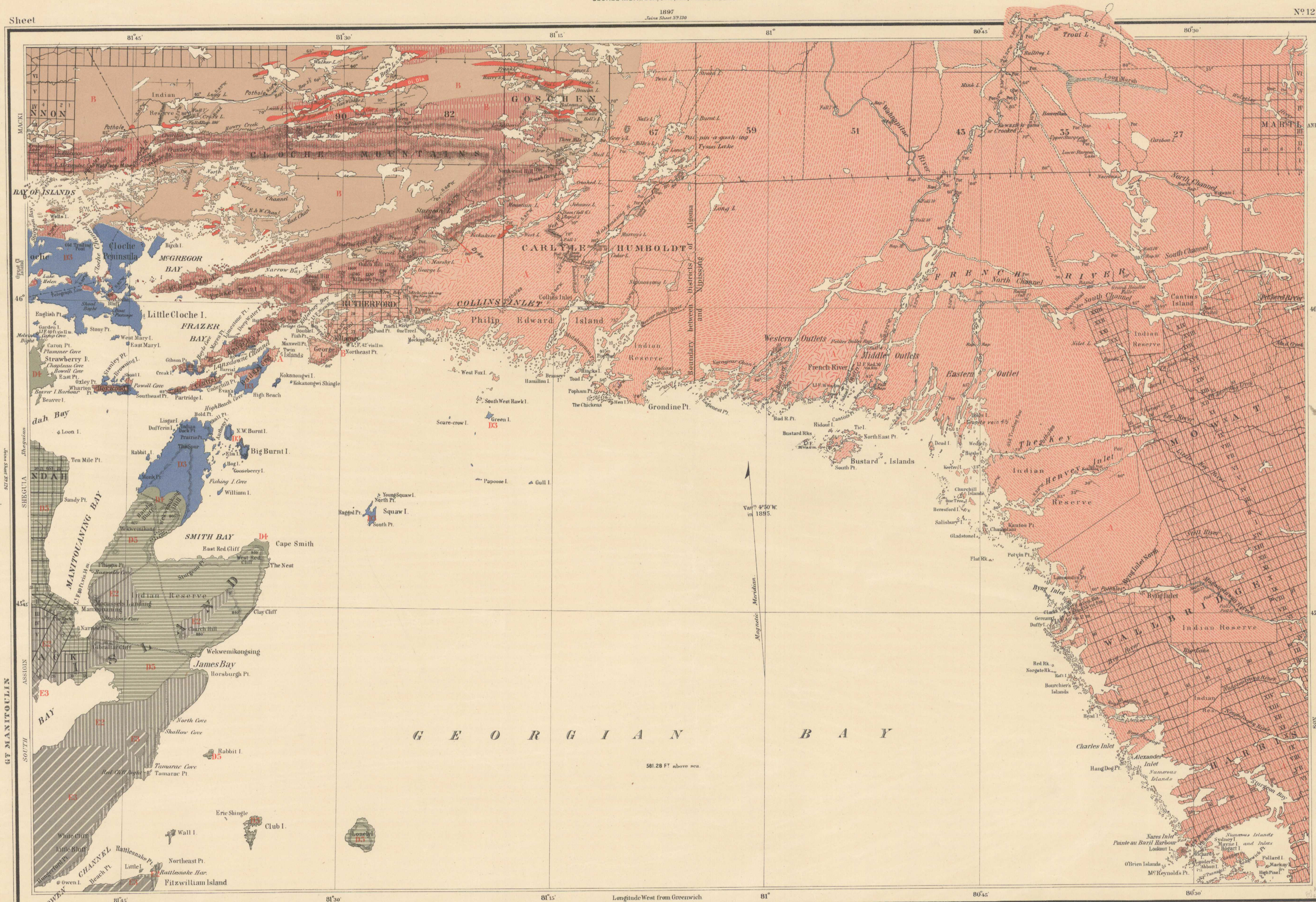
he collected at the Wallace Mine, which had been opened the previous year. The ore was found by Dr. Hunt's analysis to contain 8·26 per cent of nickel, but Mr. Murray says, "as two-fifths of the specimens consisted of earthy material which might readily be separated by dressing, the quantity of nickel in the pure ore which this would represent, would equal nearly 14 per cent." Dr. Hunt also discovered the presence of nickel in greenstone which had been brought the same year by Mr. Murray from a locality not far from the site of the present town of Sudbury.

Geological Survey of Canada

GEORGE M. DAWSON, C.M.G., LL.D., F.R.S. DIRECTOR

Sheet 1897 No. 125

Joins Sheet No. 130



Legend

Silurian

- E3 — *Niagara*
- E2 — *Clinton*

Cambro-Silurian

- D5 — *Hudson River*
- D4 — *Utica*
- D3 — *Trenton and Black River*

Huronian

- B — *Quartzite*
- B — *Sericite-, chlorite-, hornblende- and arkose-schists, clay-slates, greywackes, quartzite bands and dolomites*

Laurentian

- A — *Diorite-gneiss and granite-gneiss*
- A — *Granite*
- Di, Dia — *Diorite and diabase*

- 70° *Strike and dip*
- *Vertical dip*
- *Glacial striæ*
- 736′ *Heights above sea level*
- ♀ *Copper*
- Ni *Nickel*

DESCRIPTIVE NOTES.

