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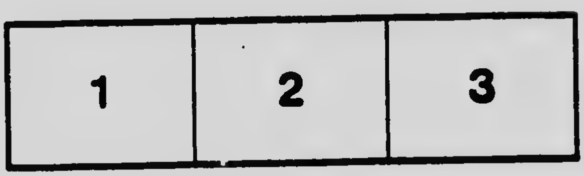
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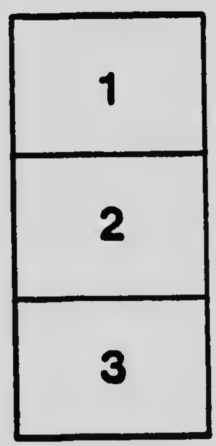
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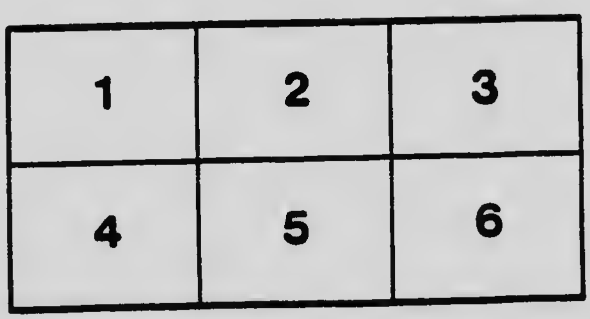
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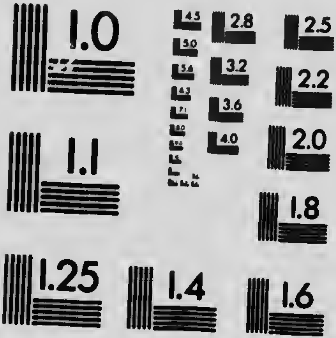

CANADA
DEPARTMENT OF MINES
GEOLOGICAL SURVEY
HON. ROBERT ROGERS, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

MEMOIR No. 17—E

GEOLOGY AND ECONOMIC RESOURCES

OF THE

LARDER LAKE DISTRICT, ONT.

AND

ADJOINING PORTIONS OF PONTIAC COUNTY, QUE.

BY

MORLEY E. WILSON

OTTAWA
GOVERNMENT PRINTING BUREAU
1912

No. 1160

Frontispiece. PLATE I.

12894

Lake Opasatika, from Polson narrows.

CANADA

DEPARTMENT OF MINES

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12894—A No. 1160

To R. W. Brock, Esq.,
Director Geological Survey,
Department of Mines.

Sir,—I beg to submit the following report on the geology and economic resources of the Larder Lake district, Ont., and adjoining portions of Pontiac county Que.

I have the honour to be, Sir,
Your obedient servant,

(Signed) **Morley E. Wilson.**

Ottawa, May 18, 1910.

TABLE OF CONTENTS.

ILLUSTRATIONS.

Photographs.

Drawings.

Maps.

LARDER LAKE DISTRICT, ONT.

AND

ADJOINING PORTIONS OF PONTIAC COUNTY, QUE

BY

Morley E. Wilson.

INTRODUCTORY.

General Statement and Acknowledgments.

Along with the rapid development of mining in the Timiskaming region, and the continued northward progress of railway construction, the activities of the prospector have been directed more and more to the country lying to the north of Lake Timiskaming, and beyond the height of land. Up to the present the chief result of this activity has been the discovery of gold at widely separated points throughout this territory, one of the most important of these localities being the Larder Lake district.

The following report treats of the geological and economic resources of the Larder Lake district, Ontario, and adjacent portions of Pontiac county, Quebec. This region is of special interest, not only because of its possibilities as a gold mining camp, but also because it is geologically typical of a wide stretch of country in that part of northern Ontario and Quebec. The report is accompanied by a geological map of the whole area examined, on a scale of 1 inch = 2 miles, and an additional, more detailed map of the mining claims in the vicinity of Larder lake, on a scale of 1 inch = 1 mile.

Since very few of the numerous lakes and rivers of the district had been previously mapped, a considerable part of the field work required for the preparation of the geological maps was necessarily devoted to making topographical surveys. For this purpose, tl Rochon micrometer telescope and surveyor's compass we:e used i mapping the lakes and navigablo streams, whilo a chain and su veyor's compass wero employed on the portages. The surveys mac in this way were tied to the numerous base, meridian, and town ship lines run by the Crown Lands Departments of Ontario an Quebec. The map thus prepared, with the addition of tho numerou surveyed claim lines in tho area, in most cases, furnished sufficien located points to fix tho geological boundaries, but in some plac additional surveyed lines were necessary.

Tho surveys and geologicul investigations, upon which tl report with the accompanying maps is based, occupied the season of 1908 and 1909. In 1908, field work was carried on in the vicinit of Lake Opasatika. In 1909, the area covered the previous year wa extended eastward to Kekeko lake, in Quebec, and westward acros the interprovincial boundary to Larder lake, in Ontario. Durin the latter season, the topographical part of the work was carried o by Mr. Robert Harvie, of McGill University. By this arrangemen the writer was left free to devoto his attention to the geologica features of the area. Messrs. G. H. Kilburn, W. D. McAndrew and A. R. McLaren were attached to the party as student assistan in 1908, while Messrs. A. J. Merrill and N. B. Davis acted in th samo capacity in 1909.

The following are the surveys, other than our own, which wer used in the preparation of the geological map accompanying th report:—

Interprovincial boundary survey between Ontario and Quebe from Lake Timiskaming to the height of land, by O'Hanly an O'Dwyer, 1873-4.

Survey of lakes on Canoe route from Windigo to Larder lak by W. A. Parks, 1904.

Extension of Interprovincial boundary survey northward fro the height of land, by Patten and Leberge, 1906.

Base, meridian, and township lines surveyed by the Crow Lands Departments of Ontario and Quebec.

Surveyed claim lines recorded with the Ontario Bureau o Mines, and the Department of Mines for Quebec.

The earliest topographical work in the region was a micrometer survey of the canoe route from Lac des Quinze to Abitibi, made in 1867, by Mr. Lindsay Russell.

In 1893, Mr. J. S. Bignell also made a survey of Albee, Evain (Kaishk[1]), and Kekeko lakes, for the Quebec government. The last named surveys, however, although accurate in general, were not sufficiently detailed to warrant their use on a map on the scale of 2 miles to 1 inch.

The thanks of the survey are due to Mr. Albert Mckegg and Mr. John Alger, of the Klock Lumber Company; to Mr. John Hough, Mining Recorder at Larder City; to Mr. H. P. Depencier, Manager and Mr. D. S. Sawyer, Secretary, of the Dr. Reddick Gold Mining Company; to Mr. B. Brooks, of the Tournenie Mining Company, and to many others, who by their co-operation assisted in the progress of the work.

Location and Area.

The district described in the present report lies on both sides of the interprovincial boundary between Ontario and Quebec, about 30 miles north of Lake Timiskaming, and immediately south of the height of land. It comprises a rectangular area of about 600 square miles, measuring 30 miles in length from east to west, and 20 miles in breadth from north to south.

Transportation and Communication.

There are several routes which may be followed in reaching this region. For the eastern part, the easiest and most used means of access is the Abitibi canoe route from Lac des Quinze. For the Ontario portion of the district, either the new government road from Dane, or the canoe route from Windigo lake, may be followed.

Prior to the autumn of 1908, when the government road from Dane to Larder lake was completed, the usual route from Lake Timiskaming to Larder lake was by way of Tomstown, on the Blanche river. This village was reached either by steamboat from New Liskeard, or by railway to Heaslip, a station on the Timiskaming and Northern Ontario railway, 3 miles distant. The steam-

[1] Several geographical names used on the map which accompanies this report have been changed in the text, in accordance with recent decisions of the Geographic Board

boat service has since been discontinued. As the river route from Tomstown to Wendigo lake is very circuitous, with three portages, one of which is over a mile in length, that portion of the Blanche is usually avoided by taking the road to Wilson landing, a distance of 7 miles. From Wendigo to Larder the canoe route follows a connected chain of lakes, which afford comparatively easy travelling, the portages, although numerous—eleven in number—being

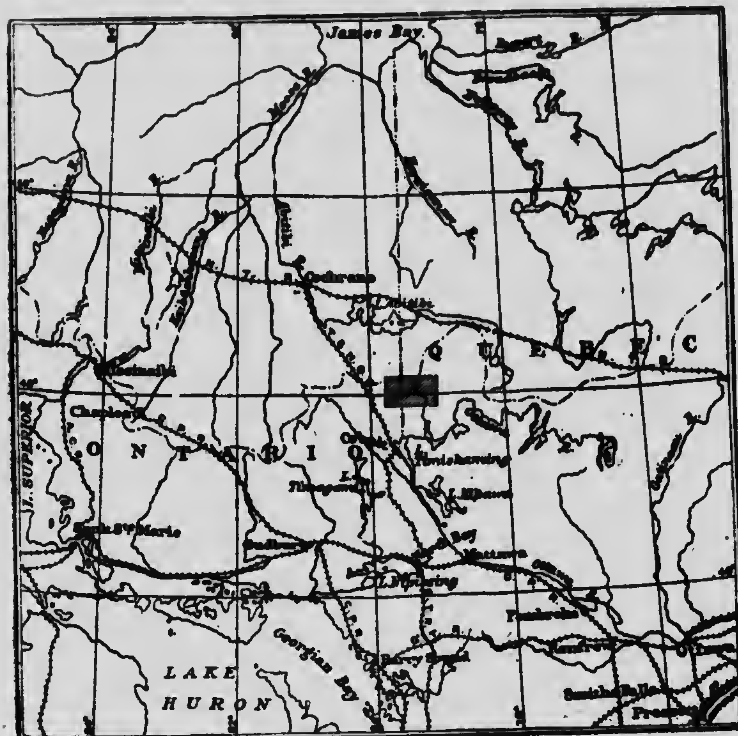

FIG. 1. Index map showing position of area covered by report.

all short, in no case more than a fourth of a mile in length. There is also a wagon road from Wendigo to Larder lake, with two branches, an eastern one leading to Fitzpatrick landing, and a western one to Spoon bay, but this route is now seldom used except for winter traffic.

In 1908 a wagon road was constructed by the Provincial Government from Dane, a station on the Timiskaming and Northern Ontario railway, to Larder City, a distance of 18 miles. Since the completion of this route a stage service has been maintained between Larder City and the railway, so that Larder lake can now be reached in less than twenty-four hours from Toronto or Ottawa.

The chief means of communication for the eastern part of the district is through the old and well known canoe route from Lake Timiskaming to Abitibi, of which Lake Opasatika forms a part. There are two roads which may be followed in starting out on this route, one which leads from Ville Marie to Gillies Depot, at the foot of Lac des Quinze, and the other from North Timiskaming to Klocks Depot, 15 miles farther north on the same lake. With the exception of one portage less than a fourth of a mile in length, on the Barrière river, there is a continuous waterway, navigable by canoe, from Lac des Quinze to the head of Lake Opasatika. Lake Opasatika can also be reached from either Wendigo or Larder, through the canoe route which connects with the eastern extremity of Raven lake. There are two branches to this route, indicated on the map, a northern one leading from Wigwaug lake to Klock bay, and a southern one leading to Atikameg bay. The portages on the northern branch are exceedingly rough and poorly cut out, so that the southern branch is much the better route, although even on it there are two rocky portages, three-fourths of a mile in length, and a stream that becomes difficult to navigate in the late summer, owing to low water. In the winter of 1908-9, a road was cut from the head of Lake Opasatika to the northeast arm of Larder lake, by the Pontiac and Abitibi Mining Company. This, while too rough for a wagon road, is very useful for winter traffic.

History of Development.

The country from Lake Timiskaming northward was one of the first districts, in northeastern Canada, visited by the early French explorers, for a trading post was opened on Lake Abitibi in 1686; so that even at that early date communication between Lake Timiskaming and beyond the height of land had become fairly well established. From the canoe route indicated on the early maps of Canada, it seems certain that the French in going from Timiskaming to Abitibi followed the east or Abitibi branch of the Blanche river, to Labyrinth (Labirinto) lake, instead of the now well known route by way of Lac des Quinze and Lake Opasatika. Since both of these routes pass through the area described in this report, some inference may be drawn with regard to the time of the first explorations in the region.

For many years following these explorations of the French, the Larder Lake district and adjoining portions of Pontiac county remained comparatively unknown, except to the fur trader and the Indian. Lumbering operations, begun in the Timiskaming region about sixty years ago, created a certain amount of activity in the Quebec section of the area, but it was not until after the discovery of silver ores at Cobalt, in the autumn of 1903, that the district attracted attention.

By the spring of 1906, prospectors had extended their activities from Lake Timiskaming northward into both the Ontario and Quebec portions of this region, with the result that in July of that year gold was discovered about 2 miles northeast of Lake Opasatika, by two prospectors, Alphonse Ollier and Auguste Renault, the specimens obtained consisting of quartz, carrying considerable coarse gold. The following month a similar occurrence of gold was discovered by Dr. Reddick on the northeast arm of Larder lake, and before the end of the summer a large number of claims had been staked in the district, from which specimens carrying visible gold were obtained. The return of the prospectors in the autumn, with the news of their discoveries, was followed by a winter stampede to the region, and despite the thick mantle of snow which covered the surface, nearly the whole country in the vicinity of Larder lake was indiscriminately staked. Over forty mining companies, with a total capitalization of nearly $100,000,000, were organized during the winter for the purpose of prospecting and developing claims in the district. The evil effect of the promotion of so many companies, on claims the value of which was entirely unknown, was shown by the history of the camp during the following summer. In some cases money was spent in developing claims, in order to fulfil promises made during the promotion of the company or to comply with the demand of shareholders, although the value of the prospect scarcely justified the expenditure. In one instance, a mill was

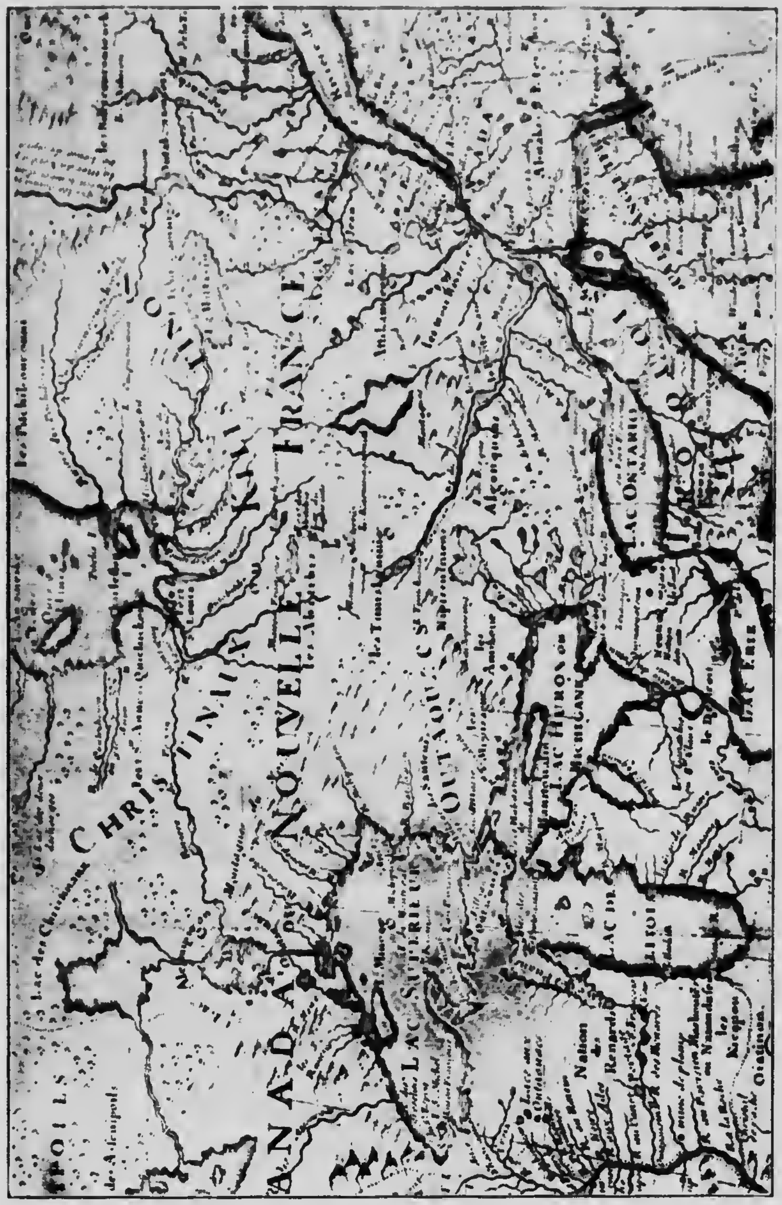

FIG. 2. Section of De l'Isle's Map of Canada, 1703.

erected before a single blast had been set off or an assay made to ascertain the extent and value of the ore deposit on the property. The inevitable failure and consequent disappointment which followed the employment of such methods necessarily retarded the progress of development work on the more promising claims in the district.

Previous Work.

The geological reports having reference to the Larder Lake district and the adjoining portions of Pontiac county, have up to the present been entirely preliminary in character, confined for the most part to descriptions of some of the most important routes of travel through the area. In the Report of Progress of the Geological Survey, Canada, for 1872-3, there is a geological description by Mr. Walter McOuat of the canoe route from Lake Timiskaming to Lake Abitibi, which includes a very accurate account of the geology of Lake Opasatika. In the Report of the Ontario Bureau of Mines for 1902, Dr. W. G. Miller, Provincial Geologist of Ontario, gives an account of his observations along the Abitibi branch of the Blanche river, during a canoe trip to the height of land, made in the summer of 1901. The 1904 Summary Report of the Geological Survey, Canada, includes a report by Dr. W. A. Parks, of Toronto University, on the geology of the country from Lake Timiskaming northward, which describes the chief geological features of some of the leading waterways of the area. The reports of the Provincial Government of Quebec on mining operations in that Province for 1906 and 1907 have sections devoted to geological observations by Mr. J. Obalski, in the northern part of Pontiac county, in which the discovery of gold at the north end of Lake Opasatika, and the similarity of this occurrence to that on Larder lake, is mentioned. Mr. R. W. Brock, now Director of the Geological Survey, spent about two weeks, in June, 1907, making a geological examination of the country in the vicinity of Larder lake. His report, accompanied by a sketch map of the area, was published in the same year, by the Ontario Bureau of Mines. Some geological notes and a second sketch map by Mr. N. L. Bowen, who, as Mr. Brock's assistant, spent the greater part of the summer of 1907 in the Larder Lake district, were also published in the Report of the Ontario Bureau of Mines for 1908.

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SUMMARY AND CONCLUSIONS.

The Larder Lake district and adjacent portions of Pontiac county possess in general the same series of Pre-Cambrian rocks in the same stratigraphical succession as found elsewhere in that part of northern Ontario and Quebec; but nevertheless, in the large proportion of sedimentaries, quartzites, arkoses, slates, and dolomites, contained in the pre-Huronian complex, it presents a geologic feature distinct from most of the other districts of the Timiskaming region.

The earliest record of geological events in the area is found in either the Keewatin or the Pontiac schist. These two groups of rock occur as a rule in separate areas and never in contact with one another, so that their age relationship was not determined.

The oldest member of the Keewatin group, the greenstones and green schists, consists entirely of igneous rocks, for the most part volcanic, as shown by their amygdaloidal and ellipsoidal structures. Along with these effusions of lava a considerable thickness of muds and ferruginous carbonates was deposited, these sediments constituting the Larder slates and dolomites. Following the deposition of the greenstones, slates, and dolomites, intrusions of quartz porphyry, rhyolite, and aplite occurred, accompanied by considerable deformation of the intruded rocks. The three members: greenstone and green schist, Larder slate and dolomite, and quartz porphyry, rhyolite and aplite, although not precisely correlative in age, are always closely associated with one another, and together comprise the Keewatin group.

The Pontiac schist, unlike the Keewatin, consists entirely of sediments, which early in Pre-Cambrian time were transformed into crystalline schists. They form a very extensive series of rocks, occupying nearly the whole of the Quebec portion of the district included in the accompanying map. Since they are highly quartzose and of sedimentary origin, it necessarily follows that they have been derived from still more ancient relatively acid rocks, although such have not been recognized in the region.

Both the Keewatin and Pontiac schist are intruded by a complex of acid igneous rocks comprising a border portion of an immense batholithic mass, extending for many miles to the southward and eastward beyond the confines of the district. This Laurentian complex consists of a great many varieties of rock, including biotite granite, hornblende granite, and granodiorite, all of which are intruded by numerous dykes of granite, aplite, and pegmatite. The junction of the batholith with the Keewatin and Pontiac schist is characterized by a wide contact zone, in which numerous fragments of the older series occur within the granite mass. It is probable that these great igneous intrusions accompanied great deformative, mountain making, movements, which folded and metamorphosed the rocks of the ancient complex into much their present condition.

