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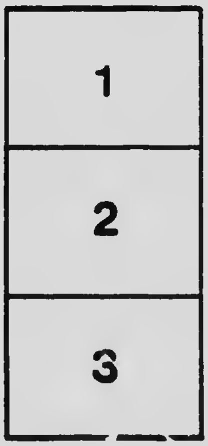
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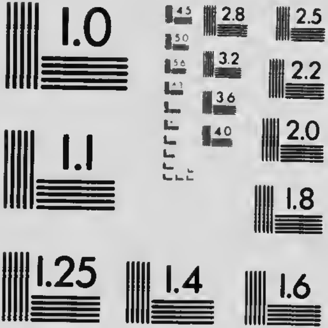

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HON. W. TEMPLEMAN, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

A GEOLOGICAL RECONNAISSANCE

OF THE REGION TRAVERSED BY THE

NATIONAL TRANSCONTINENTAL RAILWAY

BETWEEN

LAKE NIPIGON AND CLAY LAKE, ONTARIO

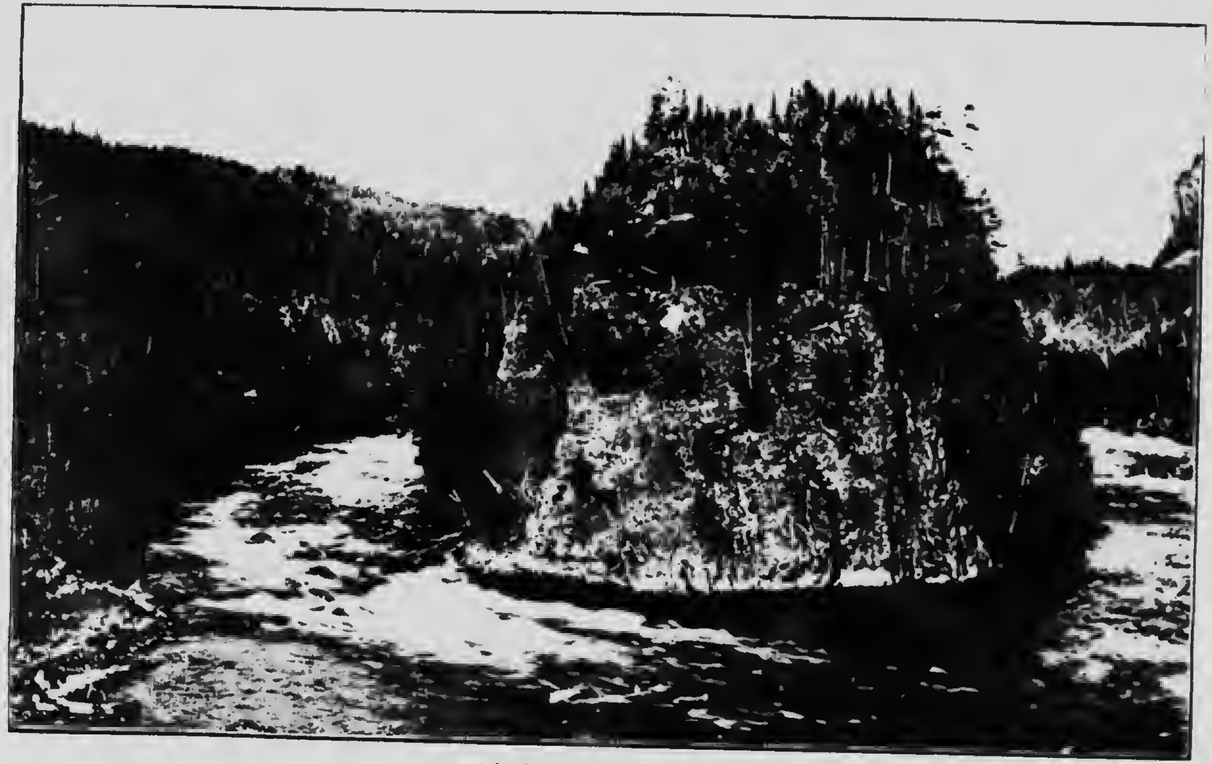
BY

W. H. COLLINS.

OTTAWA
GOVERNMENT PRINTING BUREAU
1909

No. 1059

Frontispiece. PLATE I



Split Rapids, Nipigon River.

CANADA
DEPARTMENT OF MINES
GEOLOGICAL SURVEY BRANCH.
Hon. W. Templeman, Minister; A. P. Low, Deputy Minister;
R. W. Brock, Director.

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1909

4228—1

No. 1059

To R. W. Brock,

Director Geological Survey,

Department of Mines.

Sir,—I beg to submit the following report upon a portion of northwestern Ontario lying west of Lake Nipigon which will be traversed by the National Transcontinental railway upon its completion.

I have the honour to be, sir,

Your obedient servant,

(Signed) W. H. COLLINS.

Ottawa, April, 1909.

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A GEOLOGICAL RECONNAISSANCE

OF THE REGION TRAVERSED BY THE

NATIONAL TRANSCONTINENTAL RAILWAY

BETWEEN

LAKE NIPIGON AND CLAY LAKE, ONT.

BY

W. H. COLLINS.

Introduction.

During the field season of 1906-7, I conducted a geological reconnaissance and system of micrometer surveys on a belt of country extending ten or more miles on either side of the National Transcontinental Railway location between Lake Nipigon and Clay lake, 40 miles east of Kenora. The work was materially forwarded by Messrs. H. C. Cooke and T. Firth, of the University of Toronto, who acted as my assistants. Valuable privileges were accorded by members of the National Transcontinental Railway Surveys department, both in the field and at the Ottawa, Kenora, and Nipigon offices, by officers of the Hudson's Bay Company, Revillon Frères, and the Sturgeon Lake Gold Mining Company.

Location and Area.

The region involved extends from Lake Nipigon westward for 220 miles. Its average southern limit is N. Lat. 49° 50′, where, from Sturgeon lake westward it adjoins the territory covered by the Ignace and Manitou sheets of the Geological Survey of Canada. The northern extent is irregular, in a few places reaching the Ontario boundary. The total area geologically coloured is about 6,400 square miles. All bearings mentioned in the following pages are magnetic; the deflexion varying from 2° E. to 9° E.

History of Development.

Most of the information, geological and topographical, from which the present report and maps are compiled has been obtained since 1869. A map of the Dominion of Canada, published by the Geological Survey of Canada in 1866, indicates the geographical features of the region between Lake Nipigon and Lake of the Woods very imperfectly. Lakes Nipigon, St. Joseph, Sturgeon, Savant and Seul, and the Albany, Nipigon and English rivers, are the only waters represented, and even these are inaccurate both in position and outline. No railway existed and canoe travel toward the west was by way of the Dawson route near the United States boundary. The country to the north was best known to officers of the Hudson's Bay Company, whose explorations were recorded in map form by John Arrowsmith. Between 1866 and 1869, however, an impetus was given to exploration by the decision to construct the Canadian Pacific railway. Surveys were extended from Lake Superior to the head of Lake Nipigon, and from the western coast of the latter to Sturgeon and Minnitaki lakes.

Mr. Robert Bell[1] in 1869, and again in 1871, conducted a triangulation and micrometer survey of Lake Nipigon, a portion of the Wabinosh river and the Pikitigushi river as far as Round lake. Also, in the summer of 1872 while travelling to Lake Winnipeg, he[2] made a compass traverse of a water route from Lac des Mille Lacs near Port Arthur to Sturgeon lake, and thence to Lac Seul via Minnitaki.

In 1874, acting under instructions from the Department of Public Works, Mr. Lindsay Russell explored and mapped a canoe route leading from Wabinosh bay on Lake Nipigon to the south end of Sturgeon lake. Indian Reserve No. 28, south of Lac Seul, was laid out in 1882 by A. H. Vaughan, D.L.S., portions of the shores of Lac Seul and Vermilion lake being accurately defined. An excellent micrometer-transit survey from Rat Portage, following the English and Albany rivers, to a point on Lake St. Joseph designated Fawcett post was conducted by Thos. Fawcett, D.T.S., in 1885. The Department of Crown Lands for Ontario employed Alexander Niven, O.L.S., in 1890 to survey the boundary between Thunder Bay and Rainy River districts to a point some miles north of Sturgeon lake.

[1] Rep. of Progress, G.S.C., 1869-70; 1871-2.
[2] Rep. of Progress, G.S.C., 1872-3.

This was followed seven years later by his 4th base line, 4th, 5th and 6th meridians, which afforded valuable bases for further exploration. Since 1896 the townships of Rugby, Britton, Rowell, Eton, Wainwright, Sandford, Mutrie, Vaughan, and Smellie have been outlined.

Of the ten exploring parties organized in 1900,[1] three—Nos. 7, 9 and 10—operated in the country north and west of Lake Nipigon. Party No. 7, in charge of H. P. Proudfoot, O.L.S., made micrometer traverses of the Wabinosh river and canoe route through Smooth Rock lake to Fawcett post, the Ogoki river from Wabakimi to White Clay lake and thence south to connect with the survey of Round lake. The most valuable result of Party No. 9 was a good micrometer survey of Sturgeon lake. Party No. 10 made similar traverses of Wabigoon and Cañon rivers: a portion of the south shore of Lac Seul omitted by Fawcett, and Wabuskong lake.

The following season W. McInnes[2] traversed with log and compass, Minnitaki, Vermilion, Lost, Seul, and Savant lakes, and with a compass, Sturgeon river and its chief branches. In 1902 he[3] surveyed with micrometer and compass the principal branches of the Wabinosh river, Onamakawash and Trout lakes, besides track surveying the Whitesand river.

At that time the Grand Trunk Pacific Railway surveys commenced, continuing up to June, 1905, after which the work of obtaining a suitable route was turned over to the National Transcontinental Railway department under control of the Federal government. Much valuable and detailed information has resulted from these surveys, exploratory effort has been stimulated and a reliable basis for later surveys provided. A final location has been selected from Winnipeg as far west as the junction with the Lake Superior branch at English river, and construction begun. Between English river and Lake Nipigon survey work is still under way.

To meet or anticipate the demand for information—created by railway building activity—the Department of Crown Lands for Ontario, and the Geological Survey have been active. Most of the townships already enumerated have been surveyed recently. Owing to the demand for timber, berths have been laid out in Rainy River and Thunder Bay districts in reasonable proximity to the line of

[1] Report on Exploration of Northern Ontario, 1900.
[2] Summary Report, G.S.C., 1901.
[3] Summary Report, G.S.C., 1902.

construction. Hence, under instructions from the Geological Survey, the writer, in 1906, commenced examination of the country adjacent to the proposed railway route west of Lake Nipigon. Surveys with micrometer and compass were made of Caribou lake, Obowanga creek, Allanwater, together with its lakes and chief branches, Flint river, and numerous small waterways near the line which were not indicated upon the railway plans. Compass traverses were made of Dog river and several canoe routes between that stream and Sturgeon river.

The following year, Dog river, a portion of the south shore of Lac Seul, Rock Lake river and its headwaters, a chain of large lakes extending from Clay lake to Pine lake, the Wabigoon river from its crossing of Mutrie township to the mouth, and Cañon river were instrumentally surveyed; while, as in 1906, minor waterways were traversed with a compass.

Elevations are based upon determinations made by the National Transcontinental Railway engineering staff. In the Winnipeg office of that Department the various data used in levelling between Winnipeg and Lake Nipigon have been carefully correlated and corrected. Lakes not touched by the railway have been given approximate elevations by estimating the fall on streams connecting them with other bodies adjoining the line. The altitude of Lac Seul is taken from White's Map of Canada, it being found to correspond closely with the railway determination for Lost lake; that for Sturgeon lake is from McInnes' work to the south.

Geological information has been obtained during the prosecution of these surveys at various times and by different observers. In practically all cases geological and topographical operations were conducted together, consequently the former was hastily performed and must be regarded as reconnaissance work. The earliest work referred to is that of Dr. Robert Bell in 1869 and 1871. Geological notes were also made relative to the route he traversed in 1872. Visits within the limits of the map sheets were made by D. B. Dowling in 1893[1] and A. P. Coleman[2] two years later. Owing, however, to the lack of pre-existing maps, points of observation could not be accurately located, hence their accounts have lost much in value. In 1897, W. A. Parks[3] accompanied O. L. S. Niven, and made an

[1] Annual Rep., G.S.C. (New Series), Vol. VII.
[2] Rep. Bureau of Mines for Ontario, 1895.
[3] Rep. Bureau of Mines for Ontario, 1898.

examination of the country within two miles of the lines then being surveyed. Each of the three exploring parties of 1900 was accompanied by a geologist, and a record was kept of the rocks observed. The areas examined, however, were of such great extent that accurate geological conceptions could not be expected.

Excepting that done by Parks, the first systematic geological examination was made in 1901-2 by W. McInnes. During the first season the country around Lake Minnitaki and Lac Seul, the Sturgeon river, Sturgeon and Savant lakes was covered, while the next year he was engaged north and west of Lake Nipigon. The work done in 1906-7 by the writer was similar in character.

Object of Present Investigations.

The facts obtained by the previously mentioned investigators have appeared independently, and, although a mass of information has accumulated, it is in too diffuse form to be conveniently accessible. Following the work done in 1900 by the Department of Crown Lands, a map on a scale of eight miles to an inch was compiled, but no correlation of the several geological reports was attempted. Since that time much fresh information has been obtained. The writer's work in 1906-7 was an attempt to supplement existing knowledge sufficiently to render possible its unification. As a result the topographical data are assembled in the maps, the geological data in the present report.

The region in question will in brief time be traversed by the National Transcontinental railway, a portion of which is already nearing completion. Under easy conditions of access such as will be inaugurated, new interest in the commercial resources and a demand for information are to be anticipated.

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General Character of District.

TOPOGRAPHY.

The entire region between Lake Nipigon and the Manitoba boundary is glaciated, and exhibits the usual uneven, moderately low relief characteristic of the Archæan peneplain. Lake Nipigon is 852 feet above sea-level; Lac Seul, which receives most of the water in the west, is 1,140 feet, while Chivelston lake, just north of Sturgeon lake and one of the highest bodies in the region, stands at 1,425 feet. The difference of 573 feet between Chivelston and Nipigon, which is an approximate maximum, is distributed over a distance of 80 miles, hence the average gradient is not excessive. For any locality the average land elevation is from 25 to 50 feet greater than the average water level, with the possible exception of Lake Nipigon, the country surrounding which is unusually high. The average land surface varies, therefore, between 900 and 1,450 or 1,475 feet above sea-level. Somewhat lower results are derived by inspection of the contours of the National Transcontinental railway location.

The surface of the peneplain is hilly and exceedingly irregular in configuration. With few exceptions the hills are bare, rocky knobs less than 200 feet high; rarely they reach 300 or 400 feet (e.g., Sioux Lookout), above the general level of the surrounding country. The lower levels are occupied by lakes, muskegs, or irregular and limited areas of soil. While rugged in detail the skyline visible from one of the higher summits is level, like that of a plain, and only rarely notched by a large hill.

This general aspect does not vary greatly with change of locality, yet closer inspection reveals a certain topographic variability coinciding with changing geological conditions. It expresses itself in details such as would be shown by a contoured map were such available. As it is, the shores of lakes—each of which is a true contour line, exhibit these details locally.

The diabase covered area near Lake Nipigon presents an unusual profusion of cliffs and rock walls. Much of the lake shore is high and unscalable, and the bold scenery of Nipigon river is due largely to the trap precipices which wall its valley. Steep rocky slopes are not rare in the Laurentian and Keewatin areas, but as a rule lack the abruptness characteristic of the diabase country. The difference is well shown on Caribou lake: where diabase occurs in the southeast the shores are bold and high with deep water only a few feet away, but the large central portion of the lake which lies in the Laurentian is shallow, as evidenced by the multitude of islands, and the gently receding shores. West of Lake Nipigon where the diabase grows thin the rugged character persists, but on a reduced scale; Ted lake, a few miles south of Onamakawash is enclosed by a wall of diabase quite vertical and unscalable, though only about 25 feet high.

Contrasts are also presented by the surface of the schists and the Laurentian gneisses. The latter possess little regularity in the arrangement of hills and hollows, as is shown by the shore lines of Smoothrock, Kawaweogama and other large lakes. In the schist areas, on the contrary, there is a manifest tendency toward the development of a parallel system of ridges and trough-like valleys extending in the direction of rock strike. A ground plan of this arrangement is exhibited as shown by the shore lines of the north-eastern portion of Sturgeon lake, the Dog River system and Lake Minnitaki. It may be seen also where gneissification is pronounced in the Laurentian, but in much less perfection than among the highly-foliated schists.

DRAINAGE.

All parts of the region are well supplied with lakes, ranging in size from ponds a few chains wide to lakes like Minnitaki and Sturgeon, the latter being 37 miles long and in places 5 miles wide. Between W. long. 89° 15′ and 91° 30′ in N. lat. 50° 15′, where the country has been unusually well explored, the water-covered area in a 4 mile strip is computed at 14 per cent of the whole. Locally, for example in the vicinity of Lost and Vermilion lakes, the proportion is much greater, but for the entire region it is remarkably high. Most of these lakes are characterized by bare, rocky shores and clear water.

The abundance, and the irregularity of form of the lakes are apparently the result of geological peculiarities. Soil is scarce. The uneven pitted rock surface affords a vast number of water-tight depressions which receive and retain the rainfall. The crystalline rocks are not only impervious but also highly resistant to stream action, consequently the lake-containing basins are permanent structures even in details such as small islets and narrow bays, and only the surplus water can escape by overflow from one basin to another lower.