LAURENTIAN

The Laurentian rocks of this sheet consist of red and grey mica- and hornblende-gneisses in even and regular beds, together with coarse hornblende- and mica-schists and bands of quartz-rock with schistose partings. They dip usually at angles of medium inclination. In the western part of the sheet, the prevailing strike is N.E., while towards the eastern part it is N.W., and there appears to be an anticlinal and synclinal arrangement throughout. An area of coarse, dull olive-grey granite occurs between the western and middle outlets of French River. Some greenstone dykes, having approximate east-and-west directions, traverse the gneiss and appear to have been connected with the origin of the depressions in which lie the east-and-west fiords, such as Collins inlet, The Key and Byng Inlet.

Limestones have not been found among the Laurentian rocks within the sheet, but in the Parry Sound District, not far to the eastward, five bands of crystalline limestone have been traced.

HURONIAN AND IRRUPTIVE.

The irruptive rocks are, for the most part, associated with the Huronian areas, and consist of the belt of red granite running from Badgeley island to Three-mile Lake, twenty-three miles in length with a maximum breadth of three miles together with some belts of diabase and diorite between the east end of Lake Panache and Howry Creek, running parallel with the general stratification

The most conspicuous feature of the Huronian system within the map, is the whitish quartzite, great ridges of which enter the west side of the sheet and extend due east to Three-mile Lake, whence they run south-west to Lake Huron, forming the high points between McGregor and Killarney bays. Between these two arms of the quartzite, and northward, the most abundant rock is ash-coloured greywacke, which is associated with varying proportions of quartzites, quartz-conglomerates, agglomerates, breccias, sericite- and mica-schists impure dolomites and the irruptive greenstones above mentioned. The whole series, including the quartzites, dips at high angles. The strike is indicated at frequent intervals on the map.

CAMBRO-SILURIAN AND SILURIAN.

The Cambro-Silurian and Silurian rocks of Grand Manitoulin, La Cloche and other islands, consist of unaltered fossiliferous strata, with a southward dip of about 40 feet to the mile. The following section is taken across La Cloche, Grand Manitoulin and Fitzwilliam islands along the western edge of the sheet. The order is ascending:—

		FEET.
1.	Chocolate-coloured marls with some fine sandstones, possibly Chazy -	100
2.	Trenton group, grey limestones with shaly and marly beds - - -	320
3.	Utica; black bituminous shale - -	60
4.	Hudson River; bluish-grey and drab marls and shales interstratified with thin layers of limestone and fine-grained sandstones, with 30 or 40 feet of grey limestone at the top - -	250
	(Medina; wanting.)	
5	Clinton; drab, buff and purplish magnesian limestones, about 150 feet, followed by red marl beds at summit, very persistent but only 27 feet thick, equivalent of the "Iron Ore Band" -	177
6.	Niagara; thick and thin-bedded, dark and light grey and buff dolomites. The thick and light-coloured beds prevail, and are usually porous and crystalline, although largely composed of fragmental organic remains - -	405
7	Guelph (?); some of the highest beds on the south end of Fitzwilliam island and the south-eastern portion of Manitoulin island may belong to this formation. They consist of coarse spongy, grey and buff dolomites - - -	100
		1412

ECONOMIC MATERIALS

The Silurian rocks furnish good building stones, and their various dolomites and limestones have been found to burn into good lime. Rocks apparently suitable for hydraulic cement occur in the Clinton and Trenton formations. The Utica bituminous shales would yield oil and gas. The Huronian white quartzites afford inexhaustible quantities of excellent material for glass making. The red granite of George Islands is well suited for monuments and is a good and handsome building stone. It is easy of access and can be obtained in large blocks. Nickel and copper ores occur at the Wallace Mine on the north side of Bay of islands, and iron and copper ores have been found at a few places among the Huronian quartzites.

J. White, Chief Draughtsman
A. S. Cochrane and C. O. Sénécal, Draughtsmen

Montreal Lithographing Co. Ltd.

PROVINCE OF ONTARIO
Nipissing, Algoma and Parry Sound Districts
(French River Sheet)

Natural Scale $\frac{1}{253440}$

Scale 4 miles to one inch

Accompanying Part I, Vol. IX (New Series)
Geologically surveyed by R. Bell

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SOURCES OF INFORMATION

Surveys by A. Murray, R. Bell and A. E. Barlow, Geological Survey
Charts of Hydrographic Survey of Canada
Plans of surveys of Crown Lands Dept. of Ontario