The igneous activity of the Laurentian epoch was followed by a long period of quiescence, during which the rocks of the Keewatin, Pontiac schist, and Laurentian were eroded, the region approximately base-levelled, and a great thickness of clastic Huronian sediments deposited. These sediments have, since their deposition, been firmly cemented into hard, resistant rocks, but otherwise, have not been altered or deformed. They consist, in a general way, of a basal conglomerate, passing upward through greywacke into arkose, which in its turn is conformably overlain by an upper conglomerate. Since Pre-Cambrian times, the series has suffered almost continuously from denudation, so that it now occurs in the district as residual hills and ridges, mere remnants from which its original extent and thickness can merely be inferred.

The Huronian, as well as the older rocks of the district, are intruded locally by diabaso and gabbro, lithologically identical with similar rocks occurring at Cobalt and elsewhero in the Timiskaming region. In Boischatel township between Ollier and Renaud lakes, the basal conglomerate of the Cobalt series is also intruded by a mass of syenite porphyry which, however, has probably been derived from the same magma as the diabase and gabbro, so that all the post-Huronian intrusives may be grouped together in one class.

The history of the area since the intrusion of the post-Huronian diabase, gabbro, and other rocks, has been largely one of denudation, although it is probable that the district, in whole or in part, was submerged beneath the sea for a time during the Palæozoic, since an outlier of Silurian limestones occurs in Evanturel township, only a few miles distant. However, if such sediments were, at one time, present, they have been entirely removed by erosion, for with the exception of unconsolidated Pleistocene and recent deposits, the post-Huronian intrusions are now the youngest rocks in the area.

There are a large number of mineral occurrences in the Larder Lake district, and adjacent portions of Pontiac county, which have attracted the attention of prospectors in recent years, but the chief interest, from an economic point of view, has centred in the auriferous quartz stringers of the Keewatin ferruginous dolomite. This formation is traversed by two systems of intersecting veinlets of quartz, or of quartz and ferruginous dolomite, which in places are so numerous as to convert the dolomite into a stock work or a breccia. These veinlets, at a number of localities, contain considerable quantities of coarse, free gold, but up to the present such development work as has been done has not resulted in a producing mine.

GENERAL CHARACTER OF DISTRICT.

Topography.

The physical features of the Larder Lake district and adjacent portions of Pontiac county do not differ essentially from those of other portions of the glaciated plateau of Pre-Cambrian rocks which occupy the greater part of northern Ontario and Quebec. Numerous lakes and muskegs, separated by low ridges and rounded knobs of rocks with here and there areas of sand, gravel, or clay, are the characteristic surface features of the region. Thus, in detail the surface of the country varies greatly, although regarded as a whole it is rather monotonous and devoid of contrast.

The district in general has an elevation varying from 900 to 1,200 feet above the sea, the general slope of the surface being to the south and southeast. There are, however, a few monadnock hills and ridges of Huronian rocks, which rise to heights of from 500 to 700 feet above the surrounding country. The highest of these is a hill situated immediately to the southeast of the 40th mile post, on the interprovincial boundary, known as Moun Shiminis. This haystack-like elevation can be seen for many mile from every direction, and is by far the most striking single topo graphic feature of the whole region. According to an aneroi determination by Dr. Parks, it has a height of 750 feet above Larde lake, or between 1,800 and 1,900 feet above the sea. There are als two prominent hills between Opasatika and Dasserat (Mattawagosil Island) lakes, which rise to a height of about 1,650 feet (aneroi determination) above sea-level. These are known as the Swingin hills, the name being derived from the Objibway, which means th place where the spirit swings. Some of the Wendigo hills, whic extend along the interprovincial boundary to the west of Fish an Eel lakes, when observed at a distance can be seen to have a serrate outline. This feature owes its origin to the manner in which th surface of erosion tends to parallel the bedding planes of the slight tilted Huronian.

This district, as is usual in Pre-Cambrian regions, abounds lakes, over one hundred occurring within the area of 600 squa miles described in this report. They vary in size from small pon

Plate II.

View looking north, Ward lake.

only a few chains in diameter, to lakes several square miles in area; the largest, Lake Opasatika, occupying about 20 square miles. In those localities where the rocks have a definite and uniform structure, it may be observed that the rock structure expresses itself in the linear arrangement of the lake basins. Thus, the northeasterly-southwesterly trending chain of lakes, on the Wendigo canoe route, parallels the strike of the Huronian rocks in which it occurs. The same phenomenon of parallelism between hydrography and geological structure is exemplified by Wigwaug (White Birch) lake, and by the northeast arm of Larder lake.

The drainage of the area is largely into Lake Timiskaming, in the eastern part by way of the upper Ottawa, and in the western by way of the Blanche river and its tributaries. There are, however, a few lakes in the northern margin of the district, which are north of the St. Lawrence-Hudson Bay divide and flow directly or indirectly into Dasserat (Mattawagosik, Island) lake and thence to Abitibi and James bay.

Owing to the intense glaciation to which the region has been subjected, the drainage system of the area possesses most of the characteristic features of youthful topography. Except where superficial deposits are well developed, stream erosion since glacial times has been practically insignificant. In all the more rocky portions of the district, the watercourses consist of a succession of alternating lakes, rapids, and waterfalls. This feature is most typically exemplified by the watercourse which forms the canoe route from Larder to Wendigo lake. Some of the waterfalls on the Wendigo route, and on the Blanche river, are very excellent potential water-powers, and would become valuable if a demand for power were created by mining or other developments in their vicinity.

Agriculture.

Large areas of clay occur in the Quebec section of the region, which are very suitable for agricultural purposes, the soil being precisely similar to that occurring in the country to the east of Lake Timiskaming, which has supported a large and prosperous farming community for many years. At present these areas are not accessible, but if proper transportation facilities were provided they would no doubt be speedily occupied by settlers from the older districts of the Province.

Flora and Fauna.

Forest.—The best forest growth in the region is found Quebec, the Ontario portions of the district having suffered fr forest fires which swept over that part of the country about fo years ago. Much of the white pine originally present in the a has been removed by lumbering operations, but scattered tr remain here and there. These are rather abundant in the coun around Fish and Lizard lakes. There are some groves of red p in the vicinity of Dushwah lake, but elsewhere this tree is not very common occurrence. Among the more common trees compr ing the thick forest growth which everywhere covers the surface the country are white and black spruce, poplar, birch, banksi pine, and cedar, the dominance of a particular species in a local depending on a number of factors, such as soil, moisture, and for fires. Those portions of the district which have been recently sw by fire are occupied almost entirely by poplar and birch. In clay areas of Montbelliard township the forest is largely spru while in sandy districts, such as the western part of Hearst to ship, banksian pine predominates Cedar is confined to the lo lands, and the shores of lakes and rivers.

Many of the wild animals, especially the more valuable of fur-bearing species, which were formerly abundant in the distr are now uncommon. Moose are very numerous, and bears rather plentiful. Red deer and caribou are said to be prese although none were observed during the two seasons spent in region. Beaver, otter, martin, fisher, mink, and fox are also fou but are rapidly disappearing, and will no doubt continue to decre in numbers as the country develops.

GENERAL GEOLOGY.

Summary Statement.

The rocks of this region, if classified according to age, fall i a number of subdivisions; but in a larger way, divide themsel into two strikingly different groups, to the first of which belong Keewatin, Pontiac schist, and Laurentian, and to the second, Huronian. The rocks of the first class are dominantly igneous, are more or less highly metamorphosed and folded. The Huron

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e, and forest
cently swept
ch. In the
gely spruce,
Hearst town-
to the low-

uable of the
the district,
bears are
be present,
pent in the
also found,
to decrease

ge, fall into
e themselves
n belong the
second, the
igneous, and
he Huronian

PLATE III.

Rapid, foot of Hough lake.

12894—p. 14.

rocks, on the other hand, are entirely sedimentary, are metamorphosed in only a few localities, and have a nearly horizontal attitude.

The oldest rocks occurring in the area belong either to the Keewatin or to the Pontiac schist, but the age of the two series relative to one another is unknown.

Under the Keewatin has been included a large variety of closely associated rocks, the structural relations of which have been more or less obscured by the intense deformation and metamorphism to which they have been subjected. Three divisions in the series can, however, be recognized. These, beginning with the oldest, are greenstone and green schist, Larder slate and dolomite, and quartz porphyry and aplite. The greenstone and green schist, the most extensive and oldest formation, consists of basic to intermediate igneous rocks, a great part of which possesses structures characteristic of volcanic lavas. Interbedded, or possibly infolded with these volcanics, a sedimentary formation occurs. This comprises the Larder slate and dolomite. The third division of the Keewatin consists of quartz-porphyry which in a number of localities was observed to intrude the greenstone and green schist.

The name Pontiac schist has been used to designate a fine-grained, uniform, biotite schist, which occurs extensively in the eastern, Quebec portion of the region. From the mineralogical composition and microscopical appearance of this rock, it seems probable that it is a metamorphosed quartzite or arkose, and since no similar series in the same stratigraphical position has been previously described in the Timiskaming district, it has been called the Pontiac schist.

The Keewatin and Pontiac schist series are both intruded by a third division of the ancient metamorphic complex, the Laurentian. This consists entirely of acid igneous rocks, granite, gneiss, pegmatite, and aplite.

Overlying the Keewatin, Pontiac schist, and Laurentian, and separated from them by a most profound unconformity, is a series of clastics—conglomerate, greywacke, and arkose—comprising the Huronian. These rocks have been only very slightly folded into northeasterly and southwesterly trending synclines and anticlines, the angle of dip averaging about 10°. They have been very firmly cemented, however, and have so resisted erosion that they form all the higher hills and ridges of the area.

The Huronian, as well as the older rocks of the funda[illegible] complex, are intruded and metamorphosed locally by several ties of rock, including diabase, gabbro, and syenite porphyry. intrusions, with the exception of unconsolidated Pleistocen[illegible] recent deposits, being the youngest rocks in the area, are de[illegible] simply as post-Huronian. The diabase and gabbro are [illegible] doubt, approximately, equivalent in age to similar rocks fo[illegible] Cobalt, and elsewhere in the Timiskaming region.

Although at present there are no Palæozoic rocks in thi[illegible] it is evident from the presence of an outlier of Niagara lim[illegible] in Evanturel[1] township, less than 10 miles distant, that duri[illegible] Silurian epoch marine sediments were deposited in this regi[illegible] the last remnant of these has been removed by erosion.

The rocky surface of this district is, to a large extent, o[illegible] by unconsolidated Pleistocene deposits of two classes. To t[illegible] class belong the widely distributed boulders, gravel, sand, a[illegible] material left by retreating ice of the glacial epoch; and [illegible] second, the stratified clay and sand, laid down during the lac[illegible] epoch of post-glacial times. The latter occupy very wide[illegible] especially in the Quebec section of the region.

Table of Formations.

The geological succession, in descending order, is outli[illegible] the following table:—

Pleistocene and Recent.

Post Glacial........................Clay, sand, and gravel.
Glacial...........................Boulders, gravel, sand, till.

UNCONFORMITY.

Post-Huronian.

Diabase, gabbro, syenite porphyry.

IGNEOUS CONTACT

Huronian.

Conglomerate.

Arkose.

Greywacke.

Conglomerate.

[1] Geological Survey, Canada, Summary Report, 1909, p. 221.

UNCONFORMITY.

Laurentian.

Granite, gneiss, granodiorite, pegmatite, aplite.

IGNEOUS CONTACT.

Keewatin[1].	Pontiac schist[1].
Quartz porphyry, aplite, rhyolite.	Biotite schist, and quartz schist.
Larder slate and dolomite.	
Greenstone and green schist.	

Keewatin.

GENERAL CHARACTER AND SUBDIVISIONS.

The Keewatin embraces a complex group of more or less metamorphosed sedimentary and igneous rocks, which may be subdivided into three stratigraphical divisions. These in ascending order are: (1) greenstone and green schist; (2) Larder slate and dolomite; (3) quartz porphyry.

GREENSTONE AND GREEN SCHIST.

Distribution.—Owing to the numerous scattered remnants of Huronian which overlie the greenstone and green schist, as well as the innumerable small outcrops of the other members of the Keewatin associated with it, large continuous areas of the rock are not common. For this reason, no attempt will be made to outline its distribution in detail. In the Ontario portion of the district, the greenstone and green schist is the dominant rock in McVittie, Hearst, Skead, and the northwestern part of McGarry townships. In Quebec it occurs along the northern margin of the district included in the map-sheet, and in a few localities in the vicinity of Lake Opasatika, the largest of these being an area between Lake Opasatika and McLaren creek. On the whole, it is moderately well exposed, more especially so in McVittie and McGarry townships.

Lithological Character.—The greenstone and green schist member of the Keewatin consists of a great variety of basic to intermediate igneous rocks, which, however, possess one common characteristic—they are all green in colour, and for that reason are designated greenstone or green schist, according as the rock is massive or foliated. Mineralogically, they have all been more or

[1]Relationship of Keewatin and Pontiac schist not ascertained.

less altered, but the greenstones retain much of their origina ture and structure, whereas the schists have been comp recrystallized, so that their original character can only be in from their field relations.

The rocks of the massive greenstone type, as originally c tuted, belong to the diorite-andesite, diabase-basalt or peri family, although in their present form little more than the c of the original constituent minerals can be observed. On the the greenstones are exceedingly fine-grained, but locally th e.. .se textured and porphyritic. In many places they possess oidal and amygdaloidal structures, the amygdules showing a tudinal arrangement parallel to the direction of the strike amygdules usually consist of a carbonate or epidote, less con of quartz. On lot 10, concessions IV and V, Skead town mass of serpentine traversed by carbonate seams occurs, whic the arrangement of its alteration products as observed un microscope, originally consisted largely of olivine. The gre always contains a large amount of pyrite, and in some plac bonate, as on the south shores of Washusk lake where tho content is sufficient to give the rock a light grey, almost appearance.

Examined under the microscope, the greenstones are f vary in texture from coarsely holocrystalline and ophitic grained and aphanitic. In its most typical form the rock of small altered crystals of plagioclase, included in a m carbonate, epidote, and chlorite. The original augite, wh no doubt present in the rock, had entirely disappeared fro every thin section examined. The constituents of the roc than those mentioned, are: hornblende, sericite, pyrite, m ilmenite, sphene, and secondary plagioclase. The primary clase is always so decomposed as to render its further iden impracticable, although from the character of the rock it is ably in most cases labradorite.

The schistose varieties in the greenstone-green schist of the Keewatin are not nearly so abundant as the more phases. They occur most extensively, in the vicinity Opasatika, where they adjoin the Laurentian intrusive consist for the most part of chlorite and amphibole rocks

PLATE IV.

Calcite-chlorite seams in chloritic greenstone, north shore of Moose bay, Lake Opasatika.

12894—p. 18.

PLATE V.

Grooved surface resulting from the weathering out of dolomite interlaminated with hornblende schist, east shore Lake Opasatika.

a more or less parallel arrangement of their constituent minerals. Like the greenstone, they usually contain an abundance of carbonate and pyrite, the latter occurring in places as cubes, an inch or more in diameter. In some localities, notably on the north shore of Moose bay, Lake Opasatika, these rocks are traversed by a network of calcite and chlorite seams, which appear as grooves on the weathered surface (Plate IV). Also on the prominent point which occurs on the east shore of Lake Opasatika, just outside the entrance to the same bay, there is a hornblende schist belonging to this phase of the Keewatin, which is interlaminated with ferriferous dolomite (Plate V).

Microscopic examination of these rocks shows them to be largely composed of ferromagnesian minerals, some sections consisting entirely of chlorite, others of amphibole, others of hornblende—both actinolite and tremolite. Calcite and feldspar are also abundant in some sections; the other minerals present, such as biotite, quartz, pyrite, magnetite, and sphene, are unimportant.

Examination of the green schist under the microscope gives little evidence as to the original character of the rock from which it was derived, but when its field relations are studied it is seen that in places the greenstone and green schist pass into one another by an insensible gradation, showing that both types of rock were originally the same, the schistose variety representing simply a more advanced stage in dynamic metamorphism.

Structural Relations.—Owing to the metamorphosed condition of the greenstone and green schist, as well as their homogeneous character, the detailed structure of these rocks was not determined. That they are highly folded, however, is shown by the nearly vertical attitude of the sediments associated with them. A similar inference can be drawn in places, from the rapid variations in the greenstone from a fine-grained, amygdaloidal, to a coarse-textured rock, when observed in a direction at right angles to the strike. With regard to the relationship of the other members of the Keewatin to the greenstone and green schist, it is believed that the slates and dolomites were probably laid down contemporaneously with the original volcanic flows, and have been subsequently folded into their present position, although there is a possibility that they, entirely or in part, overlie the greenstones, and have been infolded. The relationship of the quartz porphyry and aplite, although som complex in places, is evidently that of a younger intrusive, si occurs as dykes cutting the greenstone and green schist.

Origin.—The rocks comprising the greenstone-green member of the Keewatin, while not all of precisely the sam are all of the same general basic to intermediate character, igneous partly intrusive, but largely effusive, and belong great epoch of igneous activity. A large part of the gree has many of the characteristic textures and structures of igneous flows, and even where these are lacking, the field re are such in many places as to indicate their volcanic origin. are, however, along with these volcanic lavas, some dyk identical in composition and degree of metamorphism with th greenstones, and evidently of approximately the same age green schists of the Keewatin, as was pointed out above, were ally massive greenstones, but have been recrystallized and under the action of dynamic agencies.

LARDER SLATES AND DOLOMITES.

General Character and Distribution.—Throughout the K greenstone and green schists, in the Ontario portions of the also in Quebec to the northeast of Lake Opasatika, areas an of slate, phyllite, dolomite, and iron formation occur in a of localities. These rocks have their greatest developmen the north shore of Larder lake, where they occur in an e belt over a mile in width and several miles in length. They of well bedded phyllites and slates, interbanded with fer dolomite, the dolomitic bands having widths ranging from yards to several hundred feet. The iron formation consi few small outcrops of banded jasper and magnetite, occurr in the slate and greenstone. One of the largest of these exposures occurs on the peninsula to the south of the Na Larder lake.

There has also been included with the Larder slate so mitic, sericite schist, chiefly that occurring in the vic Diamond and Marjorie lakes, in McVittie township, and west trending band situated a short distance north of Ren on the property of the Pontiac and Abitibi Mining Compan

Intersecting quartz veinlets in dolomite, Chesterville claim, McGarry township.

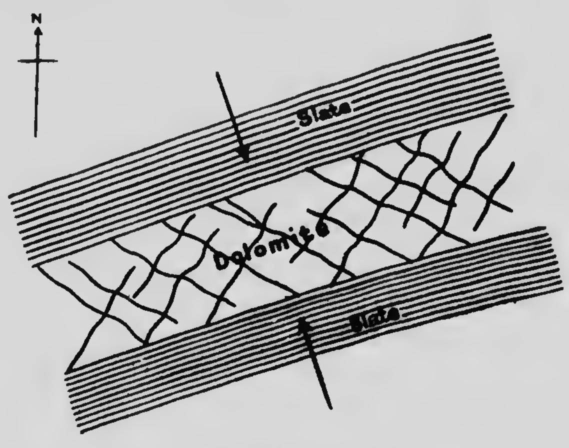
sericite schist may result from the metamorphism of either igneous or sedimentary rocks, the origin of this schist cannot be determined from its petrographical character. It has been classed provisionally, however, with the Larder slate, because of its association at a number of points with dolomite and a dolomitic chert-like rock.

Lithological Character.—Lithologically, the Larder slates and dolomites do not differ essentially from similar sedimentary rocks deposited in more recent geological periods. The slates and phyllites are soft, grey to green rocks, showing two distinct cleavages, one parallel to the bedding, and the other crossing the bedding planes obliquely. The most interesting phase of the altered sedimentaries are the dolomitic bands, which, owing to their highly siliceous and hence more resistant character, stand up conspicuously as ridges wherever they occur. They consist of pyritic, silicified, ferruginous dolomite, or possibly ankerite, traversed by numerous intersecting veinlets of quartz, or of quartz and ferruginous dolomite. In most localities the fresh rock has a bright green appearance, owing to the presence of a chromiferous mica, probably fuchsite. On the weathered surface the bands are always covered by a thick coating of rust owing to the oxidation of the ferruginous dolomite. The quartz veinlets which cut the rock are almost always present even in beds only a few feet in thickness, and in many places becomes so numerous as to convert the rock into a stockwork or breccia. They usually terminate abruptly at the margin of the band, or extend but a few inches, at the most, into the adjoining slate. In a number of localities the veinlets can be seen to cut one another obliquely, appearing on the surface as a rhomboidal network. This feature is well illustrated by an outcrop of dolomite on the Chesterville claim, shown in Plate VI. These dolomite rocks are of special importance because of the occurrence of gold in some of the quartz veinlets. The greater part of the prospecting and mining activity in the Larder Lake district and adjacent areas, in recent years, has been confined to this auriferous quartz of the brecciated dolomite.

Examined in thin section, under the microscope, the slates and phyllites are seen to consist largely of chlorite, with smaller amounts of pyrite, quartz, sericite, orthoclase, dolomite and plagioclase, the latter minerals becoming more abundant in the less meta-

morphosed phases of the rock. The dolomitic rocks, in some p
consist entirely of ferruginous dolomite, chromiferous mica,
pyrite, but usually varying proportions of feldspar, quartz,
sericite are also present. The chromiferous mica, as a rule,
not occur uniformly disseminated through the dolomite, but
tributed in a linear form, which suggests that the mineral
developed along fractures in the rock, in a secondary manner.