The streams thus formed are dependent upon chance irregularities in the rock floor, and form symmetrical channels with even gradient only where they cross soil-covered areas. Owing to their feeble cutting power rapids and falls are numerous and the current varies greatly. The Sturgeon river may be considered to typify these conditions, and its description will serve for nearly any of the important streams. The channel is rocky and extremely variable in dimensions, varying in width from 150 feet to over a mile. Islands and deep bays are abundant. Current is scarcely perceptible except in the narrow parts and near the frequent rapids and falls by which the descent is accomplished. In reality the river consists of a chain of narrow, naturally dammed lakes, with occasional river-like intervals.

There are a few important exceptions to this type. The Whitesand river, flowing into Lake Nipigon, possesses no lake expansions and few rapids in the lower half of its course, but runs in uniformly swift meandering fashion through sandy country. High banks of stratified sand are usual. The Pikitigushi is of similar character, but not so rapid. Between Clay and Wabigoon lakes the Wabigoon river winds tranquilly through a broad clay-filled valley. Only two falls occur in the whole distance. Its tributaries, Gull and Pelican brooks, are swifter, muddier, and more tortuous. Log jams render canoe travel on the former slow and disagreeable.

With these exceptions the rivers of the region are clear, and carry very little undissolved matter. Erosion of the solid rocks is apparently very slight, but glacial debris and vegetable mould are being transported locally. Owing, however, to the abundance of lake expansions, which act as settling basins, none of it travels very far. Many of the small expansions are being silted up, encroached upon by vegetation and gradually transformed into muskeg or swamps. All stages of the process are visible; thus McInnes[1] remarks with regard to Savant lake: 'The lake is characterized by many shallow bays . . . for the most part exceedingly shallow, long stretches having only a few inches of water covering a bottom of slimy mud . . . and at their heads . . . areas of swamp.'

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

Most of the drained off water goes to Hudson bay. The Sturgeon, Wabigoon, and English rivers unite under the last name, and eventually reach Lake Winnipeg. The waters of Savant lake run to the Albany river, which is joined farther down by the Ogoki. The country south and east of the height of land drains into Lake Nipigon through the Gull, Wabinosh, Whitesand, and Pikitigushi rivers, all of which are small.

Water-power is afforded by most of the large streams, in a number of cases within short distances of the National Transcontinental Railway location. Immediately at the railway crossing over the Wabigoon the river narrows to about 40 feet and falls 25 feet. Eagle and Wabigoon lakes afford opportunity for backing up and securing a steady water supply. A much larger volume goes over Pelican fall on the English river just below Pelican lake, but the channel is wide —really in two parts separated by an island—and difficult to control. The 22 ft. fall on Allanwater is also in two channels, but both are narrow and easily closed. Powers suitable for small mills occur at the foot of Pelican lake in Rugby township, near the mouth of Dog river, at the foot of Rock lake, on the stream draining Coveney lake, on Obowanga river, and at various other points

CLIMATE AND AGRICULTURE.

The climate of the northern district is much like that experienced along the Canadian Pacific Railway line between Fort William and Kenora. The large lakes open early in May as a rule, although in 1907 Sturgeon lake remained closed until June 9. Light frosts continue well into June and begin again in the latter part of August, but the small lakes are not frozen until late in October or November.

During the summer, rainfall and sunlight are sufficiently balanced to stimulate rapid vegetable growth. Small fruits, potatoes and ordinary garden vegetables are raised at Lac Seul, Abram chute, Sturgeon lake, and Nipigon House. Even tomatoes are successfully grown. To the agriculturist the climate is probably less objectionable than the character and distribution of the soils. Only a fraction of the country can ever be used for farming. Occasional patches excepted, the territory between Lakes Nipigon and Minnitaki is of little agricultural value. Small tracts of loamy soil exist on Sturgeon river where the Lake Superior branch of the new railway crosses, and locally around Minnitaki and the Vermilion lakes. A considerable portion of Indian Reserve No. 28 is also fit for grazing, being now occupied by extensive hay meadows which support a few head of cattle kept by the Indians of Frenchmans Head village. The deeply soil-covered neighbourhood of Gull lake is of questionable value, being very sandy; but conditions are better in the Wabigoon valley. A considerable farming community already exists around Dryden, and a few settlers are scattered as far west as Minnitaki station. Farming is of a mixed character, and attention confined largely to raising fodder crops. The clay does not work readily, being tough and impervious to moisture, inclined to be wet in rainy seasons, and to bake hard in dry weather. Hay grows luxuriantly in the Wabigoon valley. In general it may be stated that agricultural conditions improve steadily from Lake Nipigon westward.

TIMBER.

The same general statement applies to the forest growth. Around Lake Nipigon and westward to near Sturgeon lake the trees are spindly and do not grow rapidly; the stumps of spruce from 6" to 8" diameter growing in wet places, show from 100 to 150 annual rings. Spruce and jackpine are the chief evergreens; tamarack, poplar and canoe birch the chief deciduous trees. Between Se-eganaga and Sturgeon lakes and northward, poplar attains a diameter of 2 feet, and the other trees are correspondingly well developed. A few scattered red pines were noted on the south end of Smoothrock lake, on McEwen and Wilcox lakes; from there westward they grow steadily more abundant. White pines appear to have a more restricted range, being first seen on Sturgeon lake, but like the red variety are commoner farther west. The same statement holds for yellow birch. Elm trees are apparently confined to the Wabigoon valley, and a few small oaks were seen where the National Transcontinental railway crosses that river. Cedar is not limited to any locality, but never occurs in sufficient quantity to render it of value. The largest trees are often hollow, and locally designated 'churnbutts.' Very good tamarack swamp, mixed with ridges of birch and poplar, is to be found just west of Schist lake on Dog river; good specimens are 24" in thickness. Equally good timber was seen just south of Houghton lake. Banksian pine suitable for tie timber is abundant south of Rock lake. A splendid grove of red and white pine, specimens of which attain 3 feet in diameter, occupies the north side of Pine lake, and smaller groves were noted between

Twilight and Clay lakes, on Allan lake, and at a number of points on Clay lake.

A great deal of damage has been done already in the vicinity of the railway location. In 1906, fires ravaged the forests between Onamakawash lake and Allanwater, and in the following spring a large area was burned east of Lake Minnitaki; while less recent fires have occurred southwest of Island lake, and over a large part of the Wabigoon valley.

To meet the requirements of railway construction, timber berths have been surveyed all along the new line by the provincial Department of Crown Lands.

ACCESSIBILITY.

Before the inauguration of the Grand Trunk Pacific Railway surveys, the country they traverse was not particularly easy of access; but since then much has been done to displace the old, slow canoe travel by regularly appointed services of power-driven boats for the transport of supplies and passengers.

All the starting points are stations on the Canadian Pacific railway. On the east the only travelled route leads from Nipigon station via the Nipigon river to Lake Nipigon. For years this route has been much used by tourists attracted by the magnificent trout fishing, consequently the portages, of which there are six—aggregating four and a half miles in length—are kept in good condition. Over the two longest of these baggage may be transferred by wagon. For years the Hudson's Bay Company has kept a large sail-boat on Lake Nipigon, but in the winter of 1905-6 two steamers were built to handle the large quantity of freight going to the railway caches, one by Revillon Frères, the other by Mr. R. H. Flaherty. From South Bay, where a large supply depot has been established, they run to Nipigon House, Wabinosh cache, Mud river, and other points on the east coast.

No other easy route exists between Nipigon and Ignace stations on the Canadian Pacific railway. With the beginning of gold mining operations on Sturgeon lake, a small steamer was built, and Mr. J. Cobb, of Ignace, undertook canoe freighting contracts between the south end of the lake and Osaquan, a flag station five miles west of Ignace. This was found inadequate for the heavy traffic caused by survey and construction operations, and the canoes were replaced by a line of small steam vessels. About the same time, an opposition line of gasoline boats was placed on this route by Mr. J. Johnson. In winter the route is used as a sleigh-road.

PLATE II.

Nipigon House, Hudson Bay Post, Lake Nipigon.

In anticipation of the demand for rapid transit, steamers were placed on Big Sandy, and Minnitaki lakes, in 1901. At present this forms one of the easiest connexions between the Canadian Pacific, and National Transcontinental railway systems. A nine-mile road leads from Dinorwie station to Big Sandy lake; one steamer plies on Big Sandy and two on Minnitaki; tramways have been built across the intervening portage and that at Abram chute. Steam and gasoline vessels connect the latter point with Sturgeon river, Pelican fall, the wagon road to the Michie mine, and the camps on Lost lake. For the convenience of the contractors whose camps extend along Cañon lake, a line of gasoline boats was placed on a chain of lakes extending from that lake to Vermilion Bay station on the Canadian Pacific railway.

Where the distance between the two railways is not prohibitive, nd good waterways do not exist, wagon roads have been constructed. Several reach from Vermilion bay to Wabigoon falls and neighbouring points on the National Transcontinental railway; another, fourteen miles long, connects Minnitaki station with Allan lake, and two others run from Dryden to Good lake, a distance of eighteen miles, and to Mud lake.

A temporary telephone line now follows the Good Lake road and extends along the railway location from Lost lake to Wabigoon falls, connecting all the construction camps with Dryden.

Such rapid progress has been made with railway construction that, at the present time the line between Winnipeg and Lake Superior Junction (English River crossing, approximately) is expected to be completed this year. The branch running from the latter point to Fort William is somewhat further advanced, so that an unbroken connexion will be obtained between Winnipeg and Lake Superior. From English river eastward progress has not been so rapid; however, the final location has been determined, and only a small amount of revision remains to be done. Contracts have already been awarded for portions of the road north of Lake Nipigon.

With the completion of the eastern portion of the line, practically no point within the limits of the map sheets will be more than one or two days canoe journey from the nearest station. Canoe travel itself has been greatly facilitated by the survey parties, which have improved the old Indian trails, besides cutting many new ones.

General Geology.

GENERAL OUTLINE.

With the exception of a small amount of little metamorphosed sediments near Lake Nipigon, the entire region is underlain by crystalline rocks of pre-Cambrian age. By virtue of widely different lithological characters they fall readily into four principal divisions to which, in a measure, chronological distinctions are applicable. The division is of practical value in that the distinction involves differences of texture and colour readily perceptible in the field.

The oldest division includes what are variously termed schists, green schists, Keewatin or Huronian. The last two terms have been used synonymously in some cases, but are intended here to apply to portions of the schist complex which differ markedly in character, age, and mode of origin. The general descriptive term, schists, will be used when speaking of Keewatin and Huronian collectively.

The schists form areas elongated in an approximately N.E.-S.W. direction, which either actually connect by constricted portions or are separated by short intervals. A rude tendency is exhibited in their arrangement to the development of an anastomosing or mesh structure, like that first described for the adjacent Lake of the Woods region by A. C. Lawson.[1] The rocks comprising them are predominantly highly foliated or dark grey or green schists, which stand nearly vertically and strike in the long direction of the area in which they occur.

The Keewatin members are chiefly chlorite and sericite schists, derived from the alteration of diabases, porphyries and other eruptives. Sub-aqueous deposits are represented by banded iron formation. With these are associated igneous masses of various dimensions and compositions which, from their less squeezed and decomposed condition are evidently younger. The real ages of these post-Keewatin intrusives are practically impossible to determine, and even their delimitation requires much more detailed study than has yet been given them.

[1] Annual Report, G.S.C., 1885 and 1888.

In addition to this dominantly eruptive group is a series of sedimentary rocks, comprising conglomerate, greywacke, slate and iron formation, that resembles closely the lower Huronian east of Lake Nipigon which has been mapped recently by Coleman and Moore. The field work of 1906-7 indicates these sediments to have been folded and truncated so as to be left exposed in long strips coinciding with the long axis of the schist areas. They are penetrated like the Keewatin by igneous masses.

The schist areas are bounded by younger granites and gneisses which have induced a contact metamorphic zone of variable width, marked by increased crystallinity and obliteration of schistosity. The extent of the alteration varies greatly from point to point, the zone being sometimes scarcely perceptible, sometimes distinct and two miles wide. This irregularity is due, to some extent, to differences in the materials metamorphosed, but probably, in large part, to varying inclination of the contact plane to the existing surface. The commonest resultant rocks are a glistening black hornblende schist or amphibolite and a micaceous schist or gneiss.

The outer edge of this contact border constitutes a transition zone between the schists and the Laurentian gneisses. It consists essentially of Laurentian materials with which is associated a varying proportion of metamorphosed schist inclusions. Being transitional, the edges of this zone, especially that next the Laurentian, are indefinite.

Like the schists, the Laurentian—or second major division is a complex, consisting, however, of granites, syenites, diorites and allied plutonic types, together with their gneissic equivalents. Biotite granite, including its gneissic variations, is the most abundant rock. A hornblende-bearing type is less common. Differentiated phases are represented by syenite and diorite which form schlieren, darker in colour than the ordinary gneiss. Pegmatite dikes and stocks cutting the other rocks represent late stages of differentiation.

In addition to these there are small amounts of the same included materials which characterize the transition zone. Indeed isolated patches of this zone are not rare many miles away from the nearest schist area. Ribbons and rounded or angular blocks of hornblende and biotite schist are the usual forms observed. The whole Laurentian complex is distinguished by a plutonic type of crystalline te...

tures, prevailing acidity of composition, pale colour, and imperfect foliation.

The gneisses and schists near Lake Nipigon are overlain by a series of Keweenawan sediments, which are capped, in turn, by a thick mantle of diabase constituting, respectively, the third and fourth divisions. The sedimentary series is flat-lying and scarcely metamorphosed except in the immediate neighbourhood of the diabase, which produced some hardening. It does not exceed 50 feet in thickness where known. A thin basal conglomerate resting upon the eroded crystalline floor is succeeded by feldspathic sandstone and impure dolomite of dull red colour.

The overlying diabase is considered to be the remains of sills intruded during or following Keweenawan time.[1] Near Lake Nipigon it forms a thick, continuous cap for the sediments, but farther west, grows thinner and fragmentary, being represented by isolated patches resting upon the older crystalline complex. Judging by these vestiges, the diabase formation once extended to within a few miles of Savant lake.

Scanty amounts of stratified clays and sands and glacial debris are the only deposits younger than the diabase. Morainic and esker-like bodies of the latter, and pot-holes testify to the activity of ancient streams, probably ice-fed. The present surface is undergoing exceedingly slow erosion. The loose deposits are being transported locally and rearranged in the lower levels of the rock floor. Forest fires check the accumulation of vegetable mould except in the muskegs. They also loosen scaly layers from the crystalline floor, thereby increasing the quantity of transportable matter and exposing larger erosional surface. The total effect is not great, however, for in many localities original polished and scratched glaciated surfaces persist.

The geological sequence may be briefly outlined in descending order as follows:—

Glacial an lacustrine deposition.
Erosion period, including glaciation.
Diabase intrusions.
Keweenawan.
Erosion period.
Laurentian (beginning in pre-Huronian time).
Keewatin (including Huronian).

[1] Bulletin No. 8, Geol. Surv. Minn., 1893.

KEEWATIN AND HURONIAN.

Distribution.—Our knowledge of the northwestern portion of Ontario is not extensive enough to admit of separating Keewatin and Huronian rocks areally. In some of the geological accounts dealing with portions of the region no distinction is drawn between the two terms, while in the others Huronian rocks are not mentioned, hence, none of them are of assistance in discriminating between the two systems. It is not yet possible, therefore, to map them independently, but an attempt is made in the following pages to describe the chief features of each and give such information regarding their distribution as is now known.

They are intimately associated and stamped in all parts of the region by like metamorphic alterations. Igneous as well as sedimentary members have been changed to well-laminated schists and slates which stand nearly vertically. The average direction of strike is E.N.E.-W.S.W., but the local variations from this are often large. A general correspondence in direction obtains between the axis of the schist areas and the schistosity. Dark grey or green are the prevailing colours, and fine-grained textures are invariable. The original nature of the sediments can be discovered in the field in most cases, but their boundaries with the igneous schists are hard to determine. Where contact action has been superimposed upon regional metamorphism around the margins of the areas the true nature of the original materials is problematical.

Keewatin types.—Chlorite and sericite schists are the most abundant Keewatin rocks. They are eminently fissile rocks, of greenish colour, and possess glossy cleavage surfaces owing to the abundance of secondary micaceous minerals. Being as fine grained as slate, the individual minerals cannot be distinguished except microscopically. Neither can the two species be separated easily, for both chlorite and sericite are usually present, sometimes the one, sometimes the other predominating. Chlorite schist is the more abundant form. Light yellow sericite schist occurs occasionally, viz., on Kashaweogama lake, but a green colour is more common. Sometimes an original porphyritic structure is exhibited by oval grey spots or glassy blebs representing squeezed phenocrysts of feldspar or quartz. A quartz-porphyry schist seen at Caribou lake contained quartz grains so large and well rounded as to closely imitate a grit in appearance.

The porphyry on Abram lake is only slightly foliated, and the feldspar phenocrysts, which are from ⅛" to ¼" diameter, and possess good crystal outlines, contrast sharply with the fine black groundmass. Disseminated grains of pyrite, or loosely aggregated bands of the same mineral are wide-spread in both chlorite and sericite schists.

Basic rocks are less well preserved than the porphyries, owing to the readiness with which their ferro-magnesian minerals decompose. A massive black rock in which hornblende is easily distinguished, and to which the name diorite is applicable, occurs repeatedly in the Sturgeon, Savant, and Minnitaki areas. Dikes of similar material cut both Keewatin and Laurentian, hence they seem to be much younger than the associated schists. The hornblende in these diorites is secondary and the rocks may have been, originally, gabbros and diabase. Earlier reports mention gabbro, 'snowshoe' diorite, diabase, etc., in the Keewatin. Greenstone agglomerate and volcanic tuffs have also been recorded from Lake Minnitaki, but rocks of this character have not been observed by the present writer.

Sediments are represented certainly only by the iron formation. This rock is usually a dull grey banded quartzite containing parallel bands full of magnetite grains. Brilliant red banded varieties such as occur in Minnesota have not been noted.

The usual green schists sometimes contain narrow bands of whitish feldspathic rock which bears considerable resemblance to a fine-grained quartzite. The larger bodies have a more gneissic appearance, and prove upon microscopic study to be aplites in which biotite, the only dark mineral, is in minute quantity. The bands of this material probably represent dikes from the Laurentian granites.

Huronian types.—These include conglomerate, greywacke and slate, the latter becoming iron formation where banded with magnetite. Secondary schistosity of the matrix earns for the conglomerate the designations slate conglomerate and schist conglomerate; often, however, the cement is an unaltered grit, regarding the nature of which no doubt can exist. Coarse and fine materials often alternate as in modern beach deposits. Locally, the cementing materials have been recrystallized, apparently through proximity to intrusive bodies; thus at one point on Pelican lake pebbles were found in a cement of hornblende schist, and on Schist lake in immediate contact with the Laurentian a biotite schist encloses flattened gneiss pebbles. The pebbles are well rounded and attain diameters of 18". They are composed of Keewatin and other crystalline rocks, the chief varieties recognized being a pale grey feldspar porphyry, vein quartz, reddish medium-grained hornblende syenite, crushed quartz-porphyry and a basic eruptive weathering to deep-red colour. In addition, Coleman reports diorite and biotite gneiss, and McInnes records iron formation.

The greywackes possess secondary schistosity in varying degrees. An exposure on Vermilion lake has been described as a sandstone-like arkose. Some of those on Abram lake show equally little modification. In other cases recrystallization, with the development of biotite produces a mica schist, while other forms are near chlorite schist in appearance. No line can be drawn between the greywackes and the slate or between slate and iron formation. The slate is siliceous as a rule and approaches quartzite. Magnetite may be present in microscopic quantities or as bands visible to the unaided eye, the term iron formation being applicable to the latter. Rarely the bands are a foot or more wide. Besides these bands an original bedding is indicated on weather-etched surfaces by narrow alternating layers of fine and coarse texture. These layers and the magnetite bands appear to stand nearly vertically. They are more or less crumpled, and intersected at various angles by the secondary cleavage planes.

The clay slate on Lake Minnitaki mentioned by Coleman probably belongs to this series. Graphitic shale has also been recorded on the north shore of Vermilion lake, but nothing is known of its relationships except that the vicinity is composed principally of sheared diorites.

Metamorphic types.—The rocks in the marginal contact zone are more distinctly crystalline than the ordinary forms. Both Keewatin and Huronian materials are present, but the metamorphic change has so obliterated or obscured their former character as to render identification very difficult.

Black hornblende schist is the most abundant and widespread member. It is a black rock, appearing in the hand specimen to be almost wholly hornblende, the smooth cleavage faces of which impart a brilliant glistening appearance to freshly-broken surfaces. It ranges in texture from a slaty black schist in which the minerals cannot be distinguished, to coarse and perfectly massive amphibolite. The latter is found only in the immediate vicinity of the Laurentian, very frequently as inclusions in it. There are also speckled black and white phases containing large amounts of feldspar and quartz, but these cannot be certainly distinguished from purely igneous hornblende gneisses of the Laurentian.

Biotite schist or gneiss is a less abundant metamorphic type. It is really a gneiss according to mineralogical composition, but the other term is employed to emphasize its unusual fissility and to distinguish it from the Laurentian gneiss. It is a speckled brownish or black and white laminated rock, the cleavage surfaces of which consist almost entirely of biotite scales. Lenticular bands are common in the Keewatin-Laurentian transition zone.

Microscopical descriptions.—The hornblende schists form a well-defined group mineralogically, in spite of their textural variety. They are always entirely crystalline. The constituent minerals are without crystal boundaries, and form a mosaic of grains ranging in size between sub-microscopic dimensions and diameters of about two millimetres. In any single specimen the constituent particles are strikingly uniform in size. The fine-grained varieties possess a good cleavage owing to parallel arrangement of the hornblende particles; in the coarser forms less regularity exists. It is generally true that the fissility decreases and the coarseness increases with proximity to the Laurentian.

The mineral association is limited and fairly constant. Most thin sections consist essentially of hornblende, feldspars and quartz, with variable combinations and amounts of accessory epidote, zoisite, biotite, titanite, chlorite, apatite, pyrite and magnetite. The hornblende, which is the most abundant constituent, is fibrous in the fine-grained rocks, compact in the more massive ones. Optically it is characterized by strong pleochroic tints: $\mathfrak{a}$—yellowish-green; $\mathfrak{b}$—deep brownish-green; $\mathfrak{c}$—blue-green. The acute bisectrix is inclined at about 16° from $\mathfrak{c}$. Plagioclase, usually oligoclase but varying from albite to acid labradorite, is usually present, also smaller quantities of orthoclase and microcline. In the case of an amphibolite from Lost lake, feldspars were absent, the section consisting of hornblende and quartz with a little apatite and magnetite embedded in the former. Biotite may be absent, but in other cases it displaces hornblende partly, so as to produce a type intermediate between the hornblende and the biotite schists. Light-green epidote is widespread; some grains exhibit the abnormal blue interference colours and apparently straight extinction of zoisite. Titanite is vicarious in distribution, local aggregations of irregular grains being frequent. Pyrite and magnetite are both widespread accessories, the former often bordered by a rim of limonite. The magnetite is either evenly distributed or loosely aggregated into bands.

Primary and secondary minerals cannot be distinguished, but from field and microscopic evidence most, or all of them are secondary metamorphic products. In some cases the original rock appears to be basic igneous, like diabase, but the field relationships at many points indicate or prove sedimentary origin. The hornblende schist series on Pelican lake contains magnetite bands like those of the iron formation and grades into true sediments, and at one point it appears to form a conglomerate cement. The striking conglomerate-like formation on Caribou lake may be of the same nature.

The biotite schists are similar in structure to the above series, but exhibit less variable textures. The mineral grains are of peculiarly uniform dimensions, and constitute a mosaic in which the biotite scales especially are arranged in parallel manner. Biotite, feldspars, and quartz are the principal minerals, hornblende is variable, and titanite, garnet and pyrite form the more constant accessories. The biotite occurs as irregular scales, sometimes bleached colourless and nearly always exhibiting strong brown pleochroic aureoles around small, strongly refracting inclusions. Plagioclase showing twinning lamellæ, microcline and orthoclase are all present, making up a large portion of the sections. Titanite is rather abundant as irregular brown grains, and one or more large colourless garnets, much fractured and corroded, occur in most sections. Pyrite is disseminated or in loosely aggregated layers as in the hornblende series. A few small grains of tourmaline were found in one section, and graphite and cordierite have been observed in specimens from east of Lake Nipigon.

The biotite schists are commonly found in bands in the Laurentian, where their nature and relationships are necessarily obscure and where they may be confused with or, possibly be, ortho-gneisses. The mineral association, however, is unusual; moreover, some of the specimens obtained were in intimate association with sedimentary formations. The tourmaline-bearing one was associated with greywackes on Abram lake, and the pressed conglomerate pebbles on Schist lake are embedded in similar material, which, however, has not been examined microscopically.

Local description.—The Keewatin-Huronian rocks may be divided conveniently into five circumscribed areas for consideration of geological details:—

Minnitaki area.—Lake Minnitaki lies in the middle of a schist area about 15 miles wide by 50 miles long, the longer axis of which lies N.E.-S.W. It is connected by constrictions with similar areas around Wabigoon and Sturgeon lakes. The first important work in this area was done in 1895 by A. P. Coleman, who examined the shores of Minnitaki, Abram, and Pelican lakes. In 1897, W. A. Parks made a geological study of the rocks in the neighbourhood of Niven's 4th base and 5th meridian lines. In 1901, W. McInnes investigated the rocks on Minnitaki, Little and Big Vermilion, Abram, and Lost lakes, and Sturgeon river, thus covering the greater part of the area. The latest work, done in 1907 by the writer, includes the delimitation of the rocks seen on the canoe route leading from near Dog lake southward to Niven's 4th meridian; a further examination of Sturgeon river, Abram, Pelican, and Lost lakes, and of the rocks near Gull lake.

The narrow southwesterly lobe which terminates near Gull lake consists of highly metamorphosed materials, chiefly coarse hornblende schist, with which are associated pegmatite and sheared aplite stringers from the adjacent granite. These occur on the small lake three miles south of Rock lake, in contact with a coarse Laurentian biotite granite. On the south shore the fine white aplite and slaty hornblende schist are so interbanded as to suggest sedimentary bedding. A thin Laurentian tongue from the southwest crosses to the north shore of Round lake, where it appears as a dull grey chloritic gneiss, but hornblende schists standing on edge and striking N. 45° E. to N. 60° E. predominate. A small body of slightly sheared diorite or gabbro occurs on the north of Little Gull lake, and at its mouth is a pale, rather fine-grained gneiss very poor in dark minerals, and bearing small garnets. This rock, although rather extensively exposed, is identical with the previously mentioned sheared aplite. Sixty chains southeast of the lake it underlies a gentle anticlinal fold of hornblende schist which forms a low hill. The Laurentian is entered on Gull lake and occupies all the shore except on the northeast, where rusty biotite gneiss appears. Along the alternative canoe route to Gull lake farther west the hornblende schists are only about 60 chains wide, and are followed on the south by biotite gneiss containing schist inclusions.

Between Gull and Vermilion lakes the country is swampy and difficult of access. The northern edge of the schist was sought for south of Pear lake, but in a distance of 60 chains only granite gneiss was observed. The contact has been located, however, on Niven's base line, where diorite lies adjacent to felsite and gneiss.

From this point eastward the northern margin of the Minnitaki area constitutes a broken zone of highly crystalline hornblende schists resulting from contact action with the Laurentian. Numerous tongues of schist project from the main body into the gneiss, while other fragments torn entirely free lie scattered through the gneiss, producing a kind of diffuse breccia. These fragments are sharply angular and often further shattered and traversed by small granite dikes. In places the schist has been transformed into massive amphibolite. A peculiar bluish-black variety, which is strongly magnetic, occurs on the southwest end of Lost lake near the railway grade. Parks also mentions a magnetic-bearing quartzose schist sufficiently magnetic to cause a local deflexion of 33° E.

The shores of Pelican lake afford an excellent section across the hornblende schist zone. The north shore is chiefly of biotite gneiss containing angular fragments of hornblende schist, which merges into a continuous hornblende schist formation farther south. On the east shore, near where it is interrupted by a tongue of gneiss, this schist contains magnetite banded in the manner of the iron formation. Crossing the narrow granite strip the same fissile hornblende schists are again encountered. They continue, growing steadily finer in texture, until at Sioux Lookout they resemble compact black slates on the weathered surface of which are markings suggestive of an original bedding. On the islet just off shore the supposed bedding planes are crumpled, and accompanied by similarly crumpled bands of magnetite, like those in the iron formation. These occur south of the narrows, and farther on give place to fine mica-schist and greywacke. Schist-conglomerate appears at Frog rapids. The cementing material of one conglomerate specimen obtained from the south shore of Pelican lake is of hornblende schist, in which all evidence of clastic structure is obliterated. The relationships of the hornblende schists are not clear, but some of the observed facts intimate a connexion with the Huronian sediments. They are evidently due to contact rather than regional metamorphism.

The conglomerate of Frog rapids is succeeded by greywacke, which extends to the line of islands that parallel the south shore.

The islands are composed of conglomerate whose cement is similar to and continuous with the greywacke. It is coarse and sandstone-like, and shows alternations of coarse and fine-grained material. The conglomerate has been traced continuously up Sturgeon river for three miles, to where it disappears beneath the water. Southwestward it reaches the main shore near the last of the islands, beyond which point it has not been followed. McInnes, however, finds it appearing on Little Vermilion lake, hence, in all likelihood it is continuous across the interval. Conglomerate extends the whole length of Little Vermilion lake. In his description of the 5th meridian, Parks mentions no such rocks, but between Whiting and Big Vermilion lakes are clastics, which elsewhere accompany the conglomerate.

The width of the conglomerate is variable owing, probably, to irregularity of dip. Only one edge is visible on Sturgeon river at any one point, the other lying beneath the water. However, it cannot exceed 500 feet, and is probably not much more than 100 feet thick. On Abram lake it occupies the whole width of the islands.

The pebbles are well rounded and vary in size up to 18" diameter. Occasionally they are faulted in a plane normal to the foliation of the cement, but otherwise show no deformation. Granite-porphyry, biotite-gneiss, diorite, hornblende syenite, green schist, vein quartz and a fine black eruptive rock were recognized. The cement, though its original texture is locally well preserved, is generally fine grained and possesses a slaty cleavage. Pebbles were observed in some narrow dike-like bands of black chloritic schist which cut across the conglomerate formation in Abram lake. The schist contains much secondary mica, and was thought to represent sheared materials.

Northward the conglomerate grades into sediments—greywacke, slaty schist, and hornblende schist. On Little Vermilion lake McInnes describes its associates as quartzites and green schists. Big Vermilion lake appears to lie in a mixture of igneous and sedimentary rocks. The easterly shore is reported as consisting of massive diorites and diabases locally sheared to schists. The south-east bay and south shore are of schistose types derived from diorites and quartz porphyry; in the latter case the quartz phenocrysts being represented by translucent blebs. Rocks described as feldspathic quartzites occupy the southwest portion. In this vicinity Parks found slates and quartzites, and near the 5th meridian an arkose of sandstone-like texture. The north shore and 5th meridian northward lie in diorites and green schists rich in pyrite. McInnes also considers the rocks along the south shore of dioritic origin. Yet at one point, another writer[1] records graphitic shales. Evidently a considerable proportion of clastic material is associated with the igneous members which lie north of the conglomerate band.

South of it altered effusives are predominant. From Maskinonge lake along the 5th meridian to Whiting lake are slates, sericitic quartzites and an agglomerate of greenstone materials graduating into greenstone and green schist. On the south shore of Little Vermilion lake quartzites are associated with green schists derived from eruptives, which are continuous to Lake Minnitaki. This body, according to Coleman and McInnes, lies in green schists of igneous derivation. The long arm reaching from Sandy lake northeastward shows green schists striking parallel to the shore line, as well as the remains of a softer sericite schist found only at the bottoms of bays; whose susceptibility to erosion is perhaps accountable for the present channels. From near Burnt island to a point about two miles beyond tho outlet, the green schists pass imperceptibly into an agglomerate of greenstone bombs in a matrix of similar composition. The entire eastern end of the lake, and the islands are of diorite and porphyry in comparatively massive form. The south shore is composed of porphyroids and other green schists. Mingled with these, Coleman found bands of clay slate, on the extreme south shore, on the tip of the long point at the entrance to Seventeen Mile bay, and again on the shore immediately southeast of this point.

Returning to Abram chute, quite well preserved porphyry showing feldspar phenocrysts, ⅛″ to ¼″ long, in a fine green matrix, occurs at the junction of English and Sturgeon rivers.

From Sturgeon river eastward along Niven's base line, chlorite and hornblende schists and diorite continue to Lake Forty-five, where a pronounced agglomerate with occasional hills of diorite replaces them. Lake Forty-three is in pyrite bearing sericite schist. From this point eastward are intermingled diorites, agglomerates, and sheared porphyrite. Thirty-mile lake shows fine quartzite, hydromica schist and a belt of diorite, all much disturbed, while a little farther east the contact is represented by black hornblende schist abutting against foliated, reddish gneiss.

[1] Report of Bureau of Mines for Ontario, 1907, p. 177.

The description of the 4th meridian between Thirty-mile lake and English river is not so definite, but with the exception of a pink, garnetiferous quartzite 1½ miles north of the river crossing, all the types mentioned are either hornblende schist or diorite more or less sheared. It is possible that the quartzite referred to is a sheared aplite, to which rock it bears an external resemblance.

These observations agree with the geological features of the canoe route extending from Long lake north to Sturgeon river. Most of the way lies through Laurentian granite-gneiss, but the tip of the Minnitaki green schist area is crossed at a few points. A half mile south of Sturgeon river are well foliated quartz porphyry schists, ash-coloured and full of quartz blebs. The south end of the first lake is also in sheared porphyry, and a well-preserved rock of the same type occurs at the exit of the next lake above.

Sturgeon river above the crossing of the Lake Superior branch of the new railway crosses drift-covered country as far as Hidden lake. At this point iron formation is reported, so that probably the sedimentary series occurs. From Hidden lake up-stream the river lies on or near the Laurentian contact, and hornblende schists more or less brecciated are the rule.

Sturgeon Area. Except for the western arm reaching over to the Minnitaki area, this schist body conforms in general outline with the lake it surrounds. Work was done about the southern end in 1899 by W. McInnes. The next year a reconnaissance was performed by the geologist attached to Party No. 9 of the Bureau of Mines. McInnes completed his examination of the lake and vicinity in 1901, and in 1906 the writer made a brief visit to the northern part

The entire southern portion of the area is described as a complex of foliated eruptive rocks and altered sediments. The relations of the different types are complicated, and as yet nothing can be said regarding them. Porphyries, diabases and diorites changed more or less completely to sericite and chlorite schists are the chief igneous forms. Quartzites and schist conglomerate are more frequently mentioned in the geological descriptions than slate and iron formation. Iron formation pebbles occur in conglomerate found on the uppermost of the chain of lakes that empties on the east side just south of the Narrows. Probably most of the sedimentary series belongs to the Huronian, but its distribution appears to be more complex than in the Minnitaki area, and insufficient work has been done to make the structural relation evident.