Structural Relations.—The structural relations of the L
slates, phyllites, and dolomites can be best studied in the di
to the north of the northeast arm of Larder lake. In this lo
they occur as a conformable succession of strata, with a un
southwesterly strike, a uniform cleavage, and an approximatel
form dip, usually about 70 degrees or more to the northwes



Scale
0 — 6 ft.

FIG. 3. Relation of fractures in dolomite to direction of stress.

would seem that during the deformation of these rocks the r
dolomite tended to fracture, in accord with the laws of dy
along planes making an angle of approximately 45 degree
the direction of stress, so that two systems of fissures inte
one another at 90 degrees were developed. The relationship
fractures, now occupied by quartz veinlets, is shown in Fig. 3

As they occur on the north shore of Larder lake, the slates and dolomites appear to be interstratified with the greenstones and green schist, and while it may be possible that they are in reality younger than all the greenstones, having been infolded to their present position, there is no structural evidence in support of such a conclusion. Conglomerates, or other evidence of unconformity, were not observed along th line of junction of the slates and the greenstone, the two rocks apparently grading into one another.

Thickness.—In the district along the north shore of Larder lake, where the slate and dolomite are most extensively developed, these rocks seemingly form a conformable monoclinal succession, dipping steeply to the northwest for over a mile. If it be assumed that there has been no duplication of beds in this distance, the Larder slate and dolomite in that locality have a thickness of 5,000 feet, of which 900 to 1,000 feet, or nearly one-fifth, consists of ferruginous dolomite.

Origin of the Dolomitic Rocks.[1]—In the Summary Report of 1910 it was pointed out that, while it was assumed that the carbonate rock occurring on the north shore of Larder lake and elsewhere in that vicinity, owed its origin to sedimentary deposition in a manner similar to the slates and phyllites with which it was there associated, there was apparently a relationship between the dolomite and the quartz porphyry which this assumption did not explain. If it be assumed, for the purpose of investigation, that the ferruginous dolomite is not of sedimentary origin, it seems necessary to conclude that the rock has originated by the alteration and replacement of quartz porphyry and aplite under the action of hydrothermal solutions. That replacement has taken place, under this hypothesis, is evident from the fact that carbonation of all the lime, iron, and magnesia in the quartz porphyry or aplite would result in less than 25 per cent of ferruginous dolomite, whereas the carbonate rock usually contains 40 per cent and upwards of this constituent.

The evidence supporting the hypothesis of alteration and replacement of the porphyry and aplite by hydrothermal solutions may be briefly stated as follows:—

(1) On claim L M 31, McVittie township, immediately north of the Harris-Maxwell property, masses of porphyry—too small to

[1]Revised Nov. 30, 1911.

be indicated on the map—occur in the dolomite. The dolomite als
passes transitionally into the porphyry, on claim L M 31, on th
Valentine claims in Skead township, and in the southwest corne
of Hearst township.

(2) The porphyry everywhere contains a considerable propo
tion of carbonate, and in places is largely replaced by it. This
exemplified by porphyry dykes occurring on the south shore
Fortune lake, on the property of the Pontiac and Abitibi Minin
Company.

(3) Numerous veinlets of quartz and dolomite containi
chrome mica intersect the porphyry dykes occurring on the sou
shore of Fortune lake. Similar veinlets also cut the aplite occu
ring on the Gold King claims HF 140, on claim SV 501, and
a number of points on the shore of Fitzpatrick bay, Larder lak

(4) The following observations, while not conclusive when co
sidered individually, yet taken as a whole indicate without a dou
that the carbonate rock or the rock from which it was derived h
n subjected to the action of hydrothermal solutions.

The minerals quartz, chrome mica, ferruginous dolomite, se
cite, and pyrite, which constitute the dolomitic rock, are those wh
commonly result from hydrothermal action.

The mineral tourmaline, which contains boron, occurs in t
quartz veins traversing the dolomite.

Mr. N. B. Davis, who assisted in the field work in this distr
during the summer of 1910, found the carbonate rock to conta
traces of boron.

The occurrence of the chrome mica in the quartz veinlets
porphyry, as well as in the carbonate rock, suggests that this mine
is of secondary origin and, if secondary, a result of hydrother
action.

As opposed to the above hypothesis it may be observed that
carbonate rock in its most extensive development is interbed
with slate and phyllite, and occurs in uniform continuous ba
extending for several miles, that the quartz porphyry and aplite
not unique in containing considerable carbonate since all the K
watin rocks of the region show the same alteration to a greater
less degree, and further, there is no apparent reason why the repl
ment should be largely limited to a locality where sedimentary ro
occur.

It is apparent, therefore, that hydrothermal solutions have acted on the Keewatin rocks of the region and that some carbonation and replacement have been effected through their agency, but in view of the intense metamorphism and deformation to which these rocks have been subjected, and the extreme mobility of carbonates under such conditions, the writer has assumed provisionally that the carbonate rock as it occurs in its most typical development—along the north shore of Larder lake—is of sedimentary origin.

QUARTZ PORPHYRY, RHYOLITE, AND APLITE.

General Character and Distribution.—The greenstone and green schist described above are intruded here and there by quartz porphyry, rhyolite, and aplite, which have been included in the Keewatin as a third subdivision. Owing to the complex manner in which these rocks and the greenstone and green schist have been intermingled it is difficult in places to properly delimit all of the outcrops on the map. The largest area in the district is that which occurs in the vicinity of Bear lake, on the boundary between McVittie and McGarry townships.

Lithological Character.—The quartz porphyry in its most typical occurrences is a fresh, pink to grey rock, containing distinct phenocrysts of quartz and feldspar. As a rule it is highly charged with pyrite, and contains considerable ferruginous dolomite, which gives the rock a yellow appearance on the weathered surface. In some places it is cut by veinlets of quartz and carbonate precisely similar to those traversing the dolomitic bands. The name rhyolite has been assigned to a few small acidic dykes of exceedingly fine texture. The aplite is a pink rock consisting largely of feldspar and quartz, has a medium texture, and is intersected by veinlets of quartz and dolomite of the usual character.

The microscopic study of the quartz porphyry shows the rock to consist of phenocrysts of quartz, orthoclase, and plagioclase, enclosed in a matrix of quartz and feldspar, usually accompanied by some carbonate and chlorite. The plagioclase phenocrysts range all the way from albite to labradorite, but the alkalic varieties predominate. In those sections in which basic plagioclase becomes abundant, the orthoclase disappears, so that the rock passes out of the granite-rhyolite family into the diorite-andesite group of rocks,

and is, therefore, not properly quartz porphyry but quartz porp
rite. Since, however, quartz porphyry is the predominating t
the name porphyrite has been omitted. The rhyolite is prec
similar in composition to the quartz porphyry but possesses a
texture. The aplite when examined microscopically was foun
consist largely of quartz, graphic intergrowths of quartz and
spar and alkalic plagioclase, with carbonate and pyrite in very s
quantities.

Structural Relations.—Owing to the mechanical deformati
which the acidic members of the Keewatin have been subjecte
is difficult to determine their structural relations, but the evid
considered as a whole indicates that they are generally you
than the other members of the group. Throughout conside
areas the porphyry and greenstone appear to be very much i
mingled, so much so as to form a pseudo-conglomerate, and
possible that some of this rock may be simply the interior, co
portion of acidic volcanic flows. In a few places, however,
defined dykes of the porphyry intrude the greenstone, and a si
relationship holds for the rhyolite and aplite. If the dolo
rock is of sedimentary origin, then the quartz porphyry rh
and aplite must have intruded the dolomite, forming an
mediate rock, for all intermediate types between quartz por
and aplite and the dolomite are present. There is an alter
possibility, however, that the dolomitic rock has been formed
dykes of aplite, quartz porphyry, and related rocks by th
replacement, but, in either case, the acidic members of the
watin must be younger than the Larder slate and phyllite.

Relation of the Keewatin to Other Series.—The Ke
group, as elsewhere in the Timiskaming region, and beyo
intruded by the Laurentian granite and gneiss, and is o
unconformably by the Huronian. Its relationship to the I
schist was not ascertained, owing to the fact that the two ser
largely confined to separate portions of the district, and as
was observed do not occur in contact with one another. T
Keewatin has been intruded by the Laurentian is inferred fr
presence of inclusions of hornblende schist in the granite and
in the vicinity of the Keewatin contact. But there is a
further evidence that the highly metamorphosed green sch

uartz porphy-
inating type,
e is precisely
sesses a finer
was found to
artz and feld-
in very small

deformation to
subjected, it
the evidence
erally younger
t considerable
y much inter-
rate, and it is
aterior, coarser
however, well-
and a similar
the dolomitic
phyry rhyolite
ning an inter-
uartz porphyry
an alternative
n formed from
ks by thermal
rs of the Kee-
yllite.

-The Keewatin
and beyond, is
and is overlain
to the Pontiac
e two series are
t, and as far as
other. That the
nferred from the
anite and gneiss
here is also the
green schists of

Plate VII.

Vertical Keewatin slate, claim H. F. 31, McGarry township.

12894—p. 26.

the Keewatin are chiefly developed in the district adjacent to the Laurentian batholithic border. The unconformable relationship of the Huronian to the Keewatin is shown by the occurrence of fragments of the various Keewatin rocks in the Huronian conglomerate, and by the immense structural break which separates the two groups of rocks, the flat-lying Huronian resting on the upturned edges of the Keewatin.

PONTIAC SCHIST.

General Character.—In the eastern part of the district large areas are occupied by a very fine-grained, uniform mica schist, constituting an extensive series, lithologically distinctly separate from all the other rocks of the fundamental complex. It consists essentially of quartz and biotite, with usually some feldspar, either orthoclase or albite. The relationship of the series to the Keewatin was not ascertained, but, like the latter, it is intruded by the Laurentian granite and gneiss.

Distribution.—Although the rock surface in the district in which the Pontiac schist occurs is largely buried beneath Pleistocene deposits, rock exposures are sufficiently numerous to indicate its approximate distribution. With the exception of the southwest corner, it occupies practically the whole of Montbeillard township. There is also a westward extension from the main area along the line between Dufay and Dasserat townships, which reaches within less than 2 miles of the interprovincial boundary. The Pontiac schist thus comprises a continuous area of over 100 square miles, although its actual extent, if its distribution beneath the Huronian is considered, is no doubt considerably greater. The surface distribution of the series is sharply defined to the north by its contact with the Huronian, but to the south and west its areal extent cannot be fixed on the map, except within wide limits, owing to the contact zone which marks its junction with the Laurentian. To the east it extends beyond the limits of the area mapped.

Lithological Character.—The Pontiac schist varies in mineralogical composition from a biotite schist to a quartz schist. When freshly broken the rock presents a bright grey appearance, but on the weathered surface is usually more or less rusted, due to the oxidation of sulphide of iron. In a number of localities pyrrhotite, or pyrrhotite and magnetite, occur interlaminated with the schist, the mineralized zone having a width of several feet. Irregular veins and lenses of quartz strung out along the parting of the schist are also very common, particularly on the east shore of Moose bay, Lake Opasatika. On weathered surfaces the rock, in places, presents a ridged appearance, the ridges occurring in two sets at right angles to one another. The greater resistance to weathering shown by the schist at these points arises apparently from a slightly finer texture, since the ridges differ in no other respect from the rest of the rock. The origin of the textural variation was not apparent, but might possibly arise by recrystallization along rectangular joint planes.

Examined microscopically, the schist is found to consist essentially of quartz and biotite, with or without feldspar, the latter when present being usually orthoclase, but in some cases albite. Small quantities of other minerals, such as pyrite, muscovite, calcite, epidote, and garnet are commonly present as accessory constituents. The biotite, as a rule, is not very abundant, and is always more or less chloritized. In the more schistose sections the quartz grains are distinctly elongated in the direction of schistosity. The texture is rather fine-grained, although the individual mineral fragments vary considerably in size. In sections of some of the more massive specimens of the rock, the mica can be seen to fill the interspaces between the quartz grains.

Origin.—The microscopic examination of thin sections of the rock, as well as its field relationship, suggest very strongly that the Pontiac schist has been derived by metamorphism from ancient quartzose sediments. The banded character of the rock, in places; the occurrence of magnetite interlaminated with the schist; and the hornfels structure, which it exhibits in places when examined in thin section, under the microscope, are all indicative of a sedimentary origin. And since, in some localities, the rock consists almost entirely of quartz, having a silica content as great or greate than most acid igneous rock, it seems probable that the origina rock, at these points at least, was a quartzite. In some of thos portions of the schist most remote from the contact of the intrude Laurentian granite and gneiss, particularly in the vicinity o Kekeko lake, the rock seems to have suffered less alteration, and t retain in part its original clastic character. A thin section of th

PLAEE VIII.

Pontiac schist, east shore Moose bay, Lake Opasatika.

12894—p. 28.

schist from Kekeko lake, when examined under the microscope, was found to consist largely of grains of quartz, orthoclase, and plagioclase, evidently constituting an arkose. The presence of such an extensive series of quartzose sediments in the fundamental complex seems to necessarily imply the existence of an older Laurentian granite in this region. This, however, if exposed at the surface, has not yet been recognized.

Structural Features.—The very pronounced schistosity shown by the Pontiac schist, as well as the banding which in some places parallels the schistosity, suggests that the cleavage and the original bedding planes of the rock are coincident. The manner in which slabs of the rock break off parallel to these planes of parting is particularly well exemplified on the east shore of Moose bay, Lake Opasatika (Plate VIII). The angle of dip of the cleavage varies from zero to nearly vertical, but is usually less than 60 degrees. The direction of dip also changes greatly, although in general it is to the north or northeast, away from the intruded Laurentian granite and gneiss. Vertical or nearly vertical jointing planes paralleling the strike of rock are very common.

Relations to Other Formations.—The Pontiac schist was not observed adjacent to Keewatin rocks, although outcrops of greenstone belonging to the latter group occur within short distances of the schist, in the vicinity of Lake Opasatika. The exposures, however, afforded no evidence as to the stratigraphical or structural relationship of the two groups, so that their age with respect to one another was not determined.

The manner in which the Laurentian granite and gneiss have invaded the Pontiac schist is strikingly evident throughout a wide zone along their contact. In the district to the east of Lake Opasatika, the border of the Laurentian batholith contains numerous blocks of the mica schist throughout a belt several miles in width. These xenoliths are in many cases cut by numerous intersecting dykes of granite, aplite, and pegmatite, the older dykes, in some places, being faulted along the plane of the younger, as shown in Fig. 4. In the country to the west of Lake Opasatika the manner of intrusion appears to have been largely by lit par lit injection, innumerable narrow dykes of the granite penetrating the schist parallel to its cleavage, at intervals of a few inches or less. This type of igneous intrusion is illustrated in Fig. 5.

Throughout the contact belt to the east of Opasatika, small local areas of rock rich in ferromagnesian minerals are of common occurrence. In some places these consist entirely of hornblende, in

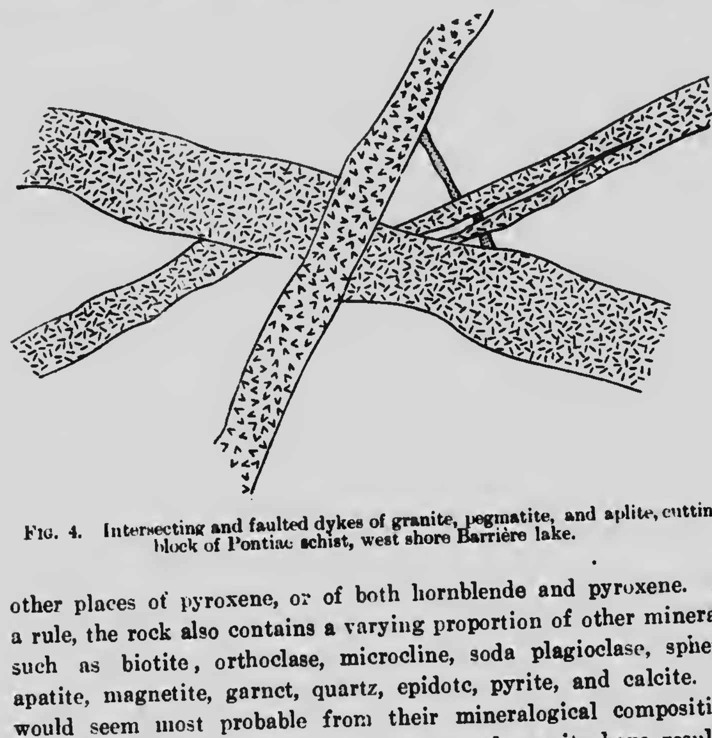


FIG. 4. Intersecting and faulted dykes of granite, pegmatite, and aplite, cutting block of Pontiac schist, west shore Barrière lake.

other places of pyroxene, or of both hornblende and pyroxene. As a rule, the rock also contains a varying proportion of other minerals, such as biotite, orthoclase, microcline, soda plagioclase, sphene, apatite, magnetite, garnet, quartz, epidote, pyrite, and calcite. It would seem most probable from their mineralogical composition, that these peculiar variations in the normal granite have resulted in some way from the recrystallization and partial assimilation of masses of Keewatin greenstone, although there is also the possibility that they are original segregations (ideoliths) in the granitic magma itself.

The unconformable relationship of the Huronian to the Pontiac schist might be inferred from the fact that the latter has been much more highly metamorphosed. However, in a number of places, Huronian conglomerate occurs overlying and containing fragments of the schist, thereby giving ample proof of an erosional break between the two series. That this is not only an erosional but a marked structural break is clearly shown by the difference in the direction and angle of dip at the point of junction, the Huronian dipping slightly to the northwest, and the schist steeply to the northeast.

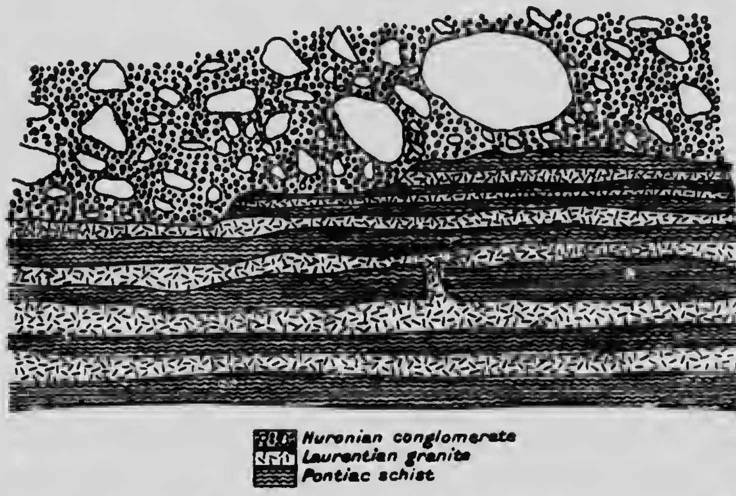


FIG. 5. Pontiac schist, intruded by Laurentian granite, and unconformably overlain by Huronian conglomerate, east shore of island in Rest lake.

The Pontiac schist is intruded in a few places by dykes of post-Huronian diabase, the most conspicuous examples being the long northeasterly-southwesterly ridges which subdivide the two large expansions at the northern end of Lake Opasatika.

LAURENTIAN.

General Character.—Practically the whole of the southeastern part of the district mapped is occupied by a complex of acid igneous rocks of various kinds constituting the Laurentian. These consist largely of granite and gneiss, although passing locally by loss of quartz, or of quartz and orthoclase, into syenite or diorite. They vary greatly in texture and composition from point to point, and are cut nearly everywhere by dykes of aplite and pegmatite, the whole forming an igneous mass of a very heterogeneous character. These rocks are younger than the Keewatin and Pontiac schist, since they intrude them, but are overlain unconformably by the Huronian.

Distribution.—The Laurentian of this district comprises a marginal portion of the larger area of similar rocks extending for many miles throughout the country, to the southward and eastward. Within the limits of the accompanying map, it is confined to the northern half of Pontleroy and Desandroins townships, and the southern part of Dufay and Montbeillard. The western border of the area is delimited by the Huronian, while the northern border is fixed by its contact with the Pontiac schist.

Lithological Character.—The rocks belonging to this series of acid intrusives, except where masses of pyroxenite and amphibolite occur, are always very light coloured, with a texture varying from extremely fine to very coarse-grained. The most typical member of the series is a biotite granite, although hornblende granite, syenite and diorite are locally not uncommon. The hornblende and biotite of the granite in many places show a slight parallelism in the arrangement of the individual mineral crystals, but a pronounced gneissoid structure is not extensively developed, except in the country immediately to the west of Atikameg bay, Lake Opasatika

In many places the granite and gneiss are intruded by dykes o pink aplite and pegmatite which from their lithological characte and field relations were evidently formed during the Laurentia epoch of igneous activity, and hence constitute an essential part c that group. Mineralogically, these are identical in compositio consisting of quartz, orthoclase, or microcline, with a small quan tity of muscovite, but the aplite has a fine-grained, almost felsiti texture, while the pegmatite is very coarsely crystalline, containir feldspar individuals 3 inches or more in length.

Microscopic examination of the Laurentian rocks shows tha omitting the aplite and pegmatite from consideration, two ma classes may be recognized, the first of which is characterized biotite as its ferromagnesian constituent, and the second by hor blende. The rocks of the biotite group are usually granites gneisses, consisting essentially of biotite, quartz, orthoclase, a microcline. Those of the hornblende subdivision range from hornblende granites to diorites, consisting chiefly of hornblende, orthoclase, and microcline, or alkalic plagioclase, with quartz entirely absent or present in subordinate amounts. Other minerals occurring in these rocks in less abundance are muscovite, apatite, sphene, epidote, allanite, magnetite, calcite, ilmenite, pyrite, and chlorite, the latter always of secondary origin after biotite or hornblende. The calcite is much more common in the hornblende rocks, especially the more basic varieties. The aplite and pegmatite, where examined microscopically, were found to consist chiefly of quartz orthoclase and microcline, with muscovite in subordinate quantity. Accessory minerals were not numerous, but when present were chiefly magnetite, biotite, and calcite.

In addition to the rock types just described, the contact zone of the Laurentian with the Keewatin and Pontiac schist contains numerous local areas of hornblendite, pyroxenite, and other variations from the normal granite, all rich in ferromagnesian minerals. If these, however, have resulted from the modification of included blocks of Keewatin greenstone they cannot properly be regarded as an integral part of the Laurentian series. Where examined under the microscope, in some cases, they are found to consist of hornblende, in others of pyroxene or of both of these minerals, but, as a rule, more or less feldspar, either acid plagioclase, orthoclase, or microcline. In some sections biotite is very abundant, along with other minerals such as sphene, apatite, magnetite, pyrite, calcite, epidote, and garnet.

Structural Features.—Structurally, the Laurentian rocks of this area appear to form a marginal portion of an immense batholithic mass, which occurs extensively throughout the country to the southeast of the district. This border belt constitutes an igneous complex of exceedingly variable character, containing numerous inclusions of the invaded rocks, and cut nearly everywhere by dykes of granite, aplite, and pegmatite. It is probable from the wide extent of the contact zone between the Laurentian and older schists, that the upper margin of the granitic mass was nearly horizontal and parallel to the present erosion surface of the country.

Relation to Other Formations.—The intrusive relationship of the Laurentian to the other members of the ancient complex, the

Keewatin and Pontiac schist, is inferred from the character of the contact zone, which occurs along the granitic, batholithic border. In the vicinity of its junction with the Keewatin, a number of exposures of hornblende schist occur within the granite, which are without doubt inclusions of the greenstone-green schist member of that series. In a similar manner the Laurentian, adjacent to the Pontiac schist, contains numerous blocks of that series throughout a belt several miles wide. It would, therefore, seem very probable that the areas of rock, rich in ferromagnesian minerals, which occur so abundantly throughout this contact zone, have resulted from the partial melting and recrystallization of included xenoliths of Keewatin greenstone, and it may be questioned whether all of the basic hornblende variations in the Laurentian have not originated in this way, representing simply a further stage in the process of intrusion and assimilation. In the district to the west of the north end of Lake Opasatika, the Laurentian has intruded the Pontiac schist in the form of innumerable narrow dykes interlaminated with the latter parallel to its foliation.

The unconformable relationship of the Huronian to the Laurentian can be observed at a number of points along the line of junction of the two series, the Huronian conglomerate resting on the eroded surface of the granite and gneiss. The more detailed discussion of this relationship will be given in the section devoted to the Huronian.

The Laurentian granitic rocks are intruded in a few localities by dykes of diabase and gabbro, lithologically identical with similar rocks of post-Huronian age. The dykes, however, are narrow, and of very limited extent.

HURONIAN.

General Character and Subdivisions.—A considerable part of the area represented by the accompanying map is occupied by hills, ridges, and smaller remnants of Huronian strata which rest on the eroded and nearly horizontal surface of the older complex. They consist of a very heterogeneous series of clastic sediments—conglomerates, arkoses, and greywackes, with all intermediate variations. These rocks are not sharply separate from one another; for conglomerate may occur in the midst of greywacke or greywacke i the midst of conglomerate, and a similar relationship may exist between any of the members of the series. However, if minor variations be disregarded, in most places where the Huronian occurs, a succession can be recognized, consisting of a basal conglomerate passing upward through greywacke into arkose, which in its turn is overlain by an upper conglomerate.

Distribution.—Owing to the immense number of scattered outcrops of Huronian present in the district, no attempt is made to outline the geographic distribution of the series in detail. The largest Huronian area is that comprising the series of hills and ridges extending along the interprovincial boundary, and eastward across the northern part of the Quebec portion of the region. Outside of this belt there are two other areas which might be mentioned: one on the north shore of Larder lake extending from the Narrows eastward, and the other at the south end of the west arm of the same lake. Elsewhere in the district the exposures of Huronian are all merely small remnants capping the Keewatin, Laurentian, or Pontiac schist.

Basal Conglomerate.—At the base of the Huronian, where its contact with the older complex is exposed, there is usually a coarse conglomerate, resting in some places on a very definitely denuded surface, but in others, grading into the older rock. The conglomerate is never distinctly stratified, although in a few places a slight parallel alignment of the pebbles can be observed. It varies greatly in thickness in different localities, the maximum being about 200 feet.

When studied in the field the basal conglomerate is found to vary greatly from point to point, both in the size and variety of its pebbles and boulders, and in the character of their cementing material. In some localities the enclosed fragments consist entirely of small pebbles, whereas, in other districts, huge boulders predominate; and the matrix, which in one locality is a fine-grained greywacke, in another district may be a coarse-grained arkose. Small local masses of arkose, or greywacke, within the conglomerate, are also common.

The pebbles and boulders of the conglomerate embrace all the numerous rock varieties contained in the underlying complex, although fragments of the greenstone and green schist are not as abundant as might be expected. Pebbles of Laurentian granite and gneiss, on the other hand, are very common, even in localities remote from the district in which these rocks occur. Fragments of porphyry, quartz, and bright red jasper are also numerous in some portions of the district, especially in the country to the north and west of Larder lake. As might be expected in a rock of such coarsely clastic character, the pebbles and boulders are in places very angular, although well rounded fragme[illegible] also common.

The matrix of the conglom[illegible] le, is very coarse-grained, consisting, in part, of minut[illegible] ments identical with the enclosed pebbles and boulders, an[illegible] various minerals, such as quartz, feldspar, and chlorit[illegible] examined microscopically, minute grains of mica schist, green[illegible] porphyry can be observed, along with variable quantiti[illegible] plagioclase ortho-clase, chlorite, pyrite, epidote, and car[illegible] [illegible] tion of this material, like the pebbles an[illegible] g the rock, may be angular, subangular, or well r[illegible]nded, [illegible] intermediate type predominates.

Greywacke.—The basal conglomerate is followed in ascending order by a second member of the Huronian series, which is largely composed of greywacke, but included some beds of arkose, and here and there a patch of conglomerate. It is, also, not uncommon in some localities for a single isolated boulder, 2 feet or more in dia-meter, to occur in the midst of the greywacke, without a single pebble to be seen in its vicinity. The greywacke is usually a bedded green to grey rock which, studied microscopically, is found to consist largely of minute fragments of quartz, orthoclase, and plagio-clase embedded in a chlorite matrix. A number of other constituent of less importance, such as sericite, epidote, hornblende, and car-bonate are also commonly present.

Arkose.—The greywacke described in the previous paragrap is gradually replaced in passing upward by arkose, the transitio zone consisting of alternating beds of the two rocks, from a fe inches to several feet in thickness. This member of the Huronia is not nearly so extensively developed, nor so sharply defined in th area as in the immediate neighbourhood of Lake Timiskamin to the southward. Microscopic examination of the rock shows it

Slightly tilted Huronian greywacke, Dushwah lake.

consist primarily of rounded to angular grains of quartz, orthoclase, and plagioclase, with subsidiary quantities of calcite, sericite, epidote, and pyrite.

Upper Conglomerate.—Resting conformably on the Huronian arkose, is an upper conglomerate, which differs but little from the basal member of the series. As a rule, the enclosed fragments of this conglomerate are smaller than those in the lower, but the two rocks are lithologically so nearly identical that they cannot be differentiated in the field, except where their stratigraphical relations are known.

Thickness.—Owing to the lack of distinct bedding planes in the conglomeratic members of the Huronian, it is usually difficult to determine the direction and angle of dip of a complete section of these rocks so that their exact thickness can not always be determined, although vertical sections of portions of the series can be obtained in many of the prominent hills of the region. The maximum vertical thickness is probably about 900 feet, but this would be slightly greater than the actual thickness, for the series has a dip of about 15 degrees. This thickness, on the other hand, may be considerably less than the maximum thickness actually present in the region, and is certainly much less than that originally deposited, since a large part of the series has been removed by denudation.

Structural Features.[1]—The Huronian on the whole has not been greatly deformed, being very gently folded into northeasterly and southwesterly trending anticlines and synclines, with an angle of dip averaging 10 degrees. In the neighbourhood of Larder lake, however, there are numerous areas of conglomerate which have been greatly mashed in a direction parallel to the strike of the underlying Keewatin. These conglomerates might have any one of the three following relationships to the other rocks of the region: (1) They might be Keewatin conglomerates deposited between the volcanic flows of that series in a manner somewhat similar to the interflow conglomerates which occur in the lower portion of the Keweenawan series. (2) They might belong to an older Huronian series, that is, a series younger than the Keewatin but older than

[1]Revised Nov. 30, 1911.

the *undisturbed* Huronian. (3) They might be portions of the ordinary flat-lying series which have suffered local disturbance.

It is possible that conglomerates belonging to all three of the above classes are present in the region, but the evidence is not conclusive. There is an area of mashed conglomerate on the shore of Larder lake, at Larder City, which has been intruded in a most complex manner by a hornblende lamprophyre—vogesite (see Plate X). The pebbles of this conglomerate also differ from the normal type in that they consist entirely of quartz porphyry, rhyolite, and iron formation. From the occurrence of pebbles of iron formation in the rock it might be concluded that it is younger than the Larder slate since the latter contains some of that formation. The presence of the intruded lamprophyre, which was not observed to cut the undisturbed Huronian, suggests on the other hand that the mashed conglomerate may be older than the flat-lying series and that it, therefore, belongs to class 1 or 2. It was also observed, however, that in some outcrops, where the mashed conglomerate had a considerable vertical thickness, the schistosity appeared to diminish from the base upward, as if the contact of the flat lying Huronian and the Keewatin might have served as a plane of deformation. This phenomena can be seen in a conglomerate hill situated on the northern boundary of claim H.J.B. 21, in McGarry township. From this observation it is probable that the mashed conglomerate, in some localities at least, represents simply a local phase of the normally flat-lying series.

In a recent contribution to the Engineering and Mining Journal, Dr. W. G. Miller describes certain mashed conglomerates occurring in the vicinity of Kirk and Cross lakes, in the Cobalt district. These conglomerates, like that at Larder City, have been intruded by lamprophyre dykes which in turn are cut by 'dykes of fine-grained granite, apophyses from the Lorrain mass.' He, therefore, concludes that this mashed conglomerate belongs to a Huronian (Timiskaming series), older than the less disturbed Huronian or *Cobalt series*. The occurrence of the lamprophyre cutting the sheared conglomerate at Larder City suggests that this conglomerate may be the equivalent of Dr. Miller's Timiskaming series.

Relations to Other Formations.—The relations of the Huronian to the Keewatin, Pontiac schist, and Laurentian indicate that prior to the deposition of the series a prolonged period of erosion occurred, during which the highly folded and metamorphosed rocks of the

Mashed conglomerate cut by a lamprophyre dyke, on shore of Larder lake at Larder City.

ancient complex were reduced to almost a peneplain. The abundance of small scattered remnants of Huronian in some portions of the district, shows that at these points, at least, the pre-Huronian base-levelled surface corresponds very closely with the present surface. But some hills of Keewatin occur in the area, having an elevation of from 200 to 300 feet above the general level of the country, and these were no doubt much more prominent prior to the time of the deposition of the Huronian, since they have certainly been much reduced by post-Huronian denudation. The areas where Laurentian rocks occur have also been greatly eroded, since all traces of the Huronian have been entirely removed throughout nearly their entire extent. It is probable that during the erosion interval which preceded the Huronian epoch, the Keewatin rocks suffered more rapid erosions than the Laurentian, so that the more prominent monadnocks of that ancient peneplain were composed of rocks belonging to the latter group.

The contacts between the Huronian and the rocks of the older complex reveal some interesting facts with regard to the character of the surface upon which the basal conglomerate of the Huronian was deposited. In some places the underlying rock passes gradually upward into the conglomerate, without any definite line of junction. This feature can be seen at the base of many of the small Huronian outcrops overlying the Larder slate and dolomite, and at the junction of the Huronian and Pontiac schist exposed at the northern extremity of Lake Opasatika. On the other hand, in some localities the contact is very sharply defined, the conglomerate resting on a smooth undecomposed surface of the older rocks. This is best exemplified on the south shore of Rest lake, where a rounded knob of Laurentian granite is overlain by coarse conglomerate.

Origin of the Huronian.[1]—The Huronian in the region under discussion, as elsewhere in the Timiskaming district, is largely represented by a series of conglomerates, greywackes, arkoses, and quartzites, formerly classed, in the Cobalt district, as lower and middle Huronian, but now designated the *Cobalt series.*[2] The origin of this group of rocks presents a problem for which a solution entirely satisfactory to those geologists most familiar with the facts

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[1]Revised Nov. 30, 1911.
[2]Engineering and Mining Journal, Vol. 92, p. 648.

to be observed in the field has not been obtained. The series was at one time thought to be wholly or in part of pyroclastic origin; later it was suggested by Dr. W. G. Miller that desert conditions prevailed in this region, in Huronian times, although he noted that the conglomerates in some respects resembled a glacial till; R. W. Brock and others also pointed out the similarity of these deposits to glacial material, but considered the evidence available at that time inconclusive, while Dr. A. P. Coleman, who has contributed several papers to the discussion, is convinced of their glacial origin.

A complete investigation of such a problem, however, involves the consideration of every possible process which may have played a part in the formation of the various members of the series. These processes may include any of the following:—

(1) Marine or marine littoral deposition.[1] (2) Wind deposition. (3) Accumulation in situ by the normal process of weathering. (4) Deposition from floating ice. (5) Fluviatile deposition. (6) Lacustrine deposition. (7) Glacial deposition; or (8) any combination of the above.

I shall apply some of the criteria which distinguish deposits originating in these various ways, and endeavour to draw some conclusion as to the probable origin of the series.

(1) The great heterogeneity and general absence of complete sorting throughout the greater part of the Huronian, the angularity or subangularity of the pebbles and boulders in much of the conglomerate, and the great thickness and enormous extent of the conglomerate are features not characteristic of marine or marine littoral deposits, and furthermore, the ancient regolith which occurs at the base of the series, in places, could scarcely have survived a marine submergence accompanied by the intense wave-action which the accumulation of a wide-spread basal conglomerate several hundred feet in thickness necessarily implies. The marine or marine littoral origin of the Huronian of this district need not, therefore, be further considered.

(2) In a few localities, notably in the vicinity of Lake Timiskaming, the quartz grains of the Huronian quartzite are surrounded

[1] Journal of Geology, Vol. XIV, p. 325.

by a film of hematite, which might possibly indicate the existence of an arid or semi-arid climate at the time the quartzite was deposited. The general domination of disaggregation over chemical decomposition in the formation of the Huronian is also probably in harmony with dry climatic conditions. Nevertheless, if an arid or semi-arid climate existed at any time during this Huronian period, it was not of sufficient intensity for æolian action to become the dominant depositional factor, for in most localities the quartzite and arkose are sufficiently well stratified to indicate a subaqueous origin, and the quartzite occurring in the vicinity of Lake Timiskaming, the grains of which are coated with hematite, contains rounded pebbles of quartz and jasper which are clearly waterworn and not windworn fragments. Moreover, since the greater part of the Cobalt series, although of continental origin, is unoxidized, it is more probable that a humid climate prevailed at the time the series was deposited, rather than desert conditions as has been suggested by Dr. Miller.[1]

(3) The gradational contacts between the Huronian and the underlying rocks seem to indicate, that, at the time Huronian deposition was initiated, the surface of the ancient complex was in a condition very similar to that of the granites of the Piedmont plateau, to-day, as described by Merrill.[2] The basal beds of the Huronian, at these points, were evidently developed in situ by the normal process of weathering, and represent a fossil soil. It is evident, however, from the presence of stratification in a considerable part of the Huronian and from the great variety of pebbles and boulders in the conglomerate, that transportation was involved in the formation of the greater part of the series. A part of the Huronian conglomerate is, therefore, evidently a remnant of an ancient regolith, but the origin of the great mass of the series must be explained in other ways.

(4) It might be possible for a group of rocks having some of the characteristics of the Cobalt series to be deposited on the sea-bottom from icebergs. The evidence pointing to a continental origin, however, is so conclusive that this mode of deposition for the whole series need not be seriously considered. Nevertheless the

[1]Report of Bureau of Mines of Ontario, Pt. II, p. 41.
[2]Bulletin of the Geological Society of America, Vol. VI, pp. 321-332.

presence of large boulders, a foot or more in diameter, in the midst of fine-grained stratified greywacke, seems to necessitate the agency of floating ice. It is, therefore, concluded that floating ice was present in the lakes or rivers of this Huronian period.

(5) The great variation in the size and constitution of the pebbles and boulders composing the conglomerate of the Cobalt series, the varying degree of abrasion to which these fragments have been subjected, and the great variability observed in the rocks of the series, when followed along the strike or along the dip, are general characteristics which commonly belong to sediments of fluviatile origin when deposited not far from the source of supply.

As opposed to the fluviatile origin of the Cobalt series, it may be noted, however, that the transportation of large boulders which occurs in places in the conglomerate has not been satisfactorily explained. These boulders are commonly 2 feet or more in diameter, and, in the case of the granite boulders, are in some places many miles from the nearest possible source. And furthermore, since the surface upon which the conglomerate was deposited was comparatively flat,[1] the streams effecting the transportation of the boulders would necessarily have comparatively gentle gradients. It has been suggested by Dr. Miller that the climate of Huronian times was semi-arid, and that with such climatic conditions violent floods might account for the transportation of such large boulders,[2] but from the evidence cited in (2) and (4), it is more probable that the climate throughout the greater part of the period was cold and humid and that torrential action was, therefore, unimportant.

(6) In some localities the greywacke, quartzite, and arkose of the Cobalt series is distinctly and uniformly bedded (see Plate IX), and the quartzite in places is also characterized by uniform and continuous ripple marks. From these observations it is inferred that the stratified greywacke, quartzite, and arkose were deposited from shallow standing bodies of water, and are, therefore, probably of lacustrine origin.

(7) In a paper contributed to the American Journal of Science in 1907, and in a number of publications since that time, Dr. A. P. Coleman has advocated the glacial origin of the Huronian of

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[1]See page 38.
[2]Report of Bureau of Mines of Ontario, Part II, 1907, p. 58.

northern Ontario and Quebec, and has pointed out the striking similarity of the conglomerate of the Cobalt series to Pleistocene till and to the Dwyka conglomerate of South Africa. The principal features upon which Dr. Coleman bases his conclusions may be summarized briefly as follows: the great thickness and wide extent of the conglomerate; the great size, angularity, and heterogeneity of the included pebbles and boulders; the character and variability of the matrix; the occurrence of immense boulders at a distance of several miles from the source of supply, and, finally, the discovery of scratched and polished pebbles and boulders in the conglomerate at Cobalt.[1]

In opposition to Dr. Coleman's hypothesis it has been maintained that glaciated surfaces should somewhere be found beneath the conglomerate instead of the regolith which commonly occurs.[2] But as Dr. Coleman has pointed out,[3] glaciated surfaces are not general beneath the till deposited along the border of the North American Pleistocene ice-sheets, nor beneath portions of the South African Dwyka. And, furthermore, smooth undecomposed surfaces have been found beneath the conglomerate of the Cobalt series both in the region described in this report[4] and in the Gowganda district.[5] These surfaces are not unlike the glaciated surfaces which are characteristic of the region at present, although stream erosion or wave-action could no doubt produce a similar effect.

While engaged in mapping the geology of the Larder Lake district and adjacent portions of Pontiac county, the Huronian rocks were especially examined by the writer and his assistants, for any evidence relative to their glacial origin. For this purpose the pebbles and boulders of the conglomerate were separated from their matrix, wherever possible, and their surface examined for striæ, but no pebbles or boulders were found in which scratches could be positively identified. During the past summer, however, Mr. E. M. Burwash, who assisted the writer in the field, succeeded in breaking out some pebbles from the conglomerate occurring at the north end

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[1]Bulletin Geological Society of America, Vol. XIX, pp. 366–397 American Journal of Science, Vol. XXIII, pp. 187–192.
[2]Can. Min. Journal, Vol. XXX, pp. 646–697.
[3]Canadian Mining Journal, Vol. XXX, pp. 691.
[4]See page 38.
[5]Preliminary Report on the Gowganda District by W. H. Collins, Geological Survey, Canada, 1909, p. 31.

of Kekeko lake, in Boischatel township, which were definitely scratched in two directions. The conglomerate at this point lies almost horizontal, and has been neither mashed, sheared, nor faulted, so that the scratches cannot be attributed to any dynamic cause operating after the formation of the conglomerae. The pebbles exhibiting the scratches when separated from their greywacke matrix, are found to consist of fine-grained greenstone, and possess rounded corners and facetted faces—the typical form of glacial stones.