The lobe lying west of the Narrows contains the same complex of clastic and effusive rocks. Its margin where observed near Sturgeon river, and on the southwest is of hornblende schists. A body of gabbro whose edges are foliated and merge into the surrounding schists extends the length of the Narrows.

The north end of the lake is only partially within the schists, a line of contact with the Laurentian extending along the median peninsula. The west side of this peninsula is faced by a coarse grey granite, showing porphyritic phases at its contacts with the older green schists. The edges of this granite are frequently dull looking from the presence of unassimilated chloritic matter taken up from the adjacent rocks. The latter are harder and somewhat more crystalline near the contact than farther away. The contact zone has been shattered and recemented by mineralized quartz veins. The usual brecciated zone of hornblende schist is absent. Couture lake and the western side of the peninsula are in fissile hydro-mica and green schists derived from porphyries. Some diabase occurs with them, and the shore northwest from the Hudson's Bay Company's store is of quartzite. The northern part of Northeast bay is also in quartzite. Schist conglomerate with massive diabase on either side appears in a small bay [illegible] miles down the east shore. The bay receiving the stream from Coveney lake is in sheared quartz porphyry. Diabase, hydro-mica schist and sheared porphyry extend to the mouth of East bay, but the small islands in the latter are chiefly of quartzite. Inland some thirty chains from the bottom of the bay is a schist conglomerate associated with iron formation, the strike of which is about N.E.

The canoe route to Sesegamaga crosses the schists. Up to Coveney lake the chief rock type is a well-sheared porphyroid showing blebs of bluish quartz, but on the second portage is a small body of crushed basic diorite. The small island near the outlet of Coveney lake is composed of a coarse grey mica syenite resembling nordmarkite. The rock is composed chiefly of microperthite and orthoclase, dark minerals being sparingly represented by a few small scales of biotite. Quartz, magnetite and large zircons are the only accessory constituents observed. Small dikes of this material cut the schists farther west.

Fissile hornblende schists appear east of Coveney lake, forming bands striking N. 20° E. On the 56 chain portage they give place to schist conglomerate but are again met at Sesoganaga lake, where they mingle with the Laurentian to form a broad transition zone.

The northern portion of the area as seen on Chivelston and Beckington lakes is chiefly of crystalline hornblende schist. Toward the south of Beckington lake this rock is replaced by felsite and sheared quartz-porphyry. Richan lake lies in fine black diorite. The blue-green hornblende in this rock, as well as in some from other localities, is probably of secondary origin.

Savant Area.—In this case, as in the preceding ones, a large lake lies within a schist area, the long axis of both coinciding. In addition a long arm of these rocks extends along the Dog river. The southwest tip of this schist body was found by W. McInnes in 1901, who, later in the same season, explored the shores of Savant lake and the canoe route to Sturgeon lake. A short visit was paid Savant lake three years later by W. G. Miller, and in 1906-7 the writer examined that part lying between Savant and Kimmewin lakes.

A persistent sedimentary series like that of the Minnitaki area extends the length of the Savant area. A narrow conglomerate band begins on the north shore of Schist lake, where it is in igneous contact with the Laurentian, and extends continuously to Savant narrows. On an island near the east end of Schist lake, the granite pebbles of this formation can be seen to be flattened into thick plates and the cement changed to crystalline biotite schist. Exposures occur on the small expansion above Schist lake, and are frequent along the north shore of Island lake for half its length, the band then sinking beneath the water and reappearing only twice, on islands. It follows the north shore and islands of Kashaweogama to a point south of Curlew lake, and was next seen on Iron lake. From this point it probably bends southward, crossing Savant lake at the Narrows. Conglomerate also occurs on the west shore three miles north of the portage to Iron lake. At Savant narrows it is nearly half a mile wide, but elsewhere only 100 or 200 feet.

Granite pebbles are abundant, but locally, for example the west bay of Iron lake, they almost fail, and the close similarity in colour and texture between the green schist pebbles and the cement renders the conglomeratic structure inconspicuous.

The cement is ordinarily a greywacke schist rich in quartz. In places on Kashaweogama it has been squeezed to chlorite schist as on Abram lake.

The conglomerate band is flanked on both sides by greywacke slate and iron formation, together with some intrusive rocks. Up Dog river to Kashaweogama only a narrow strip of greywacke slate lies between the conglomerate and the Laurentian to the north. It shows slight evidence of contact action, except near Cliff lake. The tongue which crosses the portage between Island and Cliff lakes consists of slaty rocks with which is associated siliceous iron formation. Its margin, for about two miles up Cliff lake, consists of hornblende schists, which grow more crystalline as the Laurentian is approached. On the north side of Kashaweogama from Curlew lake eastward the contact is only from ten chains to a mile away from shore, the interval consisting of magnetite-banded slaty rocks.

The south side of the Dog river from Kimmewin lake to the 6 ft. fall below Island lake is of slaty schists, standing vertically, and cleaving in a direction parallel to the river channel. At the fall is a small body of gneiss, charged with chlorite, thought to extend from the northern Laurentian area. The only knowledge of the southern contact was obtained about two and a half miles northeast of Stanzhikimi lake, where the Laurentian gneiss becomes mingled with glistening hornblende schist of the usual type. The south shore of Island lake is of fissile chlorite schists of very regular dip and strike, the original character of which could not be decided. They continue south to the contact on Lewis lake. On the south shore of Houghton lake they contain translucent quartz blebs, and are probably crushed quartz porphyry. Altered orthoclase porphyry and other effusives occur on Pickerel lake, but the entire south shore of Kashaweogama consists of iron formation and slaty schists. These exhibit an alternation of coarse and fine materials, arranged in laminæ about ¼″ thick, which were formed probably in shallow water. They are now highly inclined, but coincide in direction of strike with the secondary schistosity. The schists on the west and north of Grebe lake contain no magnetite, however. At their contact with the granite they are hardened and partially changed to biotite schist across a zone a few inches wide.

The area between Wiggle creek and the west shore of Savant lake consists essentially of sedimentary rocks. With the exception of small exposures of orthoclase porphyry, it is composed of fine blac slaty schists frequently magnetite bearing. On Iron lake and th portage to Savant lake the bedding and schistosity planes are no parallel, as farther west, but intersect at various angles. The bedde laminae are much crumpled, and extend at about N. 25° W., whi the slaty cleavage maintains its N. 15° E. course. On the portag this is particularly distinct, owing to the presence of magnetit bands which are crumpled in a manner identical with the less con spicuous bedding planes.

From the portage down the west shore of Savant lake there is a unbroken sedimentary series consisting of black quartzitic slate banded with magnetite, which grade into fine-grained greywacke nea the Narrows. The greywacke grows steadily more coarse graine until in the Narrows it becomes the cement for a conglomerate.

Allusion has already been made to masses of porphyry among the sedimentary rocks. These are all of small extent, the most prominent being seen at the west end of Island lake, in the western bay of Iron lake and along Pickerel lake. Several small bodies of diorite were also observed, viz., on the pond just northeast of Grebe lake. This is a massive black rock composed principally of blue-green hornblende, and a little decomposed plagioclase. An islet in the narrow part of Island lake is composed of similar rock and, on the north shore just east of the bay toward Cliff lake, basic dikes cut the Laurentian gneiss. These rocks are fresher in appearance than the other Keewatin rocks and, from their occurrence in the Laurentian, probably much younger.

The remainder of the Savant coast has been examined by McInnes. Northward from 1¼ mile portage are sheared quartzites, and at a distance of three miles schist conglomerate, whose connexion with the Dog River band is yet to be explained. Chlorite and green schists succeed the conglomerate, and extend to the granite contact near the north end of the lake. The north shore between the outlet and northeast bays is of mixed quartzite and green schist. Quartzite, chlorite and green schists are associated along the eastern shore. Nothing is given concerning the nature of the schists, but judging from their association with quartzites, at least a portion may be sedimentary. Coarse 'snowshoe' diorite was found on a prominent peninsula about four miles from the north end of the lake, and again at five miles from the southern extremity. The south shore is chiefly of diabase, with quartzite on the north-projecting peninsula. In general, the eastern and southern portion of Savant are unlike the remainder in the abundance of igneous rocks.

Below the Narrows, the west shore down to and including the bay which extends toward Grebe lake, shows fine black slaty rocks and chlorite schist full of disseminated pyrite crystals. The opposite shore is of conglomerate containing granite boulders. Thence to the old Grand Trunk Pacific cache are well-foliated green schists. The presence of magnetite bands in this rock is suggestive of its identity with the iron formation rocks.

From the cache to the southern extremity on Harris lake, the schist body is narrow and grows more crystalline. The first portage, and most of the lake to the south exhibit fine-grained hornblende schist containing bands of magnetite, evidently continuations of the chlorite schist and slates of the north. On Harris lake these become more and more crystalline, and mixed with biotite gneiss until at half-way down the shore Laurentian predominates.

Caribou Area.—Information [illegible] which crosses Caribou lake is limited to that obtained by examining the shores of the lake in 1906.

From the middle of Caribou lake northward the biotite gneiss of the Laurentian becomes more and more mingled with hornblende and biotite schists, so as to form a transition zone between it and the Keewatin. Along the east shore this zone contains a conglomerate-like formation, consisting of somewhat flattened, rounded pieces of gneiss enclosed in a dark hornblendic schist. The tip of the southernmost peninsula shows exposures of a crushed quartz porphyry full of large bluish quartz particles so rounded as to resemble the quartz grains of a coarse grit.

At the entrance to the northeast bay these transition rocks pass beneath a cap of diabase; on reappearing half-way along the bay they are typical Keewatin green schists, often containing pyrite crystals. Half-way down the northwest shore the green schists hold a seam of magnetite about 12″ in width. At the extreme end of the bay, is hornblende gneiss, probably marking a recurrence of the Laurentian. A green schist band has also been delimited on Pikitigushi river north of Round lake, which is probably in continuity with that of Caribou lake, but the interval has not been explored.

Obonga Area.—According to McInnes, the small patch of Keewatin shown near Obonga lake contains the usual association of green schists.

Structural Relations.—The various schist areas resemble one another in being composed of the same association of formations and in having endured the same geological vicissitudes. The detailed descriptions show each of the better-known areas—Minnitaki, Sturgeon, and Savant—to consist primarily of an igneous and a sedimentary series. Each area is marked also by regional and contact metamorphic effects of similar character and intensity, which affect equally both Huronian and Keewatin.

Their continuity and recognizable appearances render the Huronian rocks of greater value than the Keewatin in studying the structure of the schist areas. In the Minnitaki and Savant areas the conglomerate forms a continuous narrow band along the major axis, flanked by greywacke and slate. The boundaries of the latter are hard to find, but the areas exposed are linear in form and elongated in a general E.N.E.-W.S.W. direction. Wherever observed, the bedding planes of the slates are inclined steeply and strike in the direction of greatest extension. This attitude is more distinctly exhibited by the magnetite bands in the iron formation, which are found to be of bedded character. They dip nearly vertically and are often crumpled, but their strike is quite determinable. The sedimentary areas in the Dog and Sturgeon rivers, therefore, appear as strips showing the upturned edges of the series extending in a direction of from N.E.-S.W. to E.N.E.-W.S.W. They evidently represent portions of folds produced by N.W.-S.E. compression.

The sediments along the west side of Savant lake extend at N. 25° E., those on Kashaweogama at N. 70° E., and near Iron lake there is evidence of a sharp bend. These conditions are thought to indicate a pitching anticlinal fold produced by the uprise of the tongue-shaped granite body lying just east of Pickerel lake.

Too little is known about the other areas to admit of inferences regarding their structures.

The compression which caused the folding may also account for the prevalent schistosity. Its direction, although generally not far from the N.E.-S.W., seems to be determined by the varying direction of elongation of the schist areas. In this way it varies from N.-S. to E.-W. It is pretty uniformly developed in the Huronian rocks, but varies in perfection in the Keewatin owing, perhaps, to differences in the ages of the component eruptive bodies, some of which are post-Huronian.

Small faults with longitudinal displacements of a few inches are numerous. In all observed cases they extend at right angles to the schist planes—that is, in the direction of compression.

The crystalline contact zone is a somewhat inconstant but notable feature about the margin of schist bodies. The outer part of this zone consists of fragments torn away from the main body and floated out into the Laurentian before that material solidified, the result being a mixture of gneiss and brecciated inclusions transitional in character between true Laurentian and true Keewatin-Huronian.

Age.—The country between Nipigon and Clay lakes forms part of a very extensive geological province. It is sufficient to say that it includes all the country between Lake of the Woods and Lake Superior. Within this area detailed geological study has been performed in the Lake of the Woods and Rainy River district by A. Lawson in 1883-7, east of Lake Nipigon by Coleman and Moore in 1906-8, and in the states of Minnesota, Wisconsin, and Michigan by many investigators.

McInnes has worked upon practically all the schist areas between Lake Nipigon and the Lake of the Woods district, and finds the rocks in this interval to exhibit uniform structural and metamorphic conditions. The igneous complex called Keewatin by Lawson is recognizable in all the areas. But Lawson included in the Keewatin a series of conglomerate, greywacke and slate which appears really to belong to the lower Huronian. As they occur in the Hunter Island district he identifies them with the Ogishke conglomerate and associated clastic rocks of the Vermilion district in Minnesota.[1] He also found them, in the vicinity of Saganaga and Basswood lakes, intruded by granite masses to which the age-name Laurentian is given.

The sediments of the Minnitaki and Savant areas appear identical with those described by Lawson, not only in lithological and metamorphic character but in their relations with the Laurentian batholithic intrusions. However, since they are composed in part of the products of Keewatin erosion a subdivision of the Keewatin as defined by Lawson seems advisable. If Lawson's conclusions are correct, the name lower Huronian is as applicable to the Hunter

[1] American Geologist, Vol. VII., 1891, p. 321.

Island, Savant and other sedimentary groups in western Ontari it is to the Ogishke conglomerate of Minnesota. Coleman descri a sedimentary series on the east of Lake Nipigon—which he c lower Huronian—whose members are like those on Savant Abram lakes, and which expresses similar structural relationships the Keewatin. To this series he has applied the name lo Huronian.[1]

Laurentian.

Distribution.—The configuration of the Keewatin and Huronia makes three Laurentian areas distinguishable: (1) A large weste area. (2) A central area traversed by Sturgeon river. (3) A lar eastern area. These are not completely separate or physically unlik but the division is serviceable in localizing descriptions.

Description of Types.—The members of the Laurentian comple are either the solidified materials of bathylithic intrusion or olde rock matter which has become included in it but resisted assimila ti. Both sources have yielded composite groups of rocks, whic pos in common a more or less gneissic character.

The commonest member of the first group is a biotite granite of somewhat varying character, but whose most abundant phase is a light-grey rock of medium grain. It is speckled with biotite in the hand specimen, but weathered surfaces are nearly white. Biotite is not often abundant, hence foliation is not a pronounced feature. Microscopic examination of these rocks proves them to be ordinary biotite granites or gneiss consisting of albite or oligoclase-albite, microcline, orthoclase and quartz, the latter sometimes micrographically intergrown with the feldspars. Biotite in irregular brown scales is variable in amount, and light-green epidote is occasionally present. With the exception of small accessory crystals of zircon, titanite and apatite, the mineral grains are without crystal boundaries.

With the normal type are associated darker, poorly-defined bodies, which differ chiefly in possessing a greater proportion of dark minerals and more perfect gneissic structure. The latter is often highly irregular. Apparently no sharp distinction can be made between these schlieren and the ordinary gneiss, for all gradations between

[1] A. P. Coleman, 17th Annual Report, Bureau of Mines (Ontario).

them seem to exist. They are regarded as basic portions of the original magma which solidified somewhat in advance of the main body.

The other extreme of differentiation is represented by pegmatite dikes and stocks which cut all the other Laurentian rocks. These are very coarse-grained acid rocks composed essentially of feldspar, muscovite and quartz. Biotite and magnetite are not abundant. The latter appears to be a late crystallizing constituent, as it sometimes occupies cleavage cracks in the feldspar. Other minerals of the pegmatite association probably occur, though not observed. The ordinary pegmatite structure resembles that of granite on a large scale, but in some instances a banded arrangement like that seen in veins occurs. In such cases a central tabular mass of quartz is surrounded by a layer of muscovite, outside which is feldspar. The individual feldspars may attain diameters of over a foot, or may be little larger than those of the normal granite. Indeed here, as in the case of the basic varieties, the gap between ordinary granite and the extreme pegmatite is filled by a long series of intermediate forms. The boundaries between the pegmatite stocks and the surrounding granite are often indistinct, the two rocks merging into one another. A fine-grained whitish gneiss containing small garnets represents sheared aplite.

Hornblende granite and gneiss are much less common than the biotite variety. They apparently cover small areas, and so far as observed do not exhibit basic or acid differentiated forms. Graphic granite occurs locally.