As further evidence bearing on the glacial hypothesis, an attempt was made to obtain a definite estimate of the proportion of 'soled' pebbles and boulders in the Huronian conglomerate. Only those stones having rounded corners and two or more plane faces, which when projected, intersected at a considerable angle, were classed as 'soled,' and, since it was not possible to break out the pebbles and boulders for examination, on all sides, the count was made from observation of the outline exhibited in a given area of rock surface. The estimate made in this way ranged all the way from 8 to 38 per cent, but in all those localities where the conglomerate was extensively developed the percentage was high, usually from 20 to 30 per cent. If it had been possible to break out the pebbles and boulders for examination in three dimensions, the above percentage would certainly be greatly increased. It was observed in making the above estimates that all the more typical areas of conglomerate pebbles or boulders, having sharp corners, were uncommon.

Dr. Coleman's discussion of the origin of the Huronian has been largely confined to the basal conglomerate, although he suggests that beds of stratified conglomerate and slate, lying between masses of tillite, might correspond to Pleistocene interglacial deposits. From the observations cited in sections (5) and (6), above, it was concluded that portions of the Cobalt series were of lacustrine origin. This conclusion, however, is in no way opposed to the glacial origin of the conglomerate, since interglacial and post-glacial deposits are commonly of lacustrine and fluviatile origin. In the region described in this report, the Cobalt series contains a basal and an upper conglomerate. These conglomerates resemble one another very closely and undoubtedly originated in the same way. If it be assumed that these conglomerates are of glacial origin, then they constitute two separate till sheets and the stratified greywacke, arkose, and quartzite are interglacial, or possibly in some localities, post-glacial deposits.

From the above discussion, the following positive conclusions may be cited with regard to the conditions and mode of deposition of the Huronian rocks occurring in the vicinity of Lake Timiskaming and northward: (1) that the series is entirely of terrestrial origin; (2) that the basal portion of the series is, in places, an ancient regolith; (3) that climatic conditions were such at times during this Huronian period that floating ice was abundant in the lakes and rivers of the region, and (4) that lacustrine deposits are also represented in the series.

With regard to the mode of deposition of the major part of the conglomerates of the Cobalt series, only two hypotheses need be considered. They are either of fluviatile origin or have been deposited from continental ice-sheets. From a consideration, however, of the difficulties of transportation involved in the fluviatile hypothesis, and, on the other hand, the facts, that practically every feature of the Cobalt series can be duplicated in the Pleistocene glacial, interglacial, or post-glacial deposits of the same region, that there is evidence indicating that the climate during at least a part of Huronian times was cold and humid, that the pebbles and boulders of the Huronian have characteristically a 'soled' appearance, and that striated pebbles and boulders have been obtained in two localities over 60 miles apart, it seems necessary to conclude that the evidence preponderates in favour of the hypothesis that the conglomerates of the Cobalt series are of glacial origin and have been deposited from ancient Pre-Cambrian continental ice-sheets.

In the foregoing pages an attempt has been made to apply the criteria which distinguish the various types of clastic sediments to the different rock varieties represented in the Cobalt series, and to ascertain in the light of the facts now available which of these will best account for their origin. As a result, it has been shown that the preponderating evidence is in agreement with the glacial hypothesis, for with the exception of the ancient regolith which occurs at the base of the series, the conglomerates simulate a glacial till in every feature; the stratified greywacke, arkose, and quartzite contained in the series have their duplicate in the interglacial and post-glacial deposits laid down by the Pleistocene continental ice-sheets, and the upper conglomerate might well be due to a recurrence of glacial conditions.

The occurrence of the ancient regolith of the base of the Cobalt series is not a serious objection to the glacial hypothesis, when it is considered that the regions of maximum glacial deposition, near the margins of the ice-sheets, are the regions where smoothly eroded and striated surfaces are least abundant, and that the basal conglomerate has been found resting on a smooth undecomposed surface exactly similar to that produced by glacial erosion, in at least two localities.

With the progress of detailed geological investigation in regions where Pre-Cambrian rocks occur, it is becoming more and more apparent that the modern processes of sedimentation and erosion, with all their multiple variations, were at work on the earth's surface even in the early Pre-Cambrian times. The existence of Huronian continental ice-sheets would be simply another link in the chain of evidence pointing to the remarkable uniformity of natural processes even from the very earliest times, in the earth's history, of which we have any knowledge.

Correlation.—It may be noted that no attempt has been made to assign this series to any particular division of the Huronian system, although it is stratigraphically and lithologically equivalent to, and practically continuous with, rocks which elsewhere in the Timiskaming area have been called lower Huronian, or lower and middle Huronian in the Cobalt district. It is doubtful whether the relationship of these rocks to the original Huronian of the north shore of Lake Huron, or to the rocks similarly classified elsewhere in the Lake Superior-Lake Huron region, is at present sufficiently well known to permit of such close correlation. For this reason they have been described as simply Huronian.

POST-HURONIAN INTRUSIVES.

General Features and Distribution.—At widely separated points throughout the region the Huronian and older formations described above are intruded by dykes and small masses of a variety of rocks including diabase and gabbro, olivine diabase, and syenite porphyry. The olivine diabase although observed in only two localities, forms the largest and most persistent post-Huronian dyke of the whole region. This outcrops as a prominent ridge, running in a northeasterly direction, at the north end of Lake Opasatika. It has a width of about 300 yards, and can be traced for several miles. A very small outcrop of olivine diabase also occurs intruding the Laurentian at the east end of Kishkubeka lake. The syenite porphyry was observed in only one locality. It occurs as an oblong mass, about half a mile long and a fourth of a mile wide, between Ollier and Renaud lakes, to the northeast of Lake Opasatika.

A hornblende biotite lamprophyre occurs as an irregular mass on the Harris-Maxwell claim (H S. 115), as irregular dykes intruding the Keewatin greenstone occurring on the south shore of the Narrows in Larder lake, and in dykes cutting the mashed conglomerate which occurs on the shore of Larder lake at Larder City (Plate X). Because of its occurrence in the last mentioned relationship it is described along with the post-Huronian intrusives. If, however, the mashed conglomerate is not a locally deformed phase of the flat-lying Huronian conglomerate, but belongs to the older basement underlying the Huronian, then the lamprophyre is in reality more closely related to the Keewatin complex. In any case it must certainly be much older than the diabase, syenite porphyry, and other rocks classed as post-Huronian, for it has suffered considerable mineralogical alteration.

On the east shore of Larder lake to the north of Big Pete island a small reef of rock occurs which resembles the post-Huronian diabase in appearance, but when examined under the microscope was found to be camptonite. While there is no positive evidence as to the age of this rock, because of its freshness and its occurrence in proximity to post-Huronian diabase it has been classed with the post-Huronian intrusives.

Lithological Character.—The post-Huronian diabase and gabbro as a rule are fresh, massive, dark green rocks of medium texture, but becoming fine-grained and microcrystalline in the smaller dykes, and along the margins of the larger intrusions. On the basis of mineralogical composition, they may be subdivided into two classes according as olivine is present or absent. Both the olivine and the olivine free varieties can be seen in places, even in the hand specimen, to be distinctly ophitic, but in other localities the diabase loses this characteristic and passes into gabbro.

The microscopic study of the post-Huronian diabase and gabbro reveals very distinctly the various textures, ophitic, allotriomorphic, and porphyritic, which characterize tho rock in its different localities. As a rule, it consists of elongated crystals of labradorite enclosed in augite, with small amounts of apatite, magnetite, and ilmenite. Quartz is not commonly present in the rock, and when it does occur it usually forms a micrographic intergrowth with feldspar. Normally the minerals are very fresh, but secondary hornblende, chlorite, calcite, and epidote were observed in some of the thin sections examined. The olivine diabase, except for the presence of rounded crystals of olivine embedded in the augite and plagioclase, is in no way distinguishable from tho olivine free variety. A very dark brown mica was observed in this rock, which in places appeared to be a reaction product between the pyroxene and plagioclase.

The porphyry which intrudes the basal conglomerate of the Huronian, between Ollier and Renaud lakes, is a coarse, fresh, pink rock containing phenocrysts of albite nearly an inch in length. The matrix surrounding the albito crystals, when examined microscopically, was found to consist of feldspar, epidote, chlorite, sphene, calcite, chalcopyrite, and quartz. It is very probable that this rock is genetically related to the post-Huronian diabase, since it is similar in mineralogical composition to the aplitic phaso of the diabase occurring in other parts of the Timiskaming region.

Tho occurrence of camptonite as a small reef in Larder lake is of interest, because of the rarity of alkalic rocks in this region. Macroscopically, this rock has a fresh green appearance, very similar to that of the typical post-Huronian diabase, but under the microscope is seen to consist largely of the brown hornblende barkevite, with plagioclase, chlorite, spheno, epidote, ilmenite, apatite, and calcite in subsidiary proportions. The chlorite has probably resulted from the decomposition of the brown hornblende, since it occurs associated with that mineral; the rock on the whole, however, has suffered but little decomposition, and is quite comparable in this respect to all the post-Huronian rocks of the district. A slight amount of mineralization has occurred in the camptonite, for it contains masses of calcite, quartz, and epidote, with disseminated galena, chalcopyrite, and pyrite in places.

The lamprophyre, which has been classed provisionally as post-Huronian, is a very dark green rock which when examined microscopically was found to be a biotite amphibole lamprophyre. It consists essentially of orthoclase, biotite, zonal hornblende, and a pale green fibrous amphibole, having, as far as could be determined, the optical properties of actinolite. The accessory constituents of the rock are sphene, pyrite, calcite, and chlorite, the chlorite being an alteration product from the biotite.

PLEISTOCENE AND RECENT.

The ancient rocks described above are overlain by large quantities of Pleistocene and Recent materials, which are classed as glacial or post-glacial, according to the time and manner of their deposition. They rest on rock surfaces, which are rounded, striated, and polished, bearing ample evidence of the intense glacial action to which the region has been subjected. The ice movement in this region, as shown from the glacial striæ, was from a direction approximately 10 degrees east of north.

The glacial deposits of the district show great variations in different localities. Areas of sand abound in the country west of Larder lake, and in McGarry township adjacent to the interprovincial boundary. These are roughly stratified in places, and evidently constitute fluvio-glacial deposits. Till is widely distributed in the region, one of the largest developments observed occurring as a hill on the height of land portage of the Abitibi canoe route. Erratics and boulder heaps are everywhere very common, but are most conspicuous on the higher elevations, from which the more easily transported glacial material has been removed.

The post-glacial deposits consist of stratified clay and sand, laid down during the lacustrine epoch which followed the retreat of the glacial ice-sheet. The great thickness of these clays is due, without doubt, to the large amount of finely divided, easily transported drift material, which everywhere covered the rocky surface of the region. They have their best development in the Quebec portion of the area, particularly in Montbeillard township.

ECONOMIC GEOLOGY

Gold.

GENERAL FEATURES AND CLASSIFICATIONS.

Nearly all the rocks of the Larder lake district and adjacent portions of Pontiac county are cut by veins or veinlets of quartz, which, as a rule, are more or less auriferous. Of these, by far the most important are the veinlets of quartz, or of quartz and ferruginous dolomite which cut the Keewatin, aplite, dolomite, and porphyry. All the other occurrences of auriferous quartz in the region, as far as known at present, are of little value, even as prospects, and for descriptive purposes may be grouped together as a class by themselves.

VEINLETS OF QUARTZ OR OF QUARTZ AND FERRUGINOUS DOLOMITE IN DOLOMITE, PORPHYRY, AND APLITE.

The beds of Keewatin dolomite, some of which have a thickness of several hundred feet, as a rule, are cut by innumerable anastomosing and intersecting veinlets of quartz or of quartz and ferruginous dolomite, the dolomite when present occurring along the margin of the veinlet and the quartz in the centre. In a few places similar veinlets were also found cutting quartz porphyry and aplite. These occurrences constitute what may be called stockwork deposits. Their enormous extent and the spectacular showings of auriferous quartz which occur here and there in the veinlets, have led to the formation of numerous mining companies for the purpose of attempting their exploitation, but the results of development work up to the present have been generally disappointing.

Assays of samples from many of the most promising surface outcrops of this type of deposit have shown that the quartz is only locally auriferous, and that the gold when present is almost entirely of a coarse visible variety. Mill tests on a considerable scale have as yet been made in only two properties, the Harris-Maxwell and the Reddick. A shipment of 1,500 pounds of ore from an open-cut on the former property was sent to the School of Mining, Kingston, during the winter of 1907, and returned $13.20 to the ton. But a mill run of 230 tons from the same open-cut made by the Lucky Boy Mining Company, during the summer of 1909, averaged only 45 cents to the ton. A mill test from another surface showing on this property, however, gave $2.20 per ton. On the Reddick property a mill run of 100 tons from an open-cut on the Knott claim (H.J.B. 29), according to Mr. Morley Ogilvy, who had charge of the mining operations of the Dr. Reddick Company in 1908, yielded $10 to $12 to the ton, yet on further exploration carried on in 1909 under the management of Mr. H. P. Depencier, it was found that assays of samples taken from a drift at the 83 foot level, directly below this open-cut, gave only a few cents per ton in gold, showing that the average of $10 to $12 per ton did not maintain itself with depth. During the past summer (1911) development work was renewed on the Reddick, and an attempt made to ascertain the extent of a second showing of coarse gold occurring on the Knott claim, 250 feet northwest of the open-cut. A drift was projected at the 83 foot level in which, at a point a few feet to the east of the showing of gold exposed on the surface, a body of ore averaging $10 per ton and said to have a width of 20 feet, was encountered.

A few days were spent in the Larder Lake district by the writer in October of this year, but as Mr. Ogilvy, who is again in charge of the Reddick, was engaged in widening the shaft at the time the property was visited, the underground workings were not accessible. No opinion as to the probable extent or value of the new discovery can, therefore, be expressed.

While the exploratory work so far accomplished on these bands of brecciated dolomite has scarcely been sufficient to warrant a final conclusion, enough has been done to show that many of the deposits, which locally carry values in gold of $3 to $10 or more to the ton, are too small in extent for profitable operation. Nevertheless it is yet possible that somewhere the gold may be locally more extensive than has hitherto been found. It is indeed surprising that such an ore mass has not been discovered, when it is considered that the local occurrences of gold are very numerous, that the deposits of quartz in the dolomites are of enormous extent, and that these occurrences are probably genetically similar to the auriferous quartz deposits of the nearby Porcupine district. The writer, therefore, does not intend to imply in summarizing the results of exploration in the Larder Lake district that the region has no future mining possibilities or is not a field for further prospecting.

Origin.—It has been pointed out[1] that there is evidence which indicates that these stockwork deposits have originated by the fracturing and crushing of the dolomitic beds under the action of compressive stresses, possibly accompanied in places by some mechanical movements, and that channels were thereby afforded for the circulation of hydrothermal solutions which filled the fractures and replaced the wall-rock with quartz and other minerals.

No positive evidence was obtained to account for the localization of the gold, but in places it appears to be associated with shear zones and with faults of small displacement. With regard to the source of the gold occurring in these deposits, it has been suggested that the gold of the quartz veins in the Porcupine district is related to granite intrusions, the principal evidence in the support of this hypothesis being the occurrence of gold in quartz veinlets in aplite dykes. In the Larder Lake district and vicinity, gold was found in quartz veinlets in aplite on the Gold King claim, and in quartz porphyry on the property of the Pontiac and Abitibi Mining Company, to the northeast of Lake Opasatika. Gold telluride has also been found associated with the gold in the latter. It is, therefore, possible that the gold in these stockwork deposits of the Larder Lake district is genetically related to these intrusives, and since such intrusions are commonly derived from more deep-seated granite masses, the gold may be indirectly related to the granitic rocks of the region.

VEINS OF QUARTZ OR OF QUARTZ AND CALCITE.

The veins of this class have been grouped together not because of any assumed genetic connexion between them, but because of the general similarity of the deposits in mineralogical composition and structure. They are usually well defined veins of quartz, or of quartz and calcite, from a few inches to several feet in width, containing small quantities of sulphides, such as: pyrite, chalcopyrite, galena, and blende. The gold values are always small, assays seldom returning more than $2 or $3 per ton. The veins occurring in the Keewatin and Pontiac schist are commonly irregular, and of small linear extent, while those found in the Huronian are more uniform and continuous. Some of the deposits of this class contain large quantities of brecciated country-rock, and obviously occur along

[1]See page 22.

PLATE XI.

Ferruginous dolomite cut by quartz veinlets, Harris Maxwell claim.

12894 p. 52.

fault planes. This is exemplified by the Quinn claims on the shore of Dushwah lake, where an east-west zone of brecciated Huronian greywacke extends, with a width of several feet, across the face of the hill which borders the shore of the lake at that point. A vein in the Pontiac schist, on one of the claims of Gold Belt group near the west shore of Lake Opasatika, and immediately north of the line between Dasserat and Dufay townships, is of special interest because of the scapolite which occurs along its margin.

PROSPECTS.

Harris-Maxwell.—The mining operations of the Harris-Maxwell Gold Mining Company have been confined to claim H.S. 115, situated on the shore of Larder lake, about half a mile northeast of Larder City. The greater part of this claim is occupied by a hill of siliceous carbonate rock, cut by veinlets of quartz and ferruginous dolomite. Rock has been milled from an open-cut on the top of this hill, from a cut on its northeasterly slope, and from an adit about 80 feet in length, which has been driven into the hill from its eastern or lake shore side. In 1908, a 10-stamp mill was erected on the Harris-Maxwell, and was run for a short time during the summer of that year, about 30 tons of rock being milled. Nothing further was done on the property until August, 1909, when the Lucky Boy Mining Company began operations under an option, but work was suspended the latter part of September, and has not since been resumed.

Dr. Reddick.—The Dr. Reddick Larder Lake Mines, Limited, holds seven claims at the eastern extremity of the northeast area of Larder lake, but the operations of the Company have been largely confined to one of these—the Knott claim, H.J.B. 29. This claim is crossed by a band of brecciated dolomite about 400 feet wide, on the surface of which, at a number of points, specimens of coarse free gold have been obtained. Development operations completed up to the present consist of a shaft 83 feet deep, 250 feet of drifting at the 83 foot level, and numerous test pits and open-cuts, one of the latter being 10 feet wide, 50 feet long, and 15 feet deep. The mining plant installed on the property includes a 20 stamp mill, only 10 of which, however, have been in actual operation, and these for only a short time in the autumn of 1908. About 150 tons of ore were milled between the first of September and the middle of December of that year, but the work was greatly hampered by frequent breakdowns. Since that time, operations have been limited to exploratory work, between 25 and 30 men being employed for that purpose during the summer and autumn of 1909.

Gold King.—The Gold King claim H.F. 140, occupies the eastern portion of the peninsula on Larder lake, to the east of Larder City. The greater part of the rock on the claim is Keewatin greenstone, but on its northern border, near the lake shore, there is an area of porphyry, cut by veinlets of quartz and ferruginous dolomite, which carry some visible gold. The work done on the property consists of some stripping, a few small cuts, and an adit about 40 feet in length.

Big Pete.—The large island in the southeast corner of Larder lake, and a number of claims about a mile north of the Reddick, are owned by the Big Pete Canadian Mines, Limited. Exploratory work has been limited to claim H.F. 31, where a diamond drill was operated for a time on Keewatin slate.

Kerr-Addison.—The Kerr-Addison claims adjoin the Reddick on the west, and hence are crossed by the same band of ferruginous dolomite as the Knott claim, H.J.B. 29. The development work accomplished consists of some stripping, a few surface openings, and an adit 50 feet in length, on claim H.S. 166.

Tournenie.—The Tournenie Mining Company owns a large number of claims in the vicinity of the north shore of Larder lake, including those which formerly belonged to the Larder Lake Proprietary. A stamp mill was erected on one of these claims, O.E. 33, in 1907, by the Proprietary Company, but has never been put into operation. During the summer of 1909, and the winter of 1909-10, the Tournenie Company confined its efforts to developing its numerous claims sufficiently to comply with the government assessment requirements. These operations have consisted largely of open-cuts in brecciated dolomite.

Lincoln-Nipissing.—The most important claims owned by the Lincoln-Nipissing Development Company are located on a northwesterly-southeasterly band of ferruginous dolomite, which crosses the south half of lot 5, con. VI, Skead township. Some work has been done on claim C.E. 3, consisting of a few cuts, and a shaft, the depth of which was not ascertained owing to the water which it contained when visited.