The second group has been described already under the Keewatin and Huronian, to which formations they really belong. Biotite and hornblende schists are the only rocks known to be of this nature. Of the two the latter is much more abundant and preserves its fragmental shapes best. The process by which they were torn from the main schist body is best illustrated close to the contacts where the schist edge is frayed, and pieces partly separated project into the Laurentian. Other fragments of various sizes are completely enveloped by gneiss, and sometimes traversed by small granite stringers where further shattering occurred. The angular shapes are well preserved in many cases; in others the blocks have been rounded and the external portions rendered more susceptible to erosion than the centres so that the latter may be found occupying cavities in the

Laurentian after the manner of a kernel in a nutshell. In yet other cases they have been drawn out into slender ribbons, which contrast with the lighter coloured Laurentian. They occur most abundantly near green schist contacts, but may be distributed over a zone of indefinite width. Occasional small patches of this brecciated matter have been found at points many miles from the nearest schist area.

LOCAL DESCRIPTIONS.

Western Area. Biotite granite-gneiss of coarse grains, and pegmatite are characteristic of the Laurentian west of Lost lake, excellent opportunities for the study of which are afforded by the deep rock cuts along the National Transcontinental railway. Dioritic and hornblende schist inclusions are widespread and, for example, those near Mud lake contain bunches and scattered grains of chalcopyrite. Highly contorted basic schlieren, containing an unusually large proportion of biotite are well exhibited on Lost lake and west of Allan lake. They appear to merge into the ordinary granite-gneiss.

South of the railway line, there are some unusually large hornblende schist bands. Those at the second rapid on Pelican brook and near the mouth of Eagle river are 100 feet wide. Pegmatite dikes are occasionally met, but are most abundant on Gull lake. A conspicuous white hill on the south shore is composed altogether of this material. It is very coarsely crystalline, feldspars being often 18" and muscovite sheets 6" in diameter. A tendency to parallel mineral arrangement is exhibited, central vein-shaped masses of quartz being bordered by a layer of muscovite on either side, and this in turn by feldspar. On the north shore, immediately opposite, the gneiss contains a small body of intrusive diorite. Along the southwest shore a low wall of granite presents a peculiar masonry-like form, apparently due to spheroidal weathering. Granite of rather unusual red colour forms cliffs at a point one and a half miles along the portage, leading from the southwest corner of Gull lake. Garnetiferous aplite gneiss is fairly common a short distance northeast of Gull lake.

The cliffs at the extreme southwest of Lost lake present a fantastically contorted mixture of basic and acid biotite gneisses, the former showing the more perfect foliation. A gneissic structure is well developed near Keewatin contacts ordinarily, but portions of the Laurentian on the south of Lost lake consist of a scarcely foliated granite gneiss.

The section traversed by the various ramifications of English river between Pelican lake and Lac Seul, and the southeast shore of the latter, is of biotite gneiss whose general strike is indicated by the watercourses. The southern contact is fringed by a zone abundantly supplied with angular blocks and elongated fragments of hornblende schist, which, farther to the north, grow scarcer, but do not entirely fail even at the northern boundary of the Province. At the extreme east end of Lac Seul near the entrance of Wa[illegible]mini river, miles from the nearest schist area, they have sharply angular, brecciated forms, and are associated with pegmatite and coarse granite. The latter rocks are common along the south shore of the lake near the northeast corner of Indian Reserve No. 28. Garnetiferous gneiss occurs on Lac Seul, particularly on the south shore peninsula, six miles from the east end of the lake. A similar rock, consisting of dark biotite schist filled with small garnets, is found a short distance below Pelican fall. This rock does not resemble the ordinary gneiss, and may be older material included and metamorphosed by the Laurentian, like the hornblende schist.

The banded gneiss, shattered and recemented with granitic paste, and cut by pegmatite dikes, observed on Canoe lake by Coleman,[1] is believed to represent stages of Laurentian magmatic differentiation, the banded gneiss being an early solidified portion cracked and filled subsequently by a more acid residual fluid.

Central Area.—This, and the preceding area, are in direct continuity. From Dog lake up to the head of Stranger lake, and on Stanchikimi, biotite gneiss like that in the west prevails. Where it adjoins the Keewatin near Sturgeon river it is dull grey in colour, owing to the presence of chlorite. Diorite-like rock is exposed on the shore opposite the mouth of North river, but the prevalent rock from about that point over to Kinnewap brook is a hornblende-syenite gneiss. Fine-grained diabase was observed on the lake at the head of Kinnewap brook. The shores of the Sturgeon River expansion above North river lie in dark biotite gneiss, changing in the neighbourhood of the large island to obscurely foliated granite-gneiss. Biotite gneiss again dominates from Tawatinaw river eastward, dull red syenite gneiss being seen, however, at White fall, and a coarse black and white hornblende gneiss on the portage into Sturgeon lake. From Sturgeon river northward to the Keewatin

[1] Bureau of Mines Report for Ontario, 1895, p. 95.

schists are biotite gneisses, often thinly banded, and full of narrow bands of hornblende schist. Pegmatite is uncommon. At the south end of the pond lying east of Pickerel lake the granite is very light in colour, and shows a somewhat porphyritic tendency on the part of the feldspars. The Laurentian on Grebe lake is, as a whole, acid in composition, and shows comparatively little gneissification. As recorded on Niven's line and southward, biotite gneiss is the chief rock. About the Lake of Bays and the edge of the Keewatin it contains hornblende schist inclusions, sometimes much contorted, but in the southwest, near the long lake crossing the 4th meridian, it is massive. The northern bay of Sturgeon lake is in biotite gneiss except along the lower part of the peninsula, where a porphyritic granite is in intrusive contact with Keewatin green schists. Associated with this rock at the St. Anthony mine are coarse granite dikes bearing an amber-coloured mica; also a small mass of coarse-grained quartz porphyry.

Eastern Area.—The broad transition zone on Seseganaga lake consists of biotite gneiss mingled with inclusions of black hornblende schist and rusty biotite schist. In the northwestern bay included and enclosing materials are equally abundant, but elsewhere the former are of subordinate importance. Several bands of biotite schist striking about S. 30° W. extend along the east side of the western part of the lake. They are coloured rusty red by oxidation of pyrite, which forms poorly defined bands in the schist, thin sections of which show the mineral association and texture described previously.

The biotite gneiss on the central part of the lake contains comparatively little included matter. Just beyond the narrows that connects the eastern portion are large shattered blocks of hornblende schist, which are intersected by dikelets from the surrounding granite-gneiss. Inclusions persist as far east as McEwen lake, where they are no longer angular but rounded. These lumps, a foot or so in diameter, weather peripherally so as to leave a resistant core occupying the centre of a pot-like cavity in the granite-gneiss.

The transition zone extends in diffuse form northward toward Savant lake. East of that body, however, the only evidence of intrusive action is the chloritic character of the gneiss which, as a result, is of dull greyish green colour. Laminated biotite gneiss is frequently seen on Allanwater near the Grand Trunk Pacific survey crossings, and hornblende schist bands are common on Heathcote and

Barrington lakes, and Flint river. At the second portage on the latter, below Flint lake there is a coarse augen gneiss, the large feldspars of which have been squeezed into eyes an inch or more in diameter.

It may be said in general that east of Allanwater, and especially in the direction of Smoothrock lake, the Laurentian is more massive than usual and richer in pegmatite. A deep-red granite was seen on Nemo river just above Snake lake. Coarse graphic granite occurs on the first portage below Wabakimi lake on the way to Smoothrock lake.

The district traversed by Obowanga river and thence toward Caribou lake shows a recurrence of hornblende schist and biotite schist bands, owing to the proximity of the Caribou and Obonga green schist areas. As these bodies are approached the inclusions grow more abundant, just as in Sesgamaga lake. Near Lake Nipigon the Laurentian is exposed only occasionally, but at points in the Wabinosh and Whitesand valleys McInnes found biotite gneiss, pegmatite dikes and bands of hornblende schist.

Keweenawan.

GENERAL DESCRIPTION.

The Keweenawan sediments and overlying diabase formation in the east form part of an extensive area enclosing Lake Nipigon. With the exception of a few isolated patches, the thin outlying portions have been eroded, but near Lake Nipigon they are continuous. The sediments have not been found more than thirty miles west of the lake, the more distant diabase patches lying directly upon the older crystalline rocks. Within this limit they are exposed beneath the protective igneous cap in deep valleys and around the shores of lakes.

The basal member is usually a conglomerate composed of rounded and angular fragments embedded in a calcareous sandstone cement. It may also be a feldspathic sandstone which grades downward into gneiss as if derived in situ from the Laurentian. These beds, which appear to be only 10 or 15 feet thick, are succeeded by calcareous sandstone and impure magnesian limestone of prevalently brick red colour. The whole series lies horizontally, and shows little evidence of metamorphism. The maximum observed thickness is 50 feet.

LOCAL DESCRIPTIONS.

The small area on Wigwasan lake shows a basal conglomerate of angular and rounded crystalline fragments in a calcareous cement. At the fall, a short distance farther west, it is replaced by the above described feldspathic sandstone. Both conglomerate and sandstone pass upward into a red and white banded calcareous sandstone. At the east end of the lake is an impure green limestone which forms the top member of the series. The little patch lying northwest of Obonga lake is composed of crystalline felsitic sandstone, reddish in colour, but weathering white. On the second portage northwest of Bukemiga lake a red sandstone is interbedded with trap, the latter being intrusive. Red sandstone occurs beneath trap along the shore and islands of Lake Nipigon between English bay and the Hudson's Bay Company's post. On a small lake inland, a short distance from Castle bay, 50 feet of red sandstone underlie the trap, and on Mount St. John, 60 feet from the summit is a white quartzite. Sandstone underlies diabase on many of the islands in Lake Nipigon, outcropping near the water's edge.

STRUCTURAL FEATURES.

With the exception of Mount St. John, where an anticlinal structure is believed to exist, the Keweenawan lies horizontally and undisturbed where not cut by the diabase. Evidence of metamorphism is slight, the dolomite being quite uncrystalline and the quartzite very little indurated. The writer has not examined the exposures here described, but, southeast of Lake Nipigon where the same beds outcrop, he found evidence of shallow marine conditions. The materials there are clastic rather than chemical deposits; even the red dolomitic limestone being mixed with sandy matter. Well preserved ripple marks, casts of salt crystals, and scattered inclusions of gypsum were observed.

Diabase.

Distribution.—Lake Nipigon is situated centrally also with regard to the diabase, which extends in all directions away from it. Erosion has destroyed much of this formation, but some knowledge of its original extent is derived from the remnants which occur at intervals over the region. The most westerly of these, on Flint river, is 68 miles west of Lake Nipigon. At present, however, practically the entire remaining body is confined within a distance of 20 to 25 miles from the lake, and even there it is not continuous. Its thickness decreases in like ratio [illegible] the west. Near Lake Nipigon thicknesses of 320 feet are re[illegible]ed, and for Jackfish and Inner Bar islands 550 feet, but the outlyin[illegible]es are not often more than 25 feet and sometimes only 5 feet th[illegible].

Lithological Description.—The usual type is a medium to coarse grained, dark-grey rock of gabbro-like appearance, the weathered surfaces of which appear brown. Diabase texture is not easily recognized in hand specimens, although apparent upon microscopic inspection. The edges in contact with older rocks and the dike materials are fine grained and black.

A thin section from a specimen collected on Caribou lake consists of plagioclase (labradorite) and augite with considerable ilmenite. The plagioclase, which occupies over half the section, is in stout laths partly embedded in the augite. From casual examination the formation appears monotonously uniform, but the detailed work done on the east side of Lake Nipigon by Coleman has revealed a variety of rock types. He records a widespread though quantitatively small occurrence of olivine, and not uncommonly a micropegmatitic intergrowth of feldspars and quartz. Basic olivine diabase and small granitic dikes have also been found, regarding the latter of which he writes: they 'contain much quartz partly intergrown rudely with the feldspar as micropegmatite, some orthoclase, some microcline and much oligoclase, all badly weathered. The bisilicates are badly weathered also, but seem to be chiefly hornblende, perhaps augite originally, with a little biotite. Epidote occurs as a secondary mineral. The rock should perhaps be called quartz diorite from the large quantity of plagioclase, but its pink colour and the large amount of quartz present suggest granite.' This description presents much similarity to those of the aplite dikes found in the diabase of the Timiskaming, which are considered as acid products of magmatic differentiation.

Structural Relations. The Nipigon diabase forms a tattered mantle resting upon either Keweenawan sediments or the older worn crystalline floor. Its contacts are finer grained than elsewhere and, where Keweenawan rocks underlie, they are hardened and fracture unevenly. At a point just south of the geologically coloured area on the accompanying map McInnes found the sedimentary beds shattered and cut by dikes traceable into the overlying diabase mass. Coleman found the above-mentioned granite dikes cutting both sediments and diabase. The relations with the Laurentian are analogous. A 60 ft. dike of fine black diabase cuts reddish granite on an island in Wabinosh lake. Biotite gneiss at the end of Wigwasan lake is traversed by small dikes, and the same condition holds near the middle of Kenakskanias lake. In the small area north of Redhead lake, where the diabase is worn very thin and the underlying gneiss frequently shows through, the latter is seen to be intersected by fine-grained dikes continuous with the overlying rock.

A uniform gabbroid texture prevails in the main mass. However, Coleman has found columnar parting at Flat-rock portage at the south end of Lake Nipigon. The top has been removed by erosion wherever observed, consequently no direct evidence is obtainable regarding the character of its upper surface. The entire formation is believed, however, to be analogous with the Logan sills which occur farther to the southwest. According to Coleman, slight faulting has taken place since their intrusion.

Age.—The intrusive character of the contact between the diabase and Keweenawan beds proves the former to be younger. They may be of Keweenawan age, or, according to some writers,[1] post-Keweenawan. The Keweenawan sediments were consolidated sufficiently to fracture at the time of intrusion.

Pleistocene.

Glacial.—Wherever exposed, the rock surface presents the usual well glaciated appearance characteristic of the Archæan protaxis. Grooves and scratches on the original polished surface are abundant, and fairly constant in direction. The average course of thirteen striæ observed on Savant and Sturgeon Lake shores by W. McInnes is 194° astronomic. Other measurements are:—

Iron lake	179°
Kashaweogama lake	184°
Island lake	203°
Sturgeon river below Hidden lake	205°
Pelican lake	185°
Gull lake	210°
Lake 3½ miles south of Rock lake	200°

[1] A. C. Lawson, Bulletin No. 8, Geological Survey of Minn.

Glacial debris is neither abundantly nor evenly distributed. Ordinarily it is not sufficiently deep to influence the general topographical character, being confined to valleys and depressions into which it has been carried from the hilltops, especially when the latter have been exposed by forest fires. Large boulders not capable of transport by such gentle agencies as wind and rain, lie scattered over the whole area, often resting upon a perfectly clean-swept rock surface, on hilltops or lake shores. Boulders and gravel are almost wholly of crystalline material, but limestone fragments are occasionally found.

From Allanwater eastward along the railway survey lines to the vicinity of Duck lake, is a succession of gravel ridges, 150 to 200 feet high, whose smooth contours—rendered plainly visible by recent forest fires—are quite unlike the more rugged outlines of the usual rocky hummocks. They consist of fine loamy till, containing boulders of various sizes. On McEwen lake hill-sides of this sort are being worn by wave action, and similarly exposed banks were seen on Wilcox lake. Northward beyond Windfall lake the deposits become diffuse. On Allanwater, however, about five miles below the Grand Trunk Pacific crossing, a submerged morainic ridge from which the fine material has been washed by the river is represented by a string of islets composed wholly of rounded boulders.

The vicinity of Gull lake is heavily drift covered. The forest south and east of the lake has been burnt recently, exposing square miles of rolling, sandy country through which the solid rocks appear rarely. The creek entering at the east end of the lake has cut a trench 125 feet deep in this sand. The 60 chain portage on the north, as well as the 3 mile portage leading to Rock lake, are over the same material. Much sand and some clay are exposed along the National Transcontinental Railway line between Rock and Lost lakes.

Construction work and fires have exposed a number of interesting deposits at the southwest end of Lost lake. At this point a cut 40 feet deep has been made directly across a ridge of sand and gravel which stretches from the railway line down to the engineer's camp on the east side of the bay, a distance of about 300 yards. The cross-section exposed in the railway cut is of fine sand, bedded convexly, the curves corresponding with the sloping sides of the ridge. The slope toward the water is made in two terrace-like steps, each tongue-shaped in ground plane, beyond which is a narrow ridge of gravel and boulders. A short distance west of this ridge lies a smaller one of sand and several others containing laminated clay. The clay layers are crumpled locally as if disturbed by ice masses. All extend northward from the large body of drift south of the railway line. Stratified bodies of this sort, pointing to glacial or post-glacial stream action, are not confined to this one locality, being observed as far east as Bawden lake on the Lake Superior branch of the new railway, some six miles east of Lake Minnitaki.

Lacustrine Deposits.—Bedded deposits of extensive nature occur on Lac Seul, forming high white cliffs along the south coast, within the limits of Indian Reserve No. 28. According to an earlier investigator[1] they are 80 or 100 feet high, and composed of stratified sand with clay partings, like those on the north shore. Lac Seul is believed to have formed part of an extensive glacial lake adjacent to or possibly forming part of Lake Agassiz.

An extensive clay area is traversed by the Wabigoon river and its upper tributaries. A line connecting Dinorwic station, the lower end of Gull and Pelican lakes, rudely paralleling the Wabigoon river at a distance of about three miles, and swinging toward the south end of Mountain lake, marks approximately its northern boundary; southward it crosses the Canadian Pacific railway. Within these limits the clay is continuous; only in the valleys and lower levels the higher parts of the crystalline floor protrude as knobs and ridges. For three miles on either side of the Wabigoon river the National Transcontinental railway cuts through these deposits. Where exposed by construction work they appear as well laminated stiff clays in layers 1″ to 2″ thick, either dark grey or red in colour. They lie quite horizontally. Wabigoon river, Gull and Pelican brooks meander through broad valleys of the same character.

At the extreme east of the area included by the two maps, are stratified sands believed to have been laid down by the waters of a large bay of Lake Warren, represented at the present time by Lake Nipigon. Judging from the deposits which remain, this body was much deeper and more extensive than the present lake. Coleman[2] has found sand plains on Sturgeon river which lie 168 feet above the present water level.[3] Later determinations in the country farther

[1] Annual Report G.S.C., Vol. VII. (New Series), p. 52F; also 5th Rep. Bur. of Mines for Ont., pp. 90-93.
[2] Bureau of Mines Report for Ontario, 1907, p. 135.
[3] Bureau of Mines Report for Ontario, 1908, p. 167.

east give a maximum elevation of 218 feet. McInnes records a terrace at Nipigon House standing 25 feet above the water and, 35 feet higher, an accumulation of rounded boulders resembling an old beach. Lacustrine deposits are more extensive along the northwest coast. At the mouth of Whitesand river are stratified sand beds forming white cliffs 60 feet high, and the river itself cuts through similar materials for nearly its whole length. Between the first and second portages the banks rise over 100 feet above the water, and near the south end of Lake Jojo are extensive sand plains, either sparsely covered with jackpines and grey moss, or quite unprotected and drifted into ridge and hollow by the wind.

On the north shore of Sturgeon river a mile above its junction with the English river are a number of well-defined pot-holes in the green schists. The largest of these is 6 feet in diameter and 15 feet deep, its bottom being on a level with the river. Subsequent erosion has destroyed the wall next the river, exposing a vertical section of the cavity. Other smaller holes standing 15 feet above the river contain old grinding stones, and another has a smooth trough 6" deep, leading from its lip downward to the river.

Structural Geology.

The region west of Lake Nipigon consists of three principal structural elements. The oldest and most extensive is composed of the Keewatin, Huronian, and Laurentian; the second of the Keweenawan and its intrusive sills; the third of unconsolidated Pleistocene deposits. They rest upon one another as shown by the accompanying diagram, upon peneplanated surfaces. Each element is subdivisible upon structural grounds, but the distinctions are of a much lower grade of importance than for the principal elements.

Each schist area possesses a dominantly vertical secondary schistosity which exists indifferently in the igneous and sedimentary rocks. The latter, as implied by their inclined bedding planes and linear extension, are also closely folded. The igneous group, being older, must have suffered in like manner, hence folding is, like schistosity, a general feature. Moreover, the margin of each area, whether of Keewatin or Huronian materials, has been recrystallized by contact with the Laurentian. Schistosity, folding and contact metamorphism are the salient structural characteristics of every schist area in the region.

A. C. Lawson first noted in the Lake of the Woods district that the schists were arranged in anastomosing, mesh-like form around orbicular Laurentian areas, and that a close structural relationship existed between Keewatin and Laurentian. Between Lawson's district and Lake Nipigon erosion appears to have been progressively deeper, and the schists have been too largely removed to exhibit this feature. A more manifest one being the tendency toward an E.N.E.-W.S.W. arrangment. But, between Minnitaki and Sturgeon lakes it is well shown. The Minnitaki, Savant and Sturgeon schist areas surround the central Laurentian area almost completely, and even where there are gaps, at the north end of Sturgeon lake and at Dog lake, their pointed ends clearly tend to unite. The strike of the schists also agrees faithfully with the outline of the enclosed Laurentian area. Indeed the situation is identical with that which Lawson found, but less perfectly displayed.

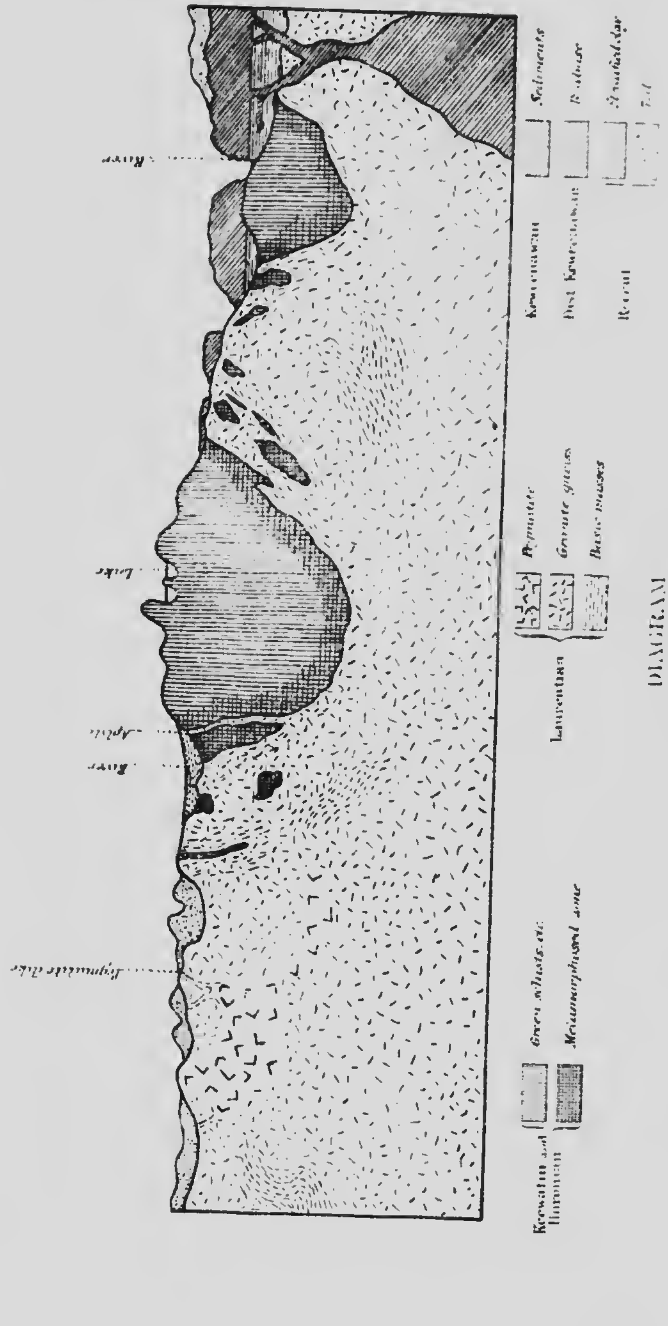

DIAGRAM
To illustrate Geological Relationships

The relationship between Keewatin-Huronian and Laurentian is further explained by the fragmental inclusions which are scattered through the latter. These inclusions, according to composition and distribution, are portions of the Keewatin-Huronian which have been torn from a main body and engulfed by granitic materials. The ribbon-like bands into which some of these have been sheared would result either during processes of solid flowage or of magmatic movement.

The numerous, perfectly angular blocks, however, imply gentle transport, hence only fluid Laurentian conditions would serve. This would also permit of the shattering to which some of the enclosed blocks were subjected, the perfectly fitting fragments being cemented by granite. But even under fluid conditions, blocks could not have migrated far, since, from the field evidence on McEwen lake, the granite magma was capable of absorbing them. The patches of angular fragments which lie at prohibitive distances from existing schist areas could not have travelled across the intervening miles. It is more probable that they were derived from the bottoms of schist bodies which once lay immediately above, but were removed by magmatic absorption or erosion. This would imply for the Keewatin-Huronian formations a much greater original distribution than the present one. The widespread distribution of the inclusions and the uniform granitic texture of the Laurentian, which is considered a result of slow deep-seated cooling, suggest it to have been continuous over the region.

Existing conditions point to a process of bathylithic Laurentian intrusions beneath a continuous system of Keewatin and Huronian formations, which threw the latter into folds. The commencement of this movement cannot be determined, but it evidently did not cease until Huronian time. The general direction of folding for the region is approximately E.N.E.-W.S.W. Contact metamorphism and secondary schistosity were consequences of the same intrusion.

The imposition of these structures upon both Keewatin and Huronian has obscured their mutual relations. However, an unconformity between them is indicated by their essentially unlike lithological character and the existence of Keewatin fragmental material in the Huronian conglomerate. (The source of the granitic pebbles has not been recognized.) The actual plane of unconformity has been disturbed and concealed, hence under existing conditions its relative importance is uncertain. It appears, however, insignificant in comparison with the great unconformity between the old crystalline complex and the Keweenawan.

It would seem that the region was peneplanated before Keweenawan sedimentation began, for the field evidence near Lake Nipigon shows the latter to lie upon a floor of Laurentian gneiss and upturned Keewatin-Huronian schists. Twenty-five miles west of the lake this pre-Keweenawan peneplain and the present peneplain practically coincide, for the separating film of diabase is only a few feet thick.

Since the Keweenawan, no important regional disturbance has happened. Except where locally shattered by the diabase intrusion the sediments of that age lie quite horizontally, and retain in excellent preservation their original form. Gentle faulting has taken place, but without disturbing noticeably the prevailing tranquillity.

The geological record is blank from the conclusion of the diabase intrusion up to glacial time. When the ice finally disappeared the region possessed an aspect little different from its present one. The rock surface was again peneplanated and polished. Some of the glacial structures—moraines and eskers—persist, while much of the finer matter has been rearranged by the waters of Lake Warren and, probably, Lake Agassiz.

The structural elements which together constitute the region are arranged in order of importance in the following table:—

5. Pleistocene deposits.. ..	1. Glacial and lacustrine deposits.	
4. Peneplanated unconformable surface.		
3. Keweenawan sediments and intrusive sills.. ..	2. Diabase sills.	
	1. Sedimentary series.	
2. Peneplanated unconformable surface.		
1. Great crystalline complex: including Keewatin, Huronian and Laurentian..	2. Exposed summits of granite bathylith.	
	1. Synclinal folds of green schist..	4. Intrusives common to Keewatin and Huronian.
		3. Huronian sediments.
		2. Unconformity.
		1. Keewatin eruptives.

[illegible] Geology.

Gold occurs in [illegible] schist areas, but the [illegible] sufficiently large or rich to be profitably operated. [illegible] bution of gold in western Ontario has [illegible] by A. P. Coleman after a season's investigation, [illegible]

'As a result of the [illegible] in western Ontario, it may be stated in general [illegible] found either in visible particles or by assay in a stretch of [illegible] reaching from near the Manitoba boundary on Shoal lake eastward to the Quartzite mine near Finmark station, a distance of 260 miles, and over a breadth of 120 or 1[illegible] miles from Minnitaki lake to the south shore of Rainy lake. It is not to be supposed, of course, that gold in paying quantities will be found everywhere within this area of 120 by 260 miles; [illegible] probably two-thirds of this territory of more than 30,000 square miles is Laurentian which has proved to be auriferous, except near the margin of the Huronian. It is not even to be taken for granted that every stretch of Huronian rock in this area is auriferous, though in most cases where exploration has been thorough, gold has been found in traces, if not more abundantly, in veins from the Huronian of almost all parts of the field.

'Two points have struck me forcibly during the summer: one, the frequency with which true fissure veins bearing free gold have been found in or near masses of eruptive granite which have burst through the Huronian schists; the other, that at two points immense bodies of schist impregnated with sulphides, i.e., fahl bands, have proved auriferous.

'Turning next to the wide diffusion of gold in schist and eruptive rocks, three examples were studied during the summer, the first on Minnitaki lake, twenty or thirty miles northeast of Wabigoon tank on the Canadian Pacific railway, where, toward the southwest end, the shore for long distances consists of schist charged with iron and copper pyrites. Every assay made of rock from this shore showed traces of gold, while similar rock from the north end of the lake, or from Abram lake, still farther north, gave nothing. The highest of our assays from this region gave only $2 per ton, however.[1]

The most important deposits of gold in the region under consideration are of the true fissure type described above, which occur near Sturgeon lake. At the north end of the lake the Keewatin schists are intruded by a body of granite whose contact extends down the western side of the large median peninsula. The intrusive character of the granite is evident; the adjacent schists have been hardened and rendered more crystalline than usual, while at its edge the granite becomes porphyritic, and filled with chloritic material, besides being very much shattered. The crevices resulting from this shattering are filled by an irregular system of mineralized quartz veins and stockworks. Various points along this contact have been proved gold bearing, the best known of which is the Sturgeon Lake Gold Mining Company's property west of Couture lake. At this place the shattered zone is about 200 feet wide. The granite, with which are associated a coarsely crystalline quartz porphyry and dikes of coarse granite, bearing light-coloured mica, is traversed by a branching mass of quartz veins, lenses and stringers. More uniformity is exhibited in the adjacent schists, where they follow the planes of schistosity. Free gold, pyrite, chalcopyrite, galena, and zinc blende are contained in a gangue of quartz, and small amounts of calcite. The walls and enclosed fragments of schist also carry gold.

Mining operations have been conducted since 1901. When first visited by the writer in August, 1906, a force of forty men was being directed by Mr. A. L. McEwen. One shaft was connected with underground workings at a depth of 100 feet, and a second was being transformed into a 40 ft. open-cut leading to the shore of Couture lake. The ore was being crushed in a ten stamp mill, free gold separated by amalgamation and the sulphide concentrates, which are said to be valuable, stored for subsequent treatment. When revisited in June of the following year, work had been suspended for two months, pending a transfer of ownership, but was expected to be resumed when navigation opened. An abundant supply of vein matter and mineralized schist was in sight, whose average assay returns are stated by the manager to be $10.67 per ton, 60 per cent

[1] 5th Rep. Bureau of Mines for Ontario, pp. 86-7.

being free milling, the balance contained in the sulphides which form 7 per cent of the weight mined.

The granite-schist contact runs southwest from the end of the peninsula, crossing a small island about a mile northwest of the hotel, on which Mr. T. K. Barnard has staked a property. The geological conditions are identical with those just described. A network of veins has been uncovered and rich samples obtained, but no mining was being done.

Along the same contact, midway between the St. Anthony and Barnard's properties gold has been found in a vein lying in the granite a short distance away from the Keewatin. The old Dawson and King Bay mines are now deserted, but show the existence of gold.

A good many claims have also been staked on East and Northeast bays, but interest has been directed recently to Belmont bay. The geology of this locality is complicated by the presence of numerous igneous bodies cutting the schists. The auriferous veins lie near them. Messrs. Douglas, Fawcett, Coveney, and Bourion have located five claims upon a vein at the edge of a coarse gabbro mass. Test pits have been sunk, and comfortable camp buildings erected. Messrs. Cody and St. Julien have also found gold, associated with pyrite and stibnite, in a vein cutting an altered porphyry whose large feldspar phenocrysts give the surface a mottled appearance.

In the same locality the Belmont Bay Mining Company has been engaged for several years, a shaft being sunk 250 feet and then abandoned. Work recommenced in 1906, and a three stamp mill was under construction when visited.

Little prospecting has been done in the Savant area, but quartz veins are abundant near Island lake. Igneous intrusions, however, are not so common as on Sturgeon lake. Small quartz veins bearing free gold are reported just north of Kimmewin lake.

Traces of alluvial gold have been found in the sands of Savant lake, and a single small colour was obtained from the beach sand of Lac Seul at a point five miles S.S.W. of the Hudson's Bay Company's post. These sands, which occur in great quantity, consist largely of quartz, garnet, magnetite and greenstone, derived, no doubt, from the detrition of Laurentian and Keewatin rocks; the small gold content may come from the same source.

IRON.

General Account. Iron ore is represented by rich portions of the iron formation which occurs in the Keewatin-Huronian areas. Where best known this formation is a phase of the Huronian slate in which magnetite is present in visible quantities. It is usually siliceous, hence the local exposures of banded quartzite may be variations. The magnetite is aggregated in parallel bands from a fraction of an inch to several inches or feet wide, and appears at the surface as glossy blue-black seams in the more dull coloured slate. They coincide with original bedding planes which have become folded into nearly vertical positions.

Under the microscope the iron formation rock appears as a fine quartz mosaic, with varying amounts of sericite, etc., through which are distributed bands of minute octahedral magnetite. The latter vary in amount up to about one-half of the whole. They show a decided tendency to become concentrated along the sides of cleavage cracks filled with quartz and siderite. Siderite occurs in scattered rhombohedra, often recognizable by the presence of limonite staining. Some of the fresh, clear material may be calcite. In some cases the original siderite rhombohedra are represented by quartz pseudomorphs. Pyrite is also distributed sparingly and partly weathered to limonite.

Distribution. With the possible exception of the imperfectly known Obonga area, all the Keewatin-Huronian areas contain iron formation, the most extensive occurrence being near Kashaweogama lake in the Savant area.

Savant Area. Iron formation occurs both north and south of Kashaweogama. On the north its extent is little known, and the observed exposures are of no value. Lean quartzite formation extending E. 10° S. to E. 20° S., crosses the portage between Island and Cliff lakes, exposures being visible near the middle and at Cliff lake. The country to the east is swampy or drift covered, but with the aid of a dip needle iron formation was located at several points near the Grand Trunk Pacific Railway survey line at the east end of Kashaweogama. It cannot be continuous across the interval, however, as in many places the Laurentian reaches nearly to the lake.

The most important body commences on the south shore at the narrows just northeast of Fisher lake. It outcrops all along the shore and reaches nearly to Circle lake.

Broad magnetite bands belonging to this area were seen 60 chains south of Kashaweogama, on a portage reached by following the creek which enters Kashaweogama two miles from its eastern end. The range is, therefore, about four miles long and between a quarter and a half mile wide. The largest bands observed at this point were 4 feet wide. At the Narrows of Kashaweogama the largest band is 15 feet wide.

Poorly banded formation occurs on Iron lake and on the portage to Savant lake, where the bands are much crumpled and extend in a southeasterly direction. Similar lean formation was found along the west shore of Savant lake as far as the Narrows. Vestiges of it have been recorded as far south as the first lake south of Savant. The magnetite seams are all narrow and commercially valueless, except those south of Kashaweogama.

A sample taken from the narrows has been analysed by Mr. F. G. Wait, Chief Chemist of the Department of Mines, who reports as follows:—

'Sample of iron ore from a point situated about ten miles west of Savant lake consists of an intimate association of magnetite with some hematite and a larger proportion of siliceous—mainly quartzose—gangue. It has been submitted to analysis and found to contain:—

Metallic iron	30·74%
Insoluble siliceous residue	55·70%
Titanic acid	None.'

Another specimen analysed in the laboratory of the Atikokan Iron Mining Company yielded 53½% of metallic iron.

Twenty-one claims were staked in this vicinity during 1907, and considerable exploratory work is said to have been done.

Minnitaki Area.—Lean iron formation, partly altered to hornblende schist, occurs near Sioux Lookout on Pelican lake. Narrow magnetite seams are visible on the islet below Frog rapids. More extensive ones, containing more pyrite than usual, were noted on the east shore of Pelican lake, just north of the granite tongue which cuts into the hornblende schists. A reported find of iron ore near Hidden lake may indicate the presence of iron formation in that vicinity. None of the observed exposures, however, are of more than geological interest.

Sturgeon Area.—McInnes records iron formation at a point 30 chains southeast of the head of East bay, in association with schist conglomerate. He also finds iron formation pebbles in the Huronian conglomerate, hence iron formation of two ages appears to be represented. Nothing is recorded of its possible value or extent.

Caribou Area. Half-way along the northwestern shore of the narrow easterly bay in Caribou lake a few small magnetite seams were found in 1906. A conspicuous cliff marks the locality more definitely. The magnetite seams, the largest of which is 12″ wide, occur in a fissile schist whose original character has not been determined. The bodies seen are of no commercial value.

Age.—The formations in the Savant and Minnitaki areas form part of the sedimentary group considered to be Huronian, and probably lower Huronian. According to geological notes upon the Sturgeon Lake area, Keewatin iron formation is implied by the iron formation pebbles in the Huronian conglomerate, while the iron formation associated with the conglomerate must be of the same age and, therefore, equivalent to the Savant formation.

The age of the Caribou Lake iron formations is not known.

PYRITE.

Pyrite occurs very commonly in the schists as disseminated grains; less frequently in concentrated bands. It often carries low gold values, but at one point is itself mined. The Northern Light Mining Company has begun work upon a vein at the east end of Big Vermilion lake. When visited in July, 1907, work was being confined to exploration of the ore body and preparations for mining upon a commercial scale in the future. Test pits had been sunk through the drift, which is from 8 to 20 feet thick. About 12 acres of bush were cleared and serviceable camp buildings erected. A wagon road three miles long leads to Vermilion river, from where gasoline launches run to Abram chute. It is expected that a spur about four miles long will be constructed to connect the mine with the new railway.

A gang of 40 men were at work. A 7 ft. x 9 ft. shaft had been sunk 110 feet, and at 90 feet a drift run 12 feet through the ore body. Since then a 35 ft. exploratory shaft has been sunk about 75 feet south of the main one, and other portions of the vein near the lake trenched or test-pitted.

The deposit occupies a well-defined nearly vertical fissure in green schist and sheared dioritic rock. At the surface the ore body is 5 feet wide, but the underground explorations are revealing much greater dimensions. The filling is massive fine-grained pyrite containing some chalcopyrite and a little quartz. The pyrite is reported to be of good quality.

About eight miles west of the Northern Light or Michie mine, seams of pyrite, from 3 to 6 feet wide, have been found at the lake shore. They are said to extend into the lake, where a greater thickness is attained.

FELDSPAR AND MUSCOVITE.

Some of the Laurentian pegmatite is sufficiently coarse textured to afford possible sources for feldspar and muscovite. The large stock on the south side of Gull lake yields muscovite plates up to 6" diameter, and feldspars much larger. The mica at the surface is weathered and brittle, but in fairly clear uncrushed sheets, which might be trimmed to sizes 4" x 5" and less.

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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.
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334	" "	1890.	801	" "	1901.
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602	" "	1895.	971	" "	1905.
625	" "	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.
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Mineral Resources Bulletins:—

No. *818. Platinum.	No. 860. Zinc.	No. 881. Phosphate.
851. Coal.	869. Mica.	882. Copper.
*854. Asbestos.	872. Molybdenum and Tungsten.	913. Mineral Pigments.
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Reports 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.
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745. Altitudes of Canada, by J. White. 1899.
*972 Descriptive Catalogue of Minerals and Rocks, by R. A. A. Johnston and G. A. Young.

YUKON.

*260 Yukon district, by G. M. Dawson. 1887. Maps Nos. 274, scale 60 m. = 1 in.; 275--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.
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. 1,026, 1,041, 1,044-1,049.

BRITISH COLUMBIA.

212. The Rocky mountains (between latitudes 49° and 51° 30°), 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 8 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. 556-7, scale 4 m. = 1 in.
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. Map No. 921, scale 4 m. = 1 in., and Map No. 922, scale 1 m. = 1 in.
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.

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 Map 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. 1,010, 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
601 Country between Athabaska lake and Churchill river, by J. B Tyrrell and D. B Dowling 1895. Map No 957 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

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. 1890. Maps Nos. 314 315, 316.
325. 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.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No 1010, scale 35 m. = 1 in

NORTH WEST TERRITORIES.

217. Hudson bay and strait, by R. Bell 1885 Map No [illegible] 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 [illegible] 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
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.

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 283, scale 4 m = 1 in.
266. Lake Superior, mines and mining, by E. D. Ingall. 1888. Maps Nos. 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.; 824, 825, 864, scale 100 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.
992. 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.
998. Report on Pembroke sheet, by R. W. Ells. (French). Map No. 660, scale 4 m. = 1 in.
1075. Gowganda Mining Division, by W. H. Collins. Map No. 1,076, scale 1 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, Levis, 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 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. 599, 606, scale 4 m. = 1 in.; 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.

NEW BRUNSWICK.

218. Western New Brunswick and Eastern Nova Scotia, 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. }
803. Coal prospects in, by H. S. Poole. 1900. } Bound together
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.

NOVA SCOTIA.

243. Guysborough, Antigonish, Pictou, Colchester, and Halifax counties, by Hugh Fletcher and 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 m. = 1 in.
685. Sydney coal-field, by H. Fletcher. Maps Nos. 652, 653, 654, scale 1 m. = 1 in.
797. 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.

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.
884. Portion of Duncan Creek Mining district, scale 6 m. = 1 in.
891. 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.

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 Crow's-nest coal field, 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.

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.

SASKATCHEWAN.

1010. Alberta, Saskatchewan and Manitoba. Coal Areas. Scale 35 m. = 1 in.

MANITOBA.

801. Part of Turtle Mountain showing coal areas, scale 1½ m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 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.
914. Preliminary Map of Timagami and Rabbit lakes, scale 1 m. = 1 in.
961. Geological Map of parts of Algoma and Thunder bay, scale 8 m. = 1 in.
1023. Corundum Bearing Rocks. Central Ontario. Scale 17½ m. = 1 in.
1076. Gowganda Mining Division, scale 1 m. = 1 in.

QUEBEC.

251. Sherbrooke sheet, Eastern Townships Map, scale 4 m. = 1 in.
287. Thetford and Coleraine Asbestos district, scale 10 ch. = 1 in.
375. Quebec sheet, Eastern Townships Map, scale 4 m. = 1 in.
571. Montreal sheet, Eastern Townships sheet, 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.
970. 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.

NEW BRUNSWICK.

675 Map of Principal Mineral Occurrences. Scale 10 m. = 1 in.
969 Map of Principal Mineral Localities. Scale 15 m. = 1 in.

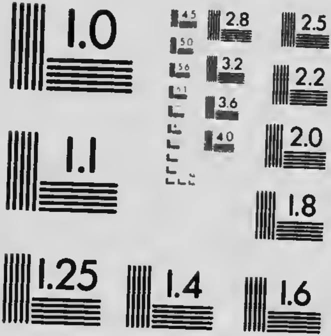
NOVA SCOTIA.

81[illegible] Preliminary Map of Springhill coal-field, scale 50 ch. = 1 in.
83[illegible] Pictou coal-field, scale 25 ch. = 1 in.
89[illegible] Preliminary Geological Plan of Nictaux and Torbrook Iron district, scale 25 ch. = 1 in.
92[illegible] General Map of Province showing gold districts, scale 12 [illegible] in.
93[illegible] Leipsigate Gold district, scale 500 ft. = 1 in.
94[illegible] Harrigan Gold district, scale 400 ft. = 1 in.
[illegible] Malaga Gold district, scale 250 ft. = 1 in.
10[illegible] Brookfield Gold district, scale 250 ft. = 1 in.
10[illegible] Halifax Geological sheet. No. 68. Scale 1 m. = 1 in.
10[illegible] Waverley Geological sheet. No. 67. Scale 1 m. = 1 in.
10[illegible] St. Margaret Bay Geological sheet. No. 71. Scale 1 m. = 1 in.
10[illegible] Windsor Geological sheet. No. 73. Scale 1 m. = 1 in.
10[illegible] Aspotogan Geological sheet. No. 70. Scale 1 m. = 1 in.

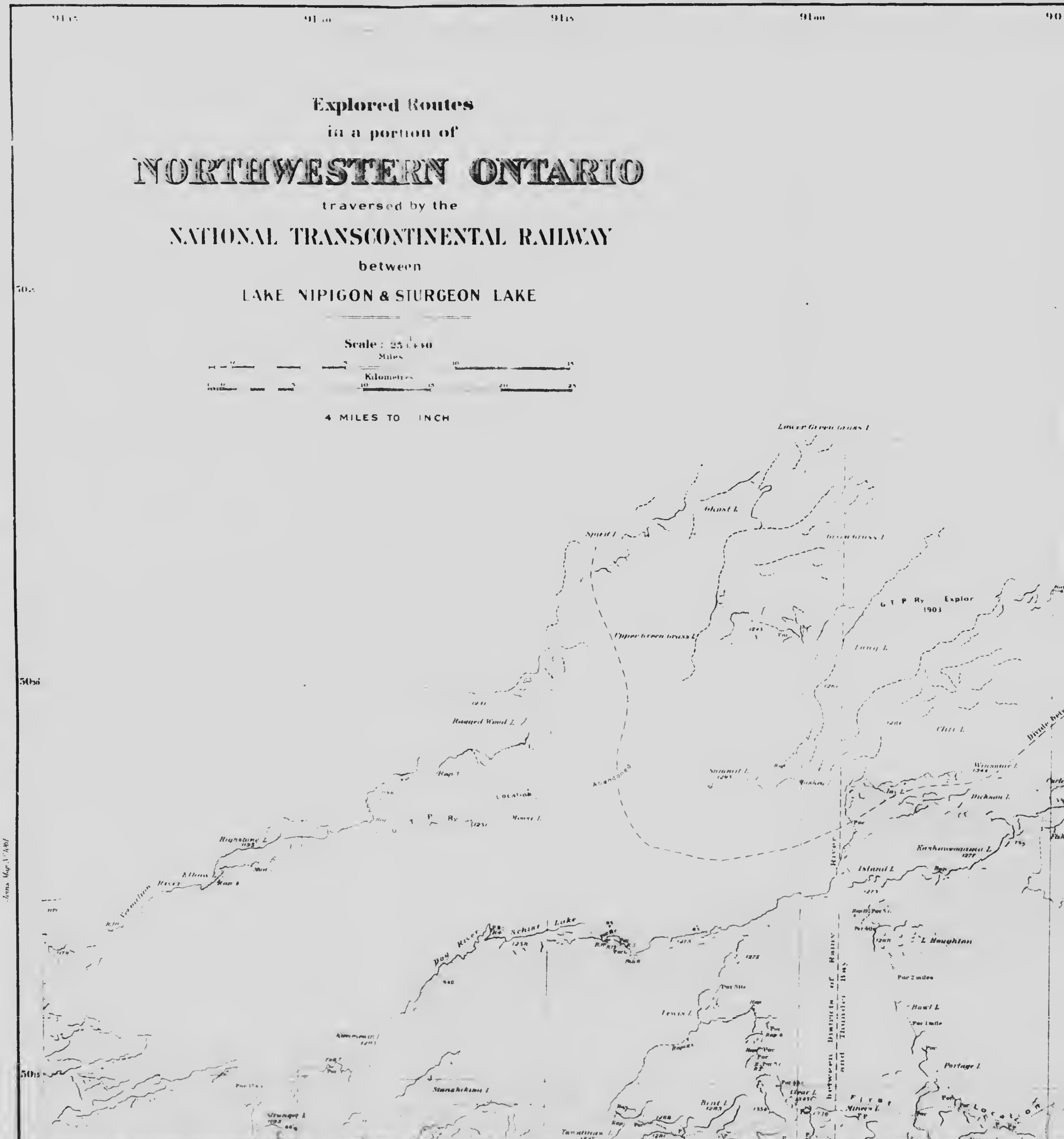
Note.—[illegible] report will be furnished free to [illegible] applicants.
Reports [illegible] by [illegible] prefixed to title.
Applica[illegible] to The Director, Geological Survey, Department of Mines, O[illegible]