Lucky Boy.—A large number of claims in the district are owned by the Lucky Boys Gold Mining Company, only two of which, however—H.S. 184, and the Chesterville claim which lies between H.J.B. 28 and H.J.B. 29 of the Reddick group—are located on the brecciated dolomite. Two shafts have been sunk on the Chesterville claim, and one on H.S. 184, the maximum depth being about 40 feet. There is also an adit about 40 feet in length on H.S. 184, which has been driven into the hill side to connect with the bottom of the shaft.

Pontiac and Abitibi.—The claims of the Pontiac and Abitibi Mining Company are located about 2 miles northeast of Lake Opasatika, on the north shore of Renaud lake. There is a small remnant of Huronian conglomerate exposed on the property, along the road which parallels the north shore of Renaud lake, but elsewhere the rocks are Keewatin, consisting largely of ellipsoidal greenstone intruded in places by dykes and irregular masses of quartz porphyry. There are two of these porphyry dykes on the south shore of Fortune lake which are intersected by veinlets of quartz and ferruginous dolomite carrying coarse gold in considerable quantities. An east-west belt of dolomitic sericite schist in which some veinlets of quartz were observed, also occurs on the property. Development work has been limited to a few scattered test pits and one 30 foot shaft. A road has been built from Renaud lake to Lake Opasatika and thence to the head of the northeast arm of Larder lake, thus establishing direct communication with the Timiskaming and Northern Ontario railway[1].

Victoria Creek.—The property of the Victoria Creek Gold Mines, Limited, comprises eight claims in the township of Gauthier, a short distance beyond the western border of the area included in the accompanying map. A considerable amount of development

[1]Since the above was written specimens of gold telluride have been found on this property.

work has been accomplished on claim J.S. 126, and includes a shaft 100 feet deep, and 115 and 125 feet of drifting at the 40 and 100 foot levels, respectively.

Combined Goldfields.—The claims of the Combined Goldfields, Limited, are located on Sharp creek, at the southeast corner of the west arm of Larder lake. The workings on the property consist of a number of pits and shafts from 10 to 30 feet deep, on both quartz and pyrite in Keewatin greenstone.

SILVER-LEAD.

There are two occurrences of argentiferous galena in the district, which may be mentioned under this head, one on claim B.G. 229, Hearst township, owned by the North Canadian Gold Mines, Limited, and the other on the Mageau claims, lot 12, con V, Skead township. In the first locality several irregular veins of galena, blende, and chalcopyrite, up to 10 inches in width, occur in Keewatin greenstone. They all pinch out quickly when followed along the strike. On the Mageau claims, veins of quartz and calcite occur, cutting Keewatin greenstone, the calcite in places containing galena, blende, and cobalt bloom.

COPPER.

Although copper minerals, chiefly chalcopyrite, occur in small quantities nearly everywhere throughout this district, no deposit of commercial importance has yet been discovered. Some of the occurrences of chalcopyrite that have more especially attracted the attention of prospectors are those on the Copper Queen claim H.S. 112, the Quinn claim on Duswah (turtle) lake, and the Renaud claim north of Nabugushk lake. The last mentioned deposit is of special mineralogical interest, consisting of small masses of chalcopyrite, and disseminated flakes of native copper, in a quartz vein in Laurentian granite.

COBALT AND NICKEL.

The occurrence of cobalt bloom on the Mageau claims, in Skead township, has been mentioned in the silver section above. According to Mr. Brock, it was also found in a calcite stringer on the Chesterville claim.

Two of the deposits of pyrrhotite, which occur in so many places throughout the Pontiac schist, are exposed in the vicinity of

Lake Opasatika: one on the south shore of Klock bay, and the other on the east shore of the lake, a short distance north of the entrance to Moose bay. A sample from the last mentioned occurrence, collected by Mr. McOuat in 1872, was submitted to Dr. Harrington, of the Geological Survey, and found to contain traces of cobalt and nickel.

MOLYBDENITE.

Molybdenite was observed in this district in a pegmatite dyke in the granite which forms the island at the north end of Evain (Kaishk) lake. This occurrence is no doubt of a similar character to that found on Kewagama lake, and elsewhere in the region eastward.[1]

IRON.

A few small outcrops of iron formation, consisting of banded jasper and magnetite, were observed, but always as very narrow bands, and usually only a few feet in linear extent. The abundance of pebbles of jasper, and jaspilite in the Huronian conglomerate, however, suggests that more extensive areas are possibly present, either beneath the Huronian of the district, or in the country adjacent.

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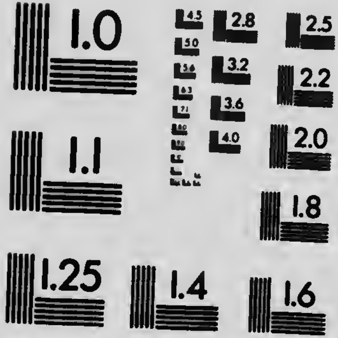
[1]Summary Report, G. S. C. 1901, 138A.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



INDEX

G

H

I

J

K

L

M

N

O

P

Q

R

S

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No. 245.	Report of Mines Section, 1886.		No. 662.	Report of Mines Section, 1897
272	" "	1887.	698	" " 1898
*300	" "	1888.	718	" " 1899
301	" "	1889.	744	" " 1900
334	" "	1890.	800	" " 1901
335	" "	1891.	835	" " 1902
360	" "	1892.	893	" " 1903
372	" "	1893-4.	*928	" " 1904
602	" "	1895.	971	" " 1905
626	" "	1896.		

Mineral Production of Canada:—

No. *414.	Year 1886.	No. *422.	Year 1893.	No. 719.	Year 1900.
*415	" 1887.	*555	" 1894.	719a	" 1901.
*416	" 1888.	*577	" 1895.	813	" 1902.
*417	" 1889.	*612	" 1896.	861	" 1903.
*418	" 1890.	*623	" 1886-96.	896	" 1904.
*419	" 1891.	*640	" 1897.	924	" 1905.
*420	" 1886-91.	*671	" 1898.	961	" 1906.
*421	" 1892.	*686	" 1899.		

Mineral Resources Bulletin:—

No. *818.	Platinum.	No. 860.	Zinc.	No. 881.	Phosphate.
851.	Coal.	869.	Mica.	882.	Copper.
*854.	Asbestos.	872.	Molybdenum and Tungsten.	913.	Mineral Pigments.
857.	Infusorial Earth.	*877.	Graphite.	953.	Barytes.
858.	Manganese.	880.	Peat.	984.	Mineral Pigments (French).
859.	Salt.				

Report of the Section of Chemistry and Mineralogy:—

No. *102.	Year 1874-5.	No. *169.	Year 1882-3-4.	No. 580.	Year 1894.
*110	" 1875-6.	222	" 1885.	616	" 1895
*119	" 1876-7.	246	" 1886.	651	" 1896.
*126	" 1877-8.	273	" 1887-8.	695	" 1898.
*138	" 1878-9.	299	" 1888-9.	724	" 1899.
*148	" 1879-80.	333	" 1890-1.	821	" 1900.
*156	" 1880-1-2.	359	" 1892-3.	*958	" 1906.

* Publications marked thus are out of print.

REPORTS.

GENERAL.

745. Altitudes of Canada, by J. White. 1899.
*972. Descriptive Catalogue of Minerals and Rocks, by R. A. A. Johnston and G. A. Young.
1073. Catalogue of Publications: Reports and Maps (1843-1909).
1085. Descriptive Sketch of the Geology and Economic Minerals of Canada, by G. A. Young, and Introductory by R. W. Brock. Maps No. 1084; No. 1042 (second edition), scale 100 m. = 1 in.
1086. French translation of Descriptive Sketch of the Geology and Economic Minerals of Canada, by G. A. Young, and Introductory by R. W. Brock. Maps No. 1084; No. 1042 (second edition), scale 100 m. = 1 in.
1107. Part II. Geological position and character of the oil-shale deposits of Canada, by R. W. Ells.
1146. Notes on Canada, by R. W. Brock.

YUKON.

*260. Yukon district, by G. M. Dawson. 1887. Maps No. 274, scale 60 m. = 1 in.; Nos. 275 and 277, scale 8 m. = 1 in.
*295. Yukon and Mackenzie basins, by R. G. McConnell. 1889. Map No. 304, scale 48 m. = 1 in.
687. Klondike gold fields (preliminary), by R. G. McConnell. 1900. Map No. 688, scale 2 m. = 1 in.
884. Klondike gold fields, by R. G. McConnell. 1901. Map No. 772, scale 2 m. = 1 in.
*909. Windy Arm, Tagish lake, by R. G. McConnell. 1906. Map No. 916, scale 2 m. = 1 in.
943. Upper Stewart river, by J. Keele. Map No. 938, scale 8 m. = 1 in. } Bound together.
951. Peel and Wind rivers, by Chas. Camsell. Map No. 942, scale 8 m. = 1 in. } Bound together.
979. Klondike gravels, by R. G. McConnell. Map No. 1011, scale 40 ch. = 1 in.
982. Conrad and Whitehorse mining districts, by D. D. Cairnes. 1901. Map No. 990, scale 2 m. = 1 in.
1016. Klondike Creek and Hill gravels, by R. G. McConnell. (French.) Map No. 1011, scale 40 ch. = 1 in.
1050. Whitehorse Copper Belt, by R. G. McConnell. Maps Nos. 1026, 1,041, 1,044, 1,049.
1097. Reconnaissance across the Mackenzie mountains on the Pelly, Ross, and Gravel rivers, Yukon, and North West Territories, by Joseph Keele. Map No. 1099, scale 8 m. = 1 in.
1011. Memoir No. 5 (Preliminary): on the Lewes and Nordens[illegible] coal-field, Yukon, by D. D. Cairnes. Maps Nos. 1[illegible] scale 2 m. = 1 in.
1228. Memoir No. 31: Wheaton district, by D. D. Cairnes.

BRITISH COLUMBIA.

212. The Rocky mountains (between latitudes 49° and 51° [illegible]) by G. M. Dawson. 1885. Map No. 223, scale 6 m. = 1 in. Map No. 224, scale 1½ m. = 1 in.
235. Vancouver island, by G. M. Dawson. 1886. Map No. 247, scale 2 m. = 1 in.
236. The Rocky mountains, geological structure, by R. G. McConnell. 1886. Map No. 248, scale 2 m. = 1 in.
263. Cariboo mining district, by A. Bowman. 1887. Maps Nos. 278-281.
*271. Mineral wealth, by G. M. Dawson.
*294. West Kootenay district, by G. M. Dawson. 1888-9. Map No. 303, scale 8 m. = 1 in.
*573. Kamloops district, by G. M. Dawson. 1894. Maps Nos. 556 and 557, scale 4 m. = 1 in.

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*Publications marked thus are out of print.

574. Finlay and Omineca rivers, by R. G. McConnell. 1894. Map No 567, scale 8 m. = 1 in.
743. Atlin Lake mining division, by J. C. Gwillim. 1899. Map No. 742, scale 4 m. = 1 in.
939. Rossland district, by R. W. Brock. Map No. 941, scale 1,600 ft. = 1 in.
940. Graham island, by R. W. Ells. 1905. Maps No. 921, scale 4 m. = 1 in.; No. 922, scale 1 m. = 1 in. (Reprint).
986. Similkameen district, by Chas. Camsell. Map No. 987, scale 400 ch = 1 in.
988. Telkwa river and vicinity, by W. W. Leach. Map No. 989, scale 2 m. = 1 in.
996. Nanaimo and New Westminster districts, by O. E. LeRoy. 1907. Map No. 997, scale 4 m. = 1 in.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling.
1093. Geology, and Ore Deposits of Hedley Mining district, British Columbia, by Charles Camsell. Maps Nos. 1095 and 1096, scale 1,000 ft. = 1 in.; No. 1105, scale 600 ft. = 1 in.; No. 1106, scale 800 ft = 1 in.; No. 1125, scale 1,000 ft. = 1 in.
1121. Memoir No. 13: Southern Vancouver island, by Charles H. Clapp. Map No. 1123–17 A, scale 4 m. = 1 in.
1175. Memoir No. 21: Geology and ore deposits of Phoenix, Boundary district, by O. E. LeRoy. Maps Nos. 1135 and 1136, scale 400 ft. = 1 in.
1201. Memoir No. 24-E: Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201–51 A, scale 35 m. = 1 in.
1206. Memoir No. 26: Tulameen Mining district, by Charles Camsell. Maps No. 1195-45 A, scale 1 m. = 1/62500; No. 1196-46 A, scale 1 m. = 1/62500; No 1197-17 A: No. 1198-18 A, scale 1 m. = 1 in.

ALBERTA.

*237. Central portion, by J. B. Tyrrell. 1886. Maps Nos. 249 and 250, scale 8 m. = 1 in.
324. Peace and Athabaska Rivers district, by R. G. McConnell. 1890-1. Map No. 336, scale 48 m = 1 in.
703. Yellowhead Pass route, by J. McEvoy. 1898. Map No. 676, scale 8 m. = 1 in.
*949. Cascade coal-fields, by D. B. Dowling. Maps (8 sheets Nos. 929-936, scale 1 m. = 1 in.
968. Moose Mountain district, by D. D. Cairnes. Maps No. 963, scale 2 m. = 1 in.; No. 966, scale 1 m. = 1 in.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.
1035a. French translation of coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.
1115. Memoir No. 8-E: Edmonton coal-field, by D. B. Dowling. Maps Nos. 1117-5 A and 1118-6 A, scale 2640 ft. = 1 in.
1130. Memoir No. 9-E: Bighorn coal basin, Alta., by G .S. Malloch. Map No. 1132, scale 2 m. = 1 in.
1131. Memoir No. 9-E (French translation): Bighorn coal basin, Alta., by G. S. Malloch. Map No. 1132, scale 2 m. = 1 in.
1204. Memoir No. 24-E: Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201–51 A, scale 35 m. = 1 in.
1220. Memoir No. 29-E: Oil and Gas Prospects of the Northwest Province, of Canada, by W. Malcolm. Map No. 1221 (55 A), scale 35 m. = 1 in.

SASKATCHEWAN.

213. Cypress hills and Wood mountain, by R. G. McConnell. 1885. Maps Nos. 225 and 226, scale 8 m. = 1 in.

*Publications marked thus are out of print.

601. Country between Athabaska lake and Churchill river, by J. B. Tyrrell and D. B. Dowling. 1895. Map. No. 967, scale 25 m. = 1 in.
868. Souris River coal-field, by D. B. Dowling. 1902.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.
1204. Memoir No. 24-E: Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201—51 A, scale 35 m. = 1 in.
1220. Memoir No. 29-E: Oil and Gas Prospects of the Northwest Provinces of Canada, by W. Malcolm. Map No. 1221 (55 A), scale 35 m. = 1 in.
1225. Memoir No. 30: The Basins of Nelson and Churchill rivers, by W. McInnes. Map No. 1226, scale 15 m. = 1 in.

MANITOBA.

264. Duck and Riding mountains, by J. B. Tyrrell. 1887-8. Map No. 282, scale 8 m. = 1 in.
296. Glacial Lake Agassiz, by W. Upham. 1889. Maps Nos. 314, 315, 316.
323. Northwestern portion, by J. B. Tyrrell. 1890-1. Maps Nos. 339 and 350, scale 8 m. = 1 in.
704. Lake Winnipeg (west shore), by D. B. Dowling. 1898. Map No. 664, scale 8 m. = 1 in. } Bound together.
705. Lake Winnipeg (east shore), by J. B. Tyrrell. 1898. Map No. 664, scale 8 m. = 1 in. } Bound together.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.
1204. Memoir No. 24-E: Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201-51 A, scale 35 m. = 1 in.
1220. Memoir No. 29-E: Oil and Gas Prospects of the Northwest Provinces of Canada, by W. Malcolm. Map No. 1221 (55 A), scale 35 m. = 1 in.

NORTH WEST TERRITORIES.

217. Hudson bay and strait, by R. Bell. 1885. Map No. 229, scale 4 m. = 1 in.
238. Hudson bay, south of, by A. P. Low. 1886.
239. Attawapiskat and Albany rivers, by R. Bell. 1886
244. Northern portion of the Dominion, by G. M. Dawson. 1886. Map No. 255, scale 200 m. = 1 in.
267. James bay and country east of Hudson bay, by A. P. Low.
578. Red lake and part of Berens river, by D. B. Dowling. 1894. Map No. 576, scale 8 m. = 1 in.
*584. Labrador peninsula, by A. P. Low. 1895. Maps Nos. 585-588, scale 25 m. = 1 in.
618. Dubawnt, Kazan, and Ferguson rivers, by J. B. Tyrrell. 1896. Map No. 603, scale 25 m. = 1 in.
657. Northern portion of the Labrador peninsula, by A. P. Low.
680. South Shore Hudson strait and Ungava bay, by A. P. Low. Map No. 699, scale 25 m. = 1 in. } Bound together.
713. North Shore Hudson strait and Ungava bay, by R. Bell. Map No. 699, scale 25 m. = 1 in. } Bound together.
725. Great Bear lake to Great Slave lake, by J. M. Bell. 1900.
778. East coast, Hudson bay, by A. P. Low. 1900. Maps Nos. 779, 780, 781, scale 8 m. = 1 in.
786-787. Grass River region, by J. B. Tyrrell and D. B. Dowling. 1900.
815. Ekwan river and Sutton lakes, by D. B. Dowling. 1901. Map No. 751, scale 50 m. = 1 in.
819. Nastapoka islands, Hudson bay, by A. P. Low. 1900.
905. The Cruise of the *Neptune*, by A. P. Low. 1905.

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* Publications marked thus are out of print.

1006. Report of a Traverse through the Southern Part of the North West Territories, from Lac Seul to Cat lake, 1902, by A. W. G. Wilson.
1080. Report on a Part of the North West Territories, drained by the Winisk and Upper Attawapiskat rivers, by W. McInnes. Map No. 1089, scale 8 m. = 1 in.
} Bound together.

1069. French translation: Report on an exploration of the East coast of Hudson bay, from Cape Wolstenholme to the south end of James bay, by A. P. Low. Maps Nos. 779, 780, 781, scale 8 m. = 1 in.; No. 785, scale 50 m. = 1 in.

1097. Reconnaissance across the Mackenzie mountains on the Pelly, Ross, and Gravel rivers, Yukon, and North West Territories, by Joseph Keele. Map No. 1099, scale 8 m. = 1 in.

1225. Memoir No. 30: The Basins of Nelson and Churchill rivers, by W. McInnes. Map No. 1226, scale 15 m. = 1 in.

ONTARIO.

215. Lake of the Woods region, by A. C. Lawson. 1885. Map No. 227, scale 2 m. = 1 in.

*265. Rainy Lake region, by A. C. Lawson. 1887. Map No. 263, scale 4 m. = 1 in.

266. Lake Superior, mines and mining, by E. D. Ingall. 1888. Maps No. 285, scale 4 m. = 1 in.; No. 286, scale 20 ch. = 1 in.

326. Sudbury mining district, by R. Bell. 1890-1. Map No. 343, scale 4 m. = 1 in.

327. Hunter island, by W. H. C. Smith. 1890-1. Map No. 342, scale 4 m. = 1 in.

332. Natural Gas and Petroleum, by H. P. H. Brumell. 1890-1. Maps Nos. 344-349.

357. Victoria, Peterborough, and Hastings counties, by F. D. Adams. 1892-3.

627. On the French River sheet, by R. Bell. 1896. Map No. 570, scale 4 m. = 1 in.

678. Seine river and Lake Shebandowan map-sheets, by W. McInnes. 1897. Maps Nos. 589 and 560, scale 4 m. = 1 in.

723. Iron deposits along the Kingston and Pembroke railway, by E. D. Ingall. 1900. Map No. 626, scale 2 m. = 1 in.; and plans of 13 mines.

*739. Carleton, Russell, and Prescott counties, by R. W. Ells. 1899. (*See* No. 739, Quebec.)

741. Ottawa and vicinity, by R. W. Ells. 1900.

790. Perth sheet, by R. W. Ells. 1900. Map No. 789, scale 4 m. = 1 in.

961. Sudbury Nickel and Copper deposits, by A. E. Barlow. (Reprint). Maps Nos. 775, 820, scale 1 m. = 1 in.; Nos. 824, 825, 864, scale 400 ft. = 1 in.

962. Nipissing and Timiskaming map-sheets, by A. E. Barlow. (Reprint). Maps Nos. 599, 606, scale 4 m. = 1 in.; No. 944, scale 1 m. = 1 in.

965. Sudbury Nickel and Copper deposits, by A. E. Barlow. (French).

970. Report on Niagara Falls, by J. W. Spencer. Maps Nos. 926, 967.

977. Report on Pembroke sheet, by R. W. Ells. Map No. 660, scale 4 m. = 1 in.

980. Geological reconnaissance of a portion of Algoma and Thunder Bay district, Ont., by W. J. Wilson. Map No. 964, scale 8 m. = 1 in.
1081. On the region lying north of Lake Superior, between the Pic and Nipigon rivers, Ont., by W. H. Collins. Map No. 964, scale 8 m. = 1 in.
} Bound together.

998. Report on Northwestern Ontario, traversed by National Transcontinental railway, between Lake Nipigon and Sturgeon lake, by W. H. Collins. Map No. 993, scale 4 m. = 1 in.

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* Publications marked thus are out of print.

998. Report on Pembroke sheet, by R. W. Ells. (French). Map No. 660, scale 4 m. = 1 in.
999. French translation Gowganda Mining Division, by W. H. Collins. Map No. 1076, scale 1 m. = 1 in.
1038. French translation report on the Transcontinental Railway location between Lake Nipigon and Sturgeon lake, by W. H. Collins. Map No. 993, scale 4 m. = 1 in.
1059. Geological reconnaissance of the region traversed by the National Transcontinental railway between Lake Nipigon and Clay lake, Ont., by W. H. Collins. Map No. 993, scale 4 m. = 1 in.
1075. Gowganda Mining Division, by W. H. Collins. Map No. 1076, scale 1 m. = 1 in.
1082. Memoir No. 6: Geology of the Haliburton and Bancroft areas, Ont., by Frank D. Adams and Alfred E. Barlow. Maps No. 708, scale 4 m. = 1 in.; No. 770, scale 2 m. = 1 in.
1091. Memoir No. 1: On the Geology of the Nipigon basin, Ont., by A. W. G. Wilson. Map No. 1090, scale 4 m. = 1 in.
1114. French translation. Geological reconnaissance of a portion of Algoma and Thunder Bay district, Ont., by W. J. Wilson. Map No. 964, scale 8 m. = 1 in.
1119. French translation: On the region lying north of Lake Superior, between the Pic and Nipigon rivers, Ont., by W. H. Collins. Map No. 964, scale 8 m. = 1 in.

(1114 and 1119: Bound together.)

1160. Memoir No. 17-E: Geology and economic resources of the Larder Lake district, Ont., and adjoining portions of Pontiac county, Que., by M. E. Wilson. Maps No. 1177—31 A, scale 1 m. = 1 in.; No. 1178—32 A, scale 2 m. = 1 in.

QUEBEC.

216. Mistassini expedition, by A. P. Low. 1884-5. Map No. 228, scale 8 m. = 1 in.
240. Compton, Stanstead, Beauce, Richmond, and Wolfe counties, by R. W. Ells. 1886. Map No. 251 (Sherbrooke sheet), scale 4 m. = 1 in.
268. Megantic, Beauce, Dorchester, Lévis, Bellechasse, and Montmagny counties, by R. W. Ells. 1887-8. Map No. 287, scale 40 ch. = 1 in.
297. Mineral resources, by R. W. Ells. 1889.
328. Portneuf, Quebec, and Montmagny counties, by A. P. Low. 1890-1.
579. Eastern Townships, Montreal sheet, by R. W. Ells and F. D. Adams, 1894. Map No 571, scale 4 m. = 1 in.
591. Laurentian area north of the Island of Montreal, by F. D. Adams. 1895. Map No. 590, scale 4 m. = 1 in.
670. Auriferous deposits, southeastern portion, by R. Chalmers. 1895. Map No. 667, scale 8 m. = 1 in.
707. Eastern Townships, Three Rivers sheet, by R. W. Ells. 1898.
*739. Argenteuil, Ottawa, and Pontiac counties, by R. W. Ells. 1899. (*See* No. 739, Ontario).
788. Nottaway basin, by R. Bell. 1900. *Map No. 702, scale 10 m = 1 in.
863. Wells on Island of Montreal, by F. D. Adams. 1901. Maps Nos. 874, 875, 876.
923. Chibougamau region, by A. P. Low. 1905.
962. Timiskaming map-sheet, by A. E. Barlow. (Reprint). Maps Nos. 509, 606, scale 4 m. = 1 in.; No. 944, scale 1 m. = 1 in.
974. Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. Map No. 976, scale 8 m. = 1 in.
975. Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. (French).
998. Report on the Pembroke sheet, by R. W. Ells. (French).
1028. Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. Map No. 1029, scale 2 m. = 1 in.
1032. Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. (French). Map No. 1029, scale 2 m. = 1 in.

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* Publications marked thus are out of print.

1052. French t... tion report on Artesian wells in the Island of Montreal, by Frank D. Adams and O. E. LeRoy. Maps No. 874, scale 4 m. = 1 in.; No. 375, scale 3,000 ft. = 1 in.; No. 876.
1064. Geology of an Area adjoining the East Side of Lake Timiskami... Que., by Morley E. Wilson. Map No. 1066, scale 1 m. = 1 in.
1110. Memoir No. 4; Geological Reconnaissance along the line of the National Transcontinental railway in Western Quebec, by W. J. Wilson. Map No. 1112, scale 4 m. = 1 in.
1144. Reprint of Summary Report on the Serpentine Belt of Southern Quebec, by J. A. Dresser.
1160. Men... No. 17-E: Geology and economic resources of the Larder Lake district, Ont., and adjoining portions of Pontiac county, Que., by M. E. Wilson. Maps No. 1177-31 A, scale 1 m. = 1 in.; No. 1178-32 A, scale 2 m. = 1 in.
1186. Memoir No. 35; Reconnaissance along the National Transcontinental railway in Southern Quebec, by J. A. Dr... r. Map No. 1180-34A, scale 8 m. = 1 in.

NEW BRUNSWICK.

218. Western New Brunswick and Eastern Nov... ...ia, by R. W. Ells. 1885. Map No. 230, scale 4 m. = 1 in.
219. Carleton and Victoria counties, by L. W. Bailey 1885. Map No. 231, scale 4 m. = 1 in.
242. Victoria, Restigouche, and Northumberland counties, N.B., by L. W. Bailey and W. McInnes. 1886. Map No. 254, scale 4 m. = 1 in.
269. Northern portion and adjacent areas, by L. W. Bailey and W. McInnes. 1887-8. Map No. 290, scale 4 m. = 1 in.
330 Temiscouata and Rimouski counties, by L. W. Bailey and W. McInnes. 1890-1. Map No. 350, scale 4 m. = 1 in.
661. Mineral resources, by L. W. Bailey. 1897. Map No. 675, scale 10 m. = 1 in. New Brunswick geology, by R. W. Ells. 1887.
799. Carboniferous system, by L. W. Bailey. 1900. } Bound together.
803. Coal prospects in, by H. S. Poole. 1900. }
983. Mineral resources, by R. W. Ells. Map No. 969, scale 16 m. = 1 in.
1034. Mineral resources, by R. W. Ells. (French). Map No. 969, scale 16 m. = 1 in.
1113. Memoir No. 16-E; The Clay and Shale deposits of Nova Scotia and portions of New Brunswick, by H. Ries and J. Keele. Map No. 1153, scale 12 m. = 1 in.

NOVA SCOTIA.

243. Guysborough, Antig... ..., Picton, Colchester, and Halifax counties, by Hugh Fletch... ...nd E. R. Faribault. 1886.
331. Pictou and Colchester counties, by H. Fletcher. 1890-1.
358. Southwestern Nova Scotia (preliminary), by L. W. Bailey. 1892-3. Map No 362, scale 8 m. = 1 in.
628. Southwestern Nova Scotia, by L. W. Bailey. 1896. Map No. 641, scale 8 ... = 1 in.
68... Sydney coal-field, by H. Fletcher. Maps Nos. 652, 653, 654, scale 1 m. = 1 in.
79... Cambrian rocks of Cape Breton, by G. F. Matthew. 1900.
871. Pictou coal-field, by H. S. Poole. 1902. Map No. 833, scale 25 ch. = 1 in.
1113. Memoir No. 16-E; The Clay and Shale deposits of Nova Scotia and portions of New Brunswick, by H. Ries and J. Keele. Map No. 1153, scale 12 m. = 1 in.

MAPS.

1042. Dominion of Canada. Minerals. Scale 100 m. = 1 in.

YUKON.

*805. Explorations on Macmillan, Upper Pelly, and Stewart rivers, scale 8 m. = 1 in.
891. Portion of Duncan Creek Mining district, scale 6 m. = 1 in.

* Publications marked thus are out of print.

894. Sketch Map Kluane Mining district, scale 6 m. = 1 in.
*916. Windy Arm Mining district, Sketch Geological Map, scale 2 m. = 1 in.
990. Conrad and Whitehorse Mining districts, scale 2 m. = 1 in.
991. Tantalus and Five Fingers coal mines, scale 1 m. = 1 in.
1011. Bonanza and Hunker creeks. Auriferous gravels. Scale 40 chains = 1 in.
1033. Lower Lake Laberge and vicinity, scale 1 m. = 1 in.
1041. Whitehorse Copper belt, scale 1 m. = 1 in.
1026. 1044–1049. Whitehorse Copper belt. Details.
1099. Pelly, Ross, and Gravel rivers, Yukon and North West Territories. Scale 8 m. = 1 in.
1103. Tantalus Coal area, Yukon. Scale 2 m. = 1 in.
1104. Braeburn-Kynocks Coal area, Yukon. Scale 2 m. = 1 in.

BRITISH COLUMBIA.

278. Cariboo Mining district, scale 2 m. = 1 in.
604. Shuswap Geological sheet, scale 4 m. = 1 in.
*771. Preliminary Edition, East Kootenay, scale 4 m. = 1 in.
767. Geological Map of Crowsnest coal-fields, scale 2 m. = 1 in.
*791. West Kootenay Minerals and Striæ, scale 4 m. = 1 in.
*792. West Kootenay Geological sheet, scale 4 m. = 1 in.
828. Boundary Creek Mining district, scale 1 m. = 1 in.
890. Nicola coal basin, scale 1 m. = 1 in.
941. Preliminary Geological Map of Rossland and vicinity, scale 1,600 ft. = 1 in.
987. Princeton coal basin and Copper Mountain Mining camp, scale 40 ch. = 1 in.
989. Telkwa river and vicinity, scale 2 m. = 1 in.
997. Nanaimo and New Westminster Mining division, scale 4 m. = 1 in.
1001. Special Map of Rossland. Topographical sheet. Scale 400 ft. = 1 in.
1002. Special Map of Rossland. Geological sheet. Scale 400 ft. = 1 in.
1003. Rossland Mining camp. Topographical sheet. Scale 1,200 ft. = 1 in.
1004. Rossland Mining camp. Geological sheet. Scale 1,200 ft. = 1 in.
1068. Sheep Creek Mining camp. Geological sheet. Scale 1 m. = 1 in.
1074. Sheep Creek Mining camp. Topographical sheet. Scale 1 m. = 1 in.
1095. 1A—Hedley Mining district. Topographical sheet. Scale 1,000 ft. = 1 in.
1096. 2A—Hedley Mining district. Geological sheet. Scale 1,000 ft. = 1 in.
1105. 4A—Golden Zone Mining camp. Scale 600 ft. = 1 in.
1106. 3A—Mineral Claims on Henry creek. Scale 800 ft. = 1 in.
1123. 17A—Reconnaissance geological map of southern Vancouver island. Scale 4 m. = 1 in.
1125. Hedley Mining district: Structure Sections. Scale 1,000 ft. = 1 in.
Deadwood Mining camp. Scale 400 ft. = 1 in. (Advance sheet.)
1135. 15A—Phoenix, Boundary district. Topographical sheet. Scale 400 ft. = 1 in.
1136. 16A—Phoenix, Boundary district. Geological sheet. Scale 400 ft. = 1 in.
1164. 28A—Portland Canal Mining district, scale 2 m. = 1 in.
Beaverdell sheet, Yale district, scale 1 m. = 1 in. (Advance sheet.)
1195. 45A—Topographical map of Tulameen. Scale 1 m. = 1/62500.
1196. 46A—Geological map of Tulameen. Scale 1 m. = 1/62500.
1197. 47A—Sketch map of Law's camp.
1198. 48A—Geological map of Tulameen coal area. Scale 1 m. = 1 in.

ALBERTA.

594–596. Peace and Athabaska rivers, scale 10 m. = 1 in.
*808. Blairmore-Frank coal-fields, scale 180 ch. = 1 in.
892. Costigan coal basin, scale 40 ch. = 1 in.
929–936. Cascade coal basin. Scale 1 m. = 1 in.
963–966. Moose Mountain region. Coal Areas. Scale 2 m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.

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*Publications marked thus are out of print.

1117. 5A—Edmonton. (Topography). Scale ½ m. = 1 in.
1118. 6A—Edmonton. (Clover Bar Coal Seam). Scale ½ m. = 1 in.
Portion of Jasper Park, scale 1 m. = 1 in. (Advance sheet.)
1132. 7A—Bighorn coal-field. Scale 2 m. = 1 in.
1201. 51A—Geological map of portions of Alberta, Saskatchewan, and Manitoba. Scale 35 m. = 1 in.
1221. 55A—Geological map of Alberta, Saskatchewan, and Manitoba. Scale 35 m. = 1 in.

SASKATCHEWAN.

1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.
1201 51A—Geological map of portions of Alberta, Saskatchewan, and Manitoba Scale 35 m. = 1 in.
1221. 55A—Geological map of Alberta, Saskatchewan, and Manitoba. Scale 35 m. = 1 in.

MANITOBA.

804. Part of Turtle mountain showing coal areas. Scale 1½ m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.
1201. 51A—Geological map of portions of Alberta, Saskatchewan, and Manitoba. Scale 35 m. = 1 in.
1201. 51A—Geological map of portions of Alberta, Saskatchewan, and Scale 35 m. = 1 in.
1226. 58A—Geological Map of Nelson and Churchill rivers, Sask., and North West Territories. Scale 15 m. = 1 in.

NORTH WEST TERRITORIES.

1089. Explored routes on Albany, Severn, and Winisk rivers. Scale 8 m. = 1 in.
1099. Pelly, Ross, and Gravel rivers, Yukon and North West Territories. Scale 8 m. = 1 in.
1226. 58A—Geological Map of Nelson and Churchill rivers, Sask., and North West Territories. Scale 15 m. = 1 in.

ONTARIO.

227. Lake of the Woods sheet, scale 2 m. = 1 in.
*283. Rainy Lake sheet, scale 4 m = 1 in.
*342. Hunter Island sheet, scale 4 m. = 1 in.
343. Sudbury sheet, scale 4 m. = 1 in.
*373. Rainy River sheet, scale 2 m. = 1 in.
560. Seine River sheet, scale 4 m. = 1 in.
570. French River sheet, scale 4 m = 1 in.
*589. Lake Shebandowan sheet, scale 4 m. = 1 in
599. Timiskaming sheet, scale 4 m. = 1 in. (New Edition, 1907).
605. Manitoulin Island sheet, scale 4 m. = 1 in.
606. Nipissing sheet, scale 4 m. = 1 in. (New Edition, 1907).
660. Pembroke sheet, scale 4 m. = 1 in.
663. Ignace sheet, scale 4 m. = 1 in.
708. Haliburton sheet, scale 4 m. = 1 in.
720 Manitou Lake sheet, scale 4 m. = 1 in.
*750. Grenville sheet, scale 4 m. = 1 in.
770. Bancroft sheet, scale 2 m. = 1 in.
775 Sudbury district, Victoria mines, scale 1 m. = 1 in.
*789. Perth sheet, scale 4 m. = 1 in.
820. Sudbury district, Sudbury, scale 1 m. = 1 in.
824-825. Sudbury district, Copper Cliff mines, scale 400 ft. = 1 in.
852. Northeast Arm of Vermilion Iron ranges, Timagami, scale 40 ch. = 1 in.
864. Sudbury district, Elsie and Murray mines, scale 400 ft. = 1 in.
903. Ottawa and Cornwall sheet, scale 4 m. = 1 in.
944. Preliminary Map of Timagami and Rabbit lakes, scale 1 m. = 1 in.
964. Geological Map of parts of Algoma and Thunder bay, scale 8 m. = 1 in.

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* Publications marked thus are out of print.

1023. Corundum Bearing Rocks. Central Ontario. Scale 17½ m. = 1 in.
1076. Gowganda Mining Division, scale 1 m. = 1 in.
1090. Lake Nipigon, Thunder Bay district, scale 4 m. = 1 in.
1177. 31A—Larder lake, Nipissing district. Scale 1 m. = 1 in.
1178. 32A—Larder lake and Opasatika lake. Scale 2 m. = 1 in.

QUEBEC.

*251. Sherbrooke sheet, Eastern Townships Map, scale 4 m. = 1 in.
287. Thetford and Coleraine Asbestos district, scale 40 ch. = 1 in.
375. Quebec sheet, Eastern Townships Map, scale 4 m. = 1 in.
*571. Montreal sheet, Eastern Townships Map, scale 4 m. = 1 in.
*665. Three Rivers sheet, Eastern Townships Map, scale 4 m. = 1 in.
667. Gold Areas in southeastern part, scale 8 m. = 1 in.
*668. Graphite district in Labelle county, scale 40 ch. = 1 in.
918. Chibougamau region, scale 4 m.=1 in.
976. The Older Copper-bearing Rocks of the Eastern Townships, scale 8 m. = 1 in.
1007. Lake Timiskaming region, scale 2 m. = 1 in.
1029. Lake Megantic and vicinity, scale 2 m. = 1 in.
1066. Lake Timiskaming region. Scale 1 m. = 1 in.
1112. 12A—Vicinity of the National Transcontinental railway, Abitibi district, scale 4 m. = 1 in.
1154. 23A—Thetford-Black Lake Mining district, scale 1 m. = 1 in.
1178. 32A—Larder lake and Opasatika lake. Scale 2 m. = 1 in.
Danville Mining district, scale 1 m. = 1 in. (Advance sheet.)
1180. 34A—Vicinity of the National Transcontinental railway between the counties of Lévis and Témiscouata, scale 8 m.=1 in.

NEW BRUNSWICK.

*675. Map of Principal Mineral Occurrences. Scale 10 m. = 1 in
969. Map of Principal Mineral Localities. Scale 16 m. = 1 in.
1155. 24A—Millstream Iron deposits, scale 400 ft. = 1 in.
1156. 25A—Nipisiguit Iron deposits, scale 400 ft. = 1 in.

NOVA SCOTIA.

*812. Preliminary Map of Springhill coal-field, scale 50 ch. = 1 in.
833. Pictou coal-field, scale 25 ch. = 1 in.
897. Preliminary Geological Plan of Nictaux and Torbrook Iron district, scale 25 ch. = 1 in.
927. General Map of Province showing gold districts, scale 12 m. = 1 in.
937. Leipsigate Gold district, scale 500 ft. = 1 in.
945. Harrigan Gold district, scale 400 ft. = 1 in.
995. Malaga Gold district, scale 250 ft. = 1 in.
1012. Brookfield Gold district, scale 250 ft. = 1 in.
1019. Halifax Geological sheet. No. 68. Scale 1 m. = 1 in.
1025. Waverley Geological sheet. No. 67. Scale 1 m. = 1 in.
1036. St. Margaret Bay Geological sheet. No. 71. Scale 1 m. = 1 in
1037. Windsor Geological sheet. No. 73. Scale 1 m. = 1 in.
1043. Aspotogan Geological sheet. No. 70. Scale 1 m. = 1 in.
1153. 22A—Nova Scotia, scale 12 m. = 1 in.

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* Publications marked thus are out of print.

NOTE.—Individual Maps or Reports will be furnished free to *bona fide* Canadian applicants.

Reports and Maps may be ordered by the numbers prefixed to titles.

Applications should be addressed to The Director, Geological Survey, Department of Mines, Ottawa.