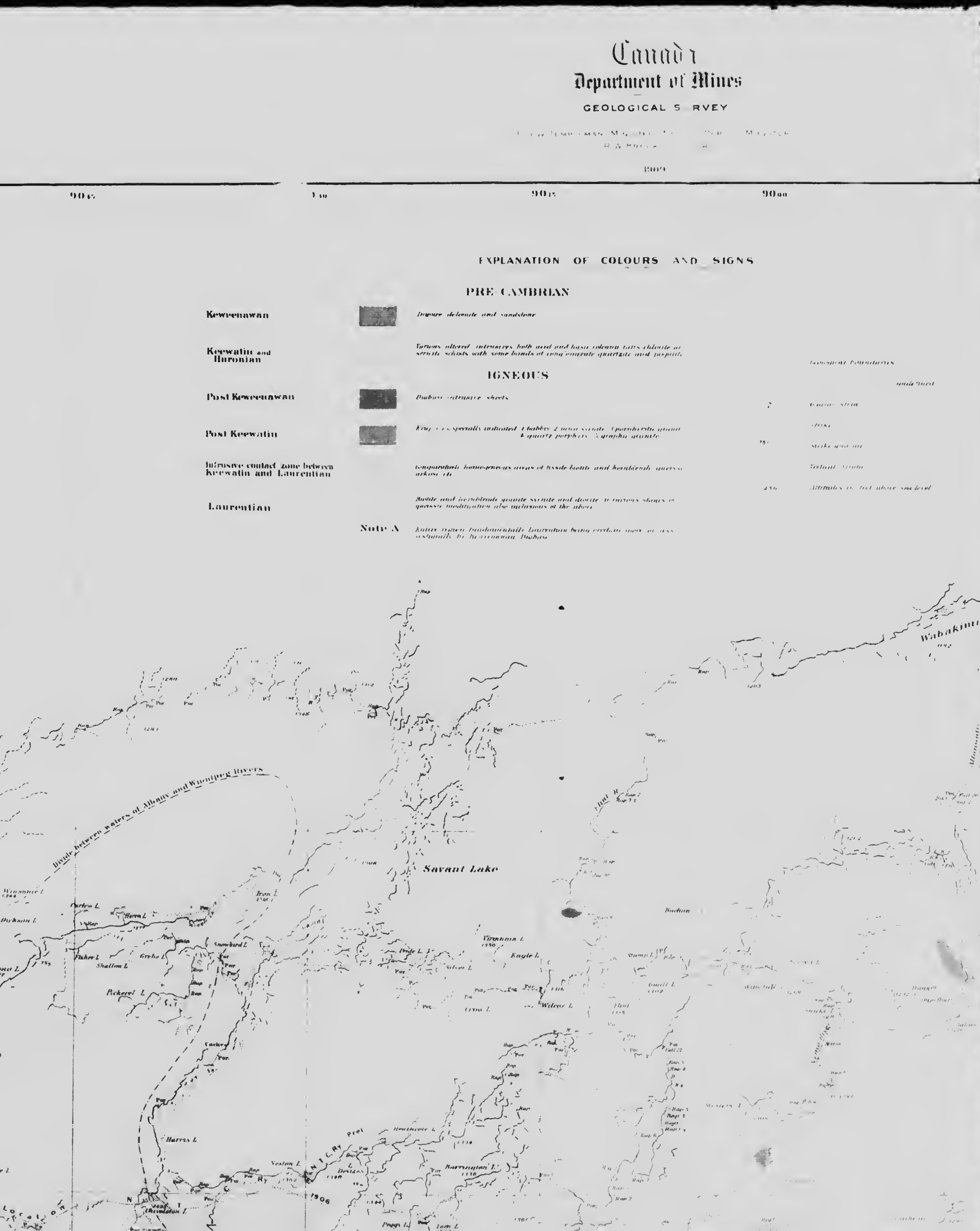
MICROCOPY RESOLUTION TEST CHART

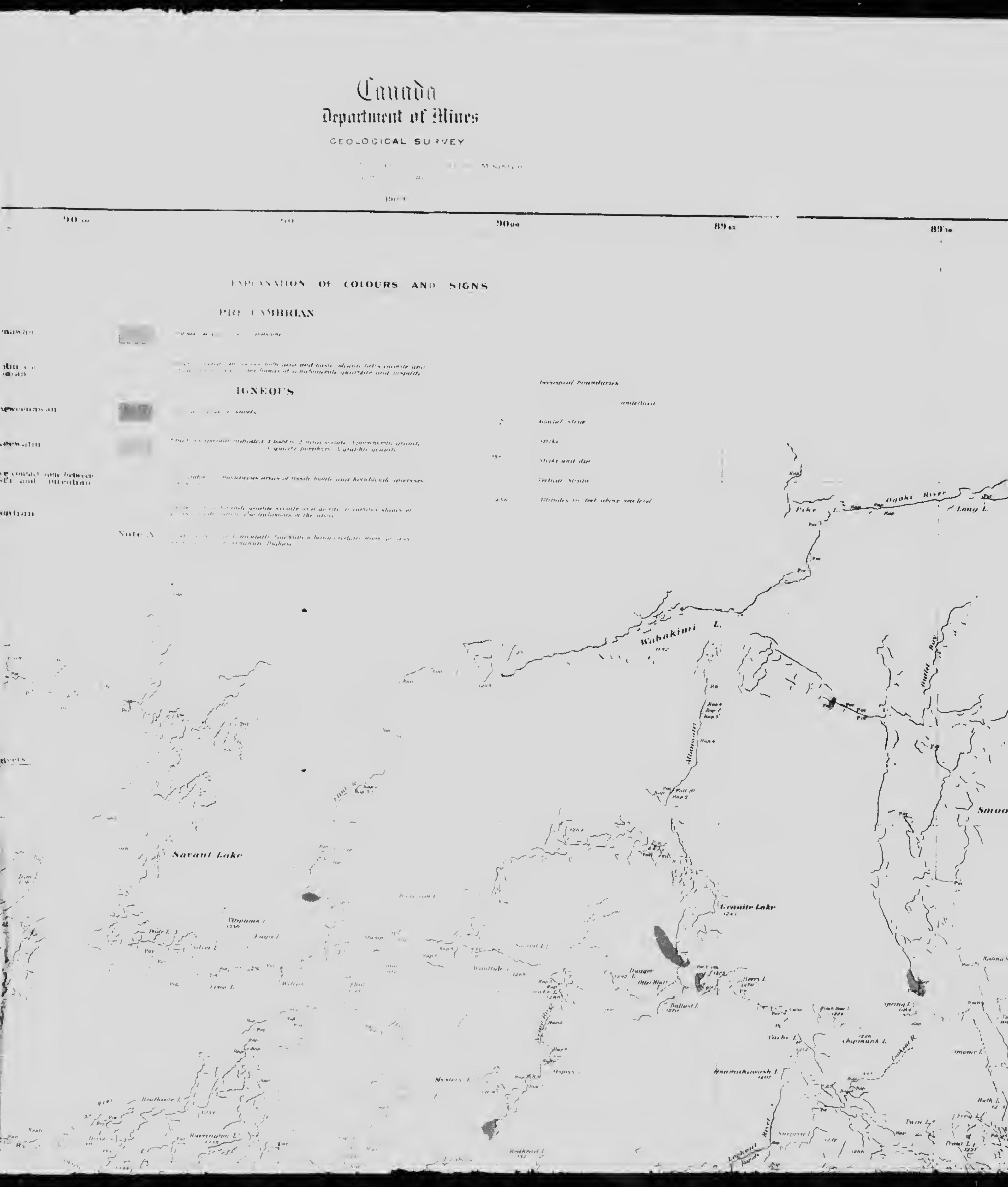
(ANSI and ISO TEST CHART No. 2)



EXPLORATIONS




Canada
Department of Mines
GEOLOGICAL S RVEY
1909
EXPLANATION OF COLOURS AND SIGNS
PRE-CAMBRIAN
Keweenawan
Impure dolomite and sandstone
Keewatin and Huronian
IGNEOUS
Post Keweenawan
Diabase intrusive sheets
Post Keewatin
Intrusive contact zone between Keewatin and Laurentian
Laurentian
Note A
Divide between waters of Albany and Winnipeg Rivers
Savant Lake
Wabakimi
Snowbird L.
Pickerel L.
Eagle L.
Harris L.
Barrington L.
Vesten L.
1906

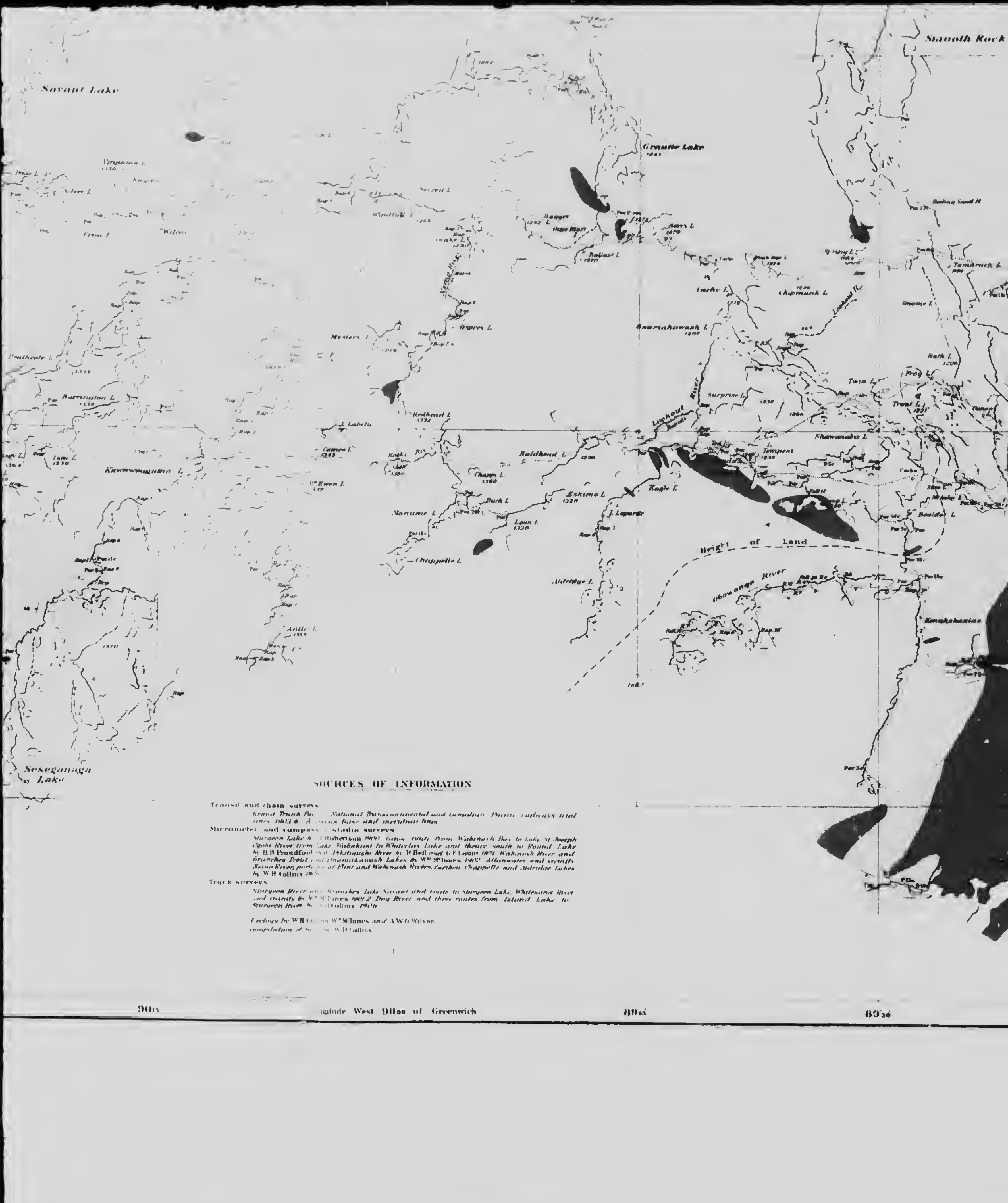

Canada
Department of Mines
GEOLOGICAL SURVEY
EXPLANATION OF COLOURS AND SIGNS
PRE-CAMBRIAN
IGNEOUS
Note A
Provincial boundaries
undefined
Glacial striæ
Dike
Strike and dip
Vertical strata
Altitudes in feet above sea level
Ogoki River
Pike L.
Long L.
Wabakimi L.
Savant Lake
Granite Lake
Dagger
Otter
Ballast L.
Berry L.
Spring L.
Chapmunk L.
Caché L.
Anamikawash L.
Mystery L.
Heathcote L.
Barrington L.
Virginia L.
Eagle L.
Bath L.
Twin L.
Frog L.
Trout L.
Lookout Rapids
Smoo

GEOLOGY

89 15
89 00
88 30
50 45
50 30
Whitewater Lake
Caribou Lake
Big Lake
Note A

C. O. Senecal B.A.Sc. Geographer & Chief Draughtsman
A. Dickison, Draughtsman


Savant Lake
Pickerel L.
Sturgeon Lake
Seseganaga Lake
Kawnwengama L.
Heathcote L.
Barrington L.
Harris L.
Queens L.
Peggy L.
Tom L.
Antler L.
Chappelle L.
Nanaime L.
1906
SOURCES OF INFORMATION
Track surveys
90 45
90 30
90 15
Longitude West 90 00 of Greenwich


Savant Lake
Granite Lake
Kawaweogama L.
Redhead L.
Baldhead L.
Eskimo L.
Loon L.
Chappelle L.
Aldridge L.
Surprise L.
Lookout River
Shawanabis L.
Tempest L.
Eagle L.
Height of Land
Obowanga River
Trout L.
Bath L.
Boulder L.
Tamarack L.
Gnome L.
Chipmunk L.
Cache L.
Onamakawash L.
Osprey L.
Mystery L.
Barrington L.
Seseganaga Lake
SOURCES OF INFORMATION
Track surveys
90°00' of Greenwich
89°45'
89°30'

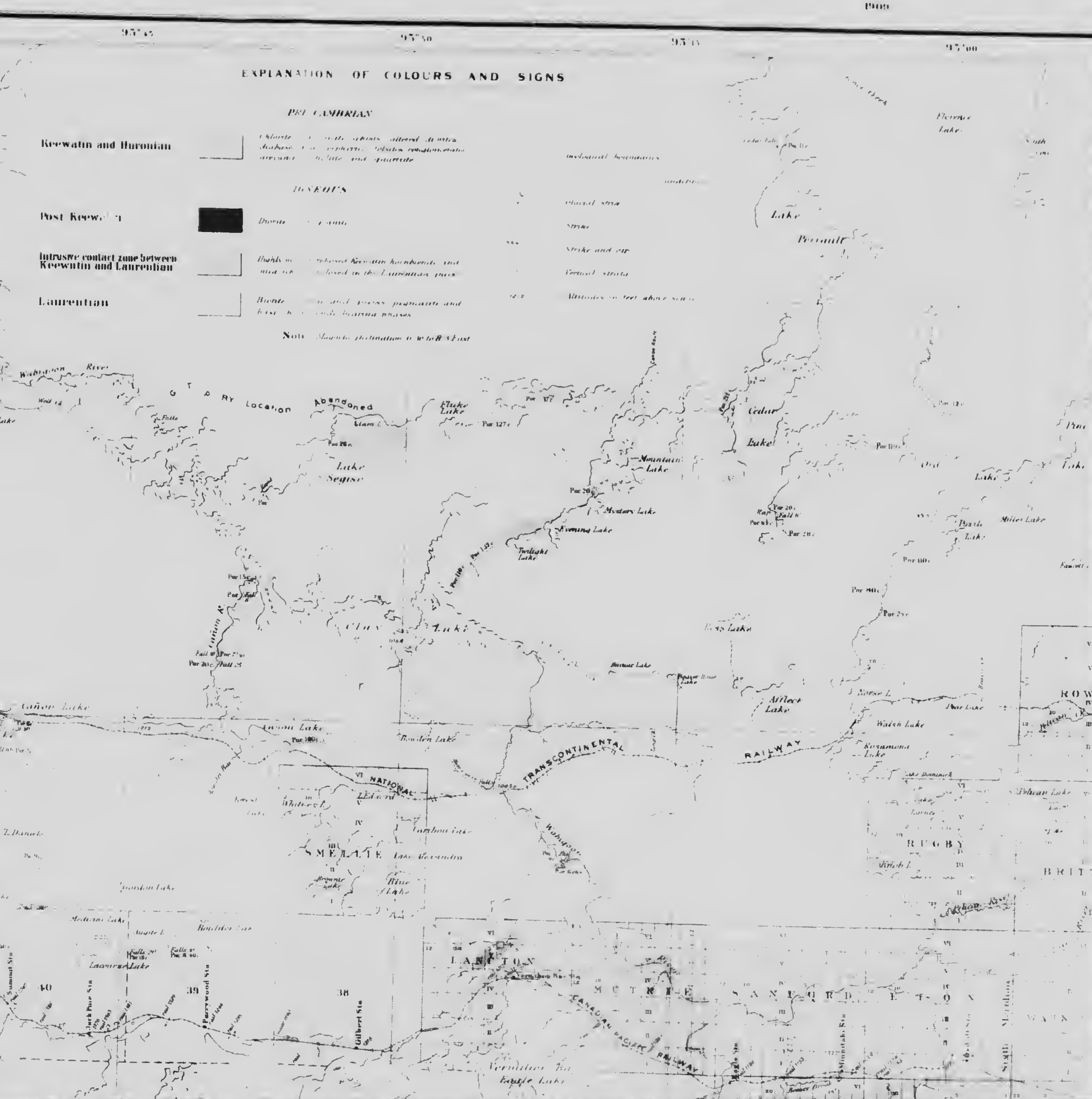
N° 993
2nd Edition

To accompany Reports N° 1059 English and N° 1060 (French)

EXPLORATIONS

Canada
Department of Mines
GEOLOGICAL SURVEY

1909

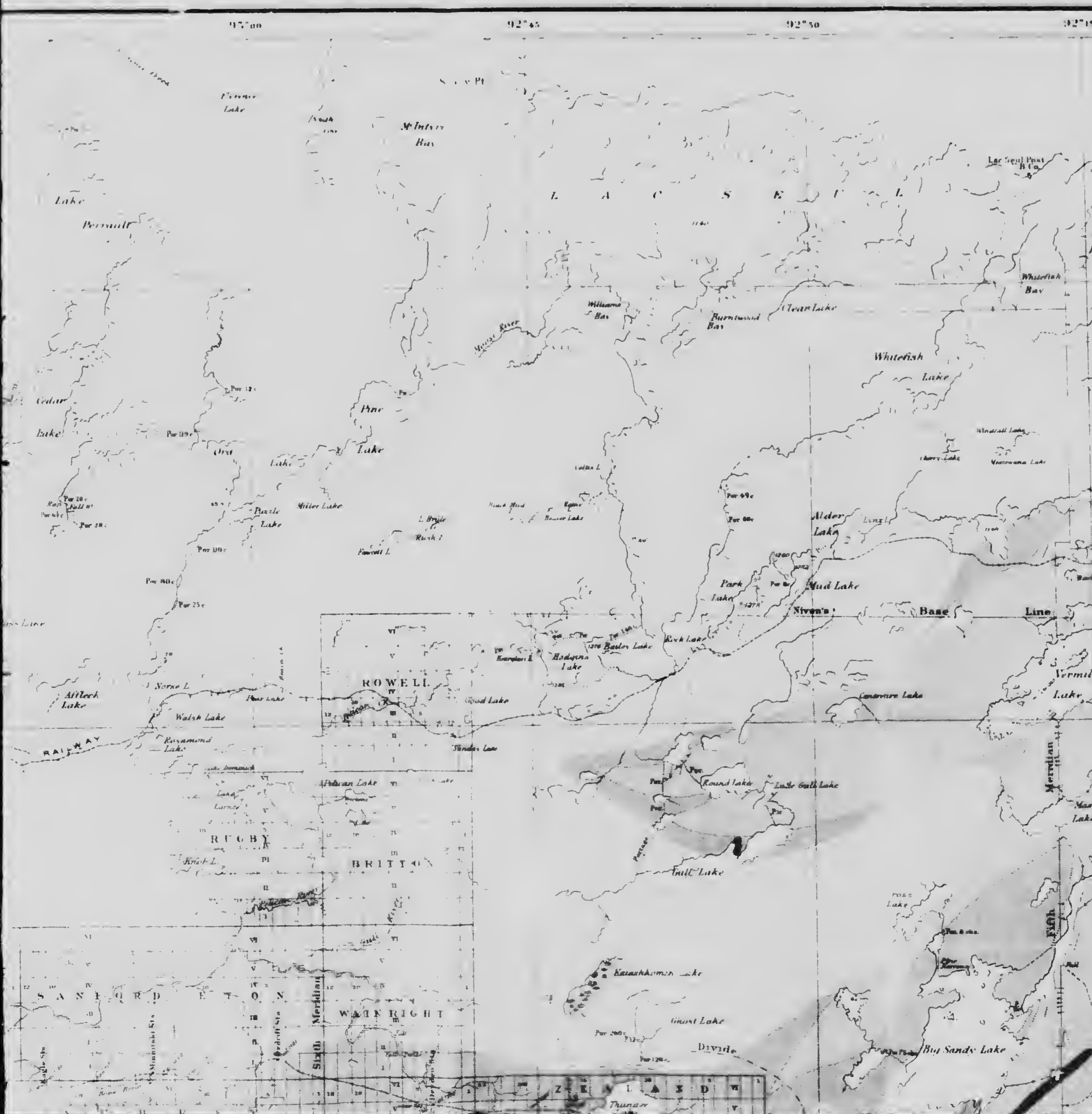


Canada