Ho

ECONOMIC GEOLOGY

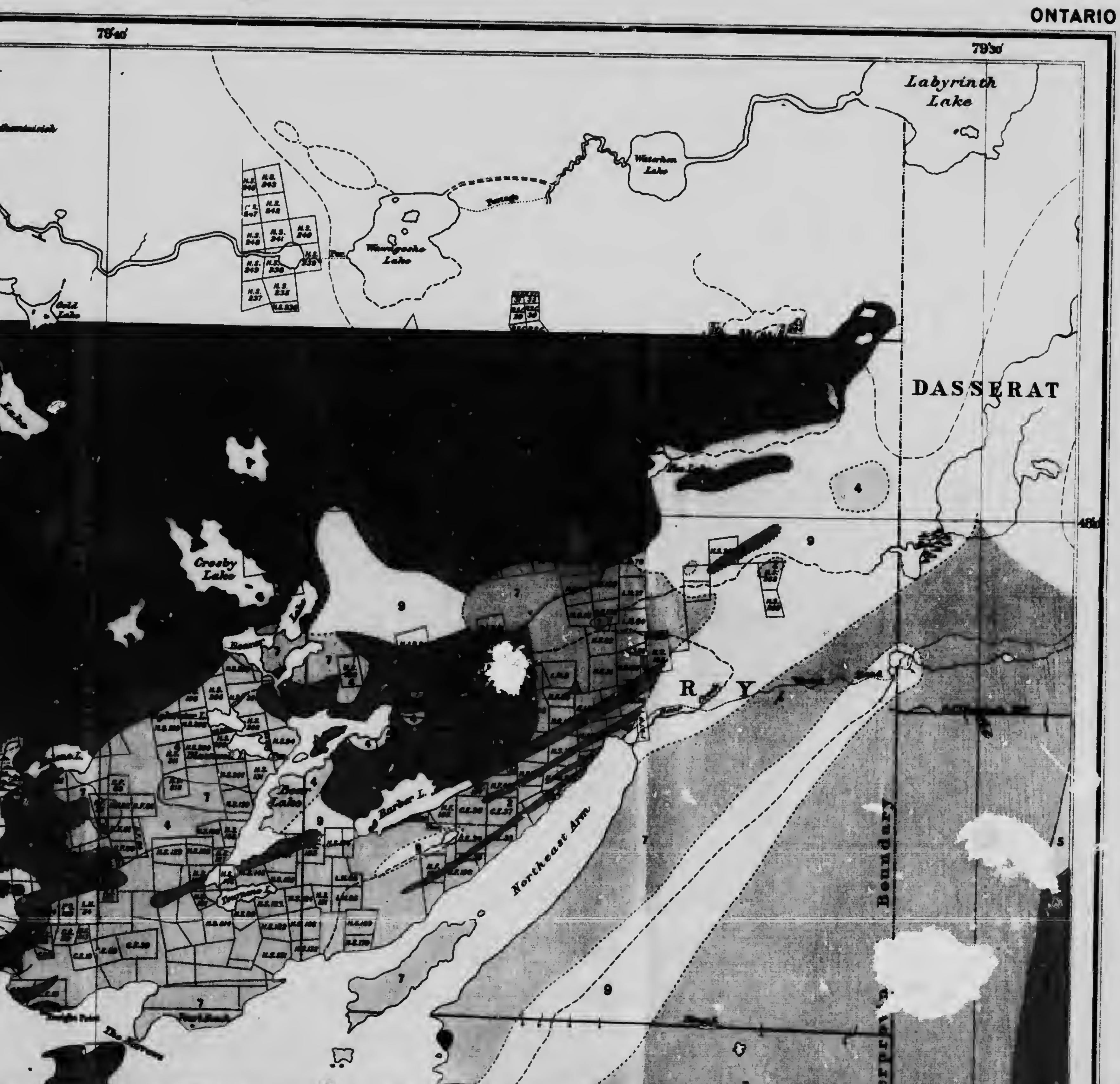
LEGEND

QUATERNARY	PLEISTOCENE AND RECENT	9	Gravel, sand, stratified clay, (lacustrine?), till
PRE-CAMBRIAN?	POST LOWER HURONIAN		Diabase, diabase porphyry olivine diabase, lamprophyre
PRE-CAMBRIAN	HURONIAN	7	Conglomerate arkose, greywacke
	LAURENTIAN		Biotite granite and gneiss, hornblende granite and gneiss, granodiorite, diorite aplite, pegmatite
	PONTIAC SCHIST	5	Biotite gneiss, biotite schist, quartz schist
		4	Quartz porphyry, rhyolite
			Ferruginous dolomite
	KEEWATIN		

Canada
Department of Mines
GEOLOGICAL SURVEY

HON. W.B NANTEL, MINISTER, A. P. LOW, DEPUTY MINISTER
R. W. BROCK, DIRECTOR.

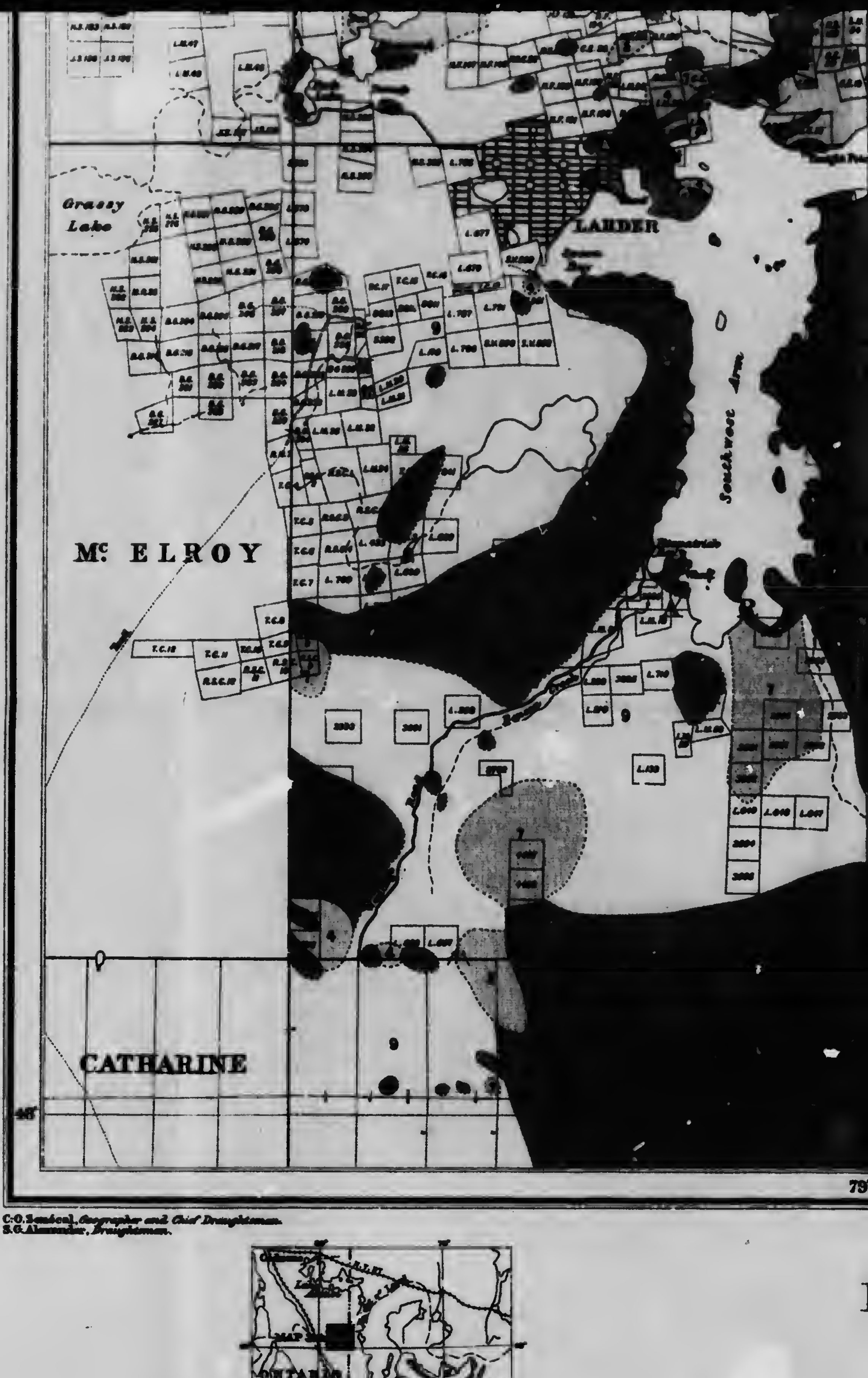
1911



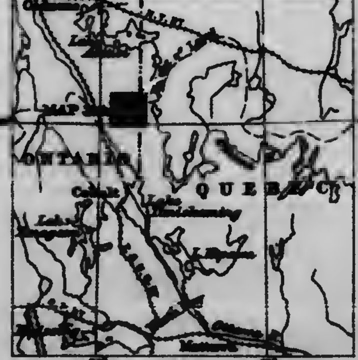
Note. Small areas of sedimentary material not indicated on the map, are known to occur associated with the greenstones and green schists. (Keewatin, 1.)

Magnetic declination about 9° 43′ West.

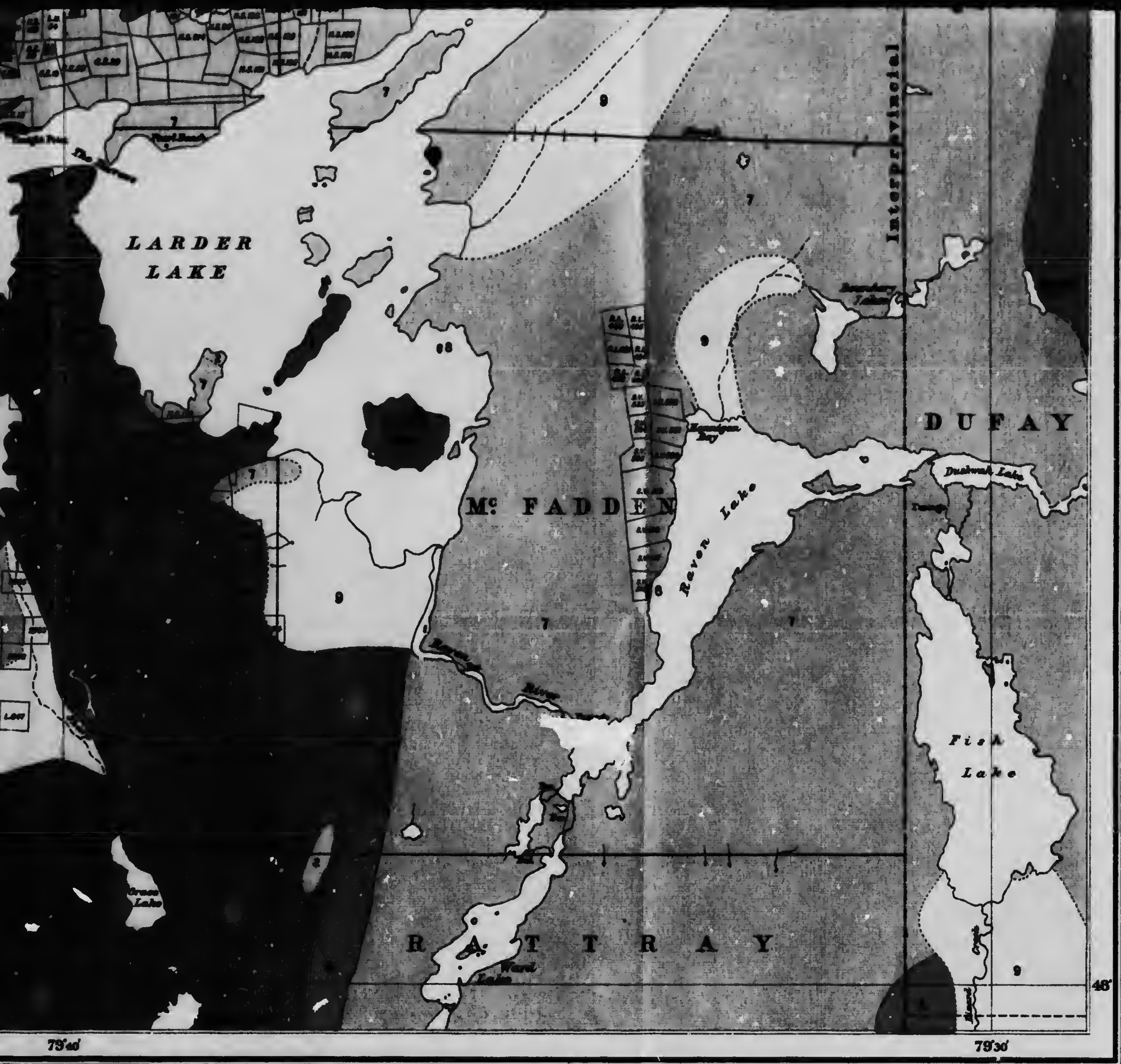
Geographical position based on latitude and longitude observations at Liskeard by Dominion Astronomical Branch, Department of Interior.



C.O. Senécal, *Geographer and Chief Draughtsman.*
S.G. Alexander, *Draughtsman.*



Scale, 100 Miles to 1 Inch.



MAP 31 A

LARDER LAKE

NIPISSING DISTRICT

ONTARIO

Scale, $\frac{1}{63,360}$

Miles

Kilometres

1 MILE TO 1 INCH

GEOLOGY

M.E.WILSON	1909.

SURVEYS

W.J.WILSON	1901.
W.A.PARKS	1904.
M.E.WILSON	1909.
DEPARTMENT OF LANDS, FORESTS AND MINES, ONTARIO.	
DEPARTMENT OF LANDS AND FORESTS, QUEBEC.	
H.LEFEBVRE	COMPILER.

To accompany Memoir No.17

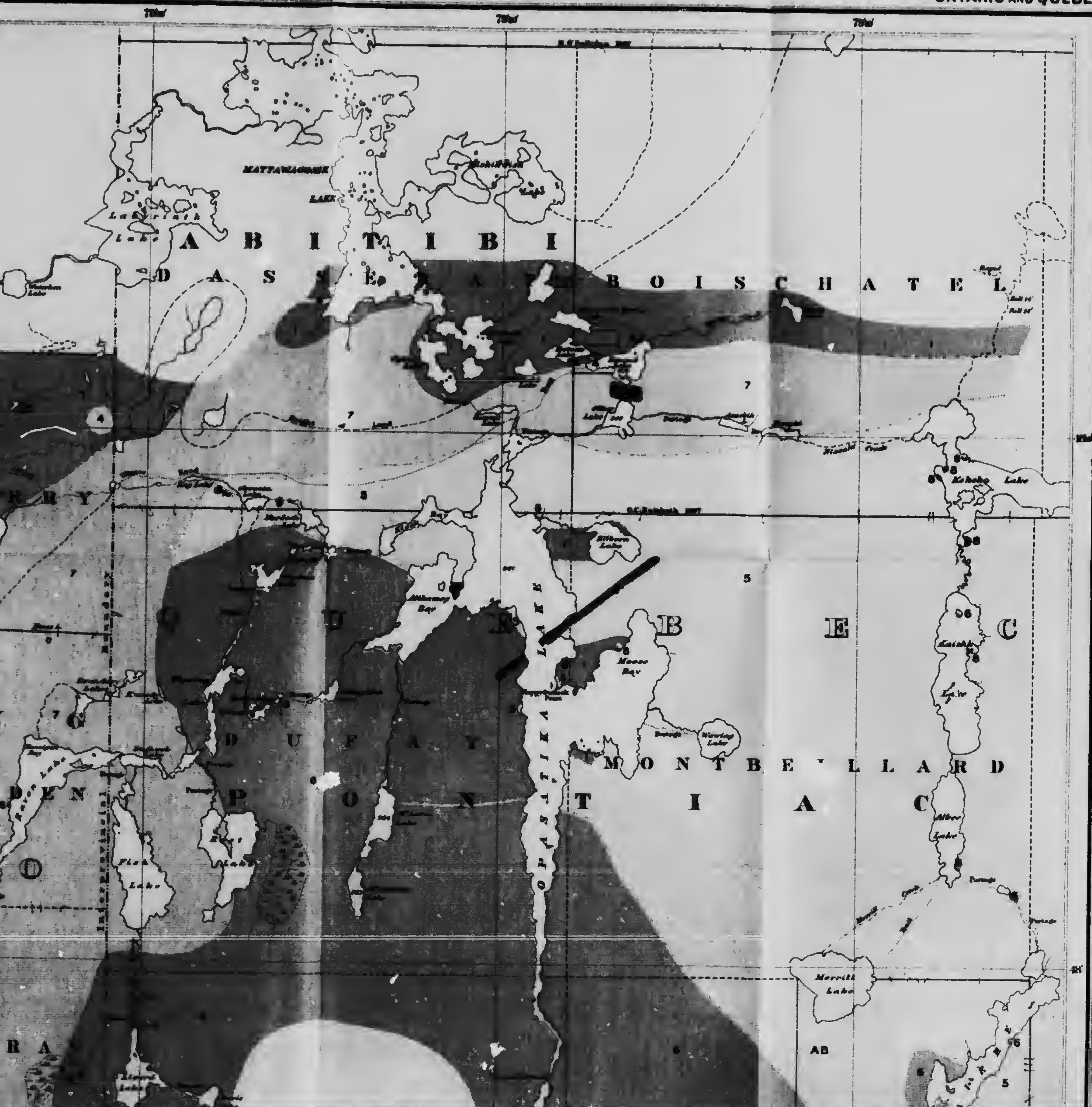
ECONOMIC GEOLOGY

Canada
Department of Mines
GEOLOGICAL SURVEY

HON. W. B. NANTEL, MINISTER. A. P. LOW, DEPUTY MINISTER
R. W. BROCK, DIRECTOR.

1912

ONTARIO AND QUEBEC



PRE-CAMBRI

4

Granite porphyry, ... and aplite

AB

2-3

KEEWATIN

1

Geological boundary defined.

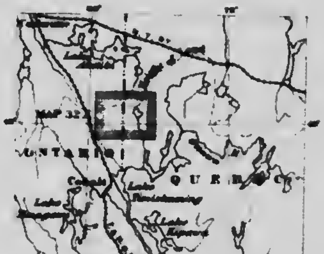
Geological boundary assumed

Note. Small areas of sedimentary material not indicated on the map, are known to occur associated with the greenstones and green schists, (Keewatin, 1).

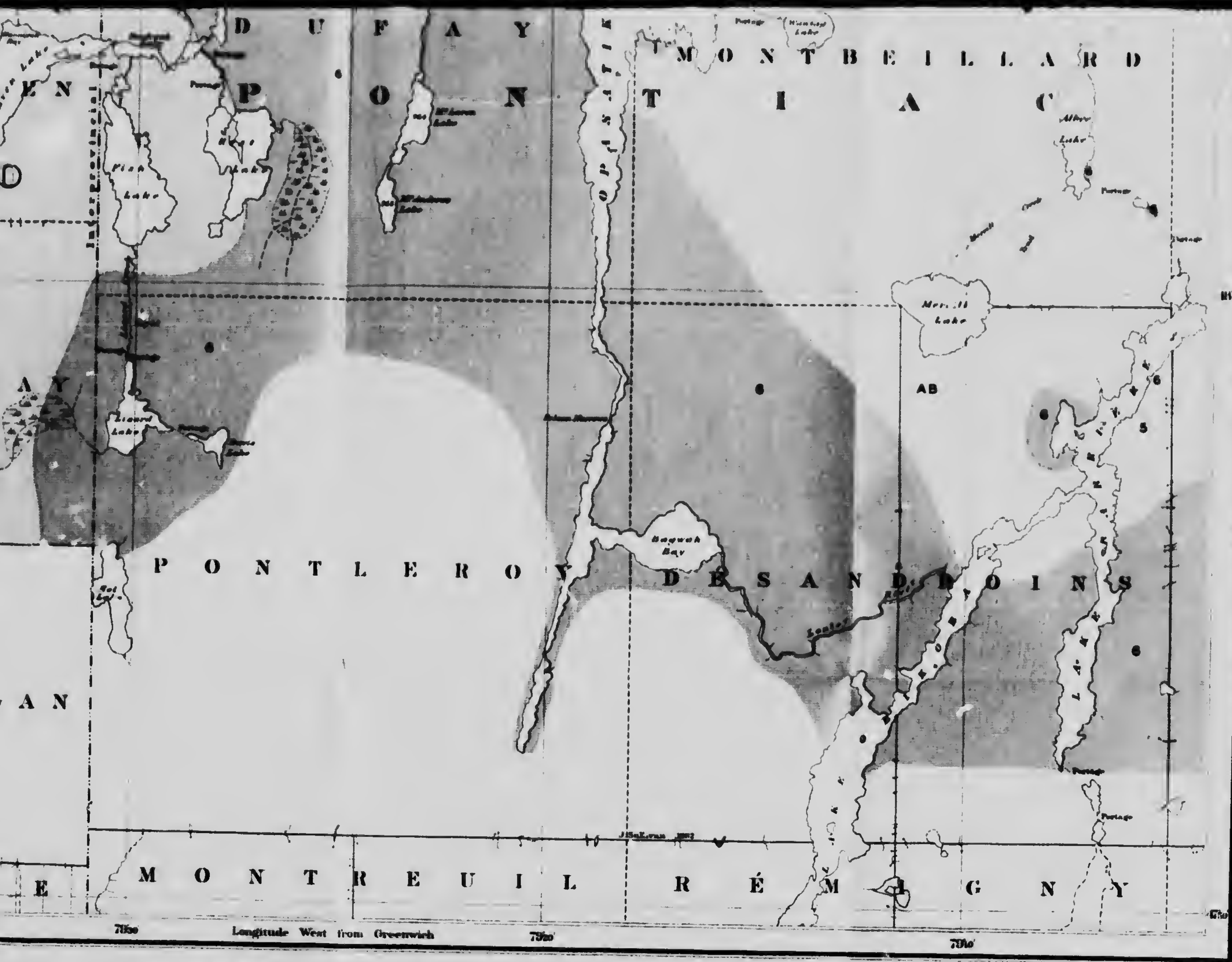
Magnetic declination about 9°15' West.

Geographical position based on latitude and longitude observations at Liskeard by Dominion Astronomical Branch, Department of Interior.

C.O. Senécal, Geographer and Chief Draughtsman.
S.G. Alexander, Draughtsman.



LARDER L



MAP 32 A

ER LAKE AND OPASATIKA LAKE

NIPISSING, ABITIBI AND PONTIAC

ONTARIO AND QUEBEC

Scale $\frac{1}{126,720}$

Miles

Kilometres

2 MILES TO 1 INCH

GEOLOGY

M. E. WILSON 1908-1909

SURVEYS

W. J. WILSON 1901
W. A. PARKS 1904
M. E. WILSON 1908-1909
DEPARTMENT OF LANDS, FORESTS AND MINES, ONTARIO
DEPARTMENT OF LANDS AND FORESTS, QUEBEC
H. LEFEBVRE COMPILER

To accompany Memoir No. 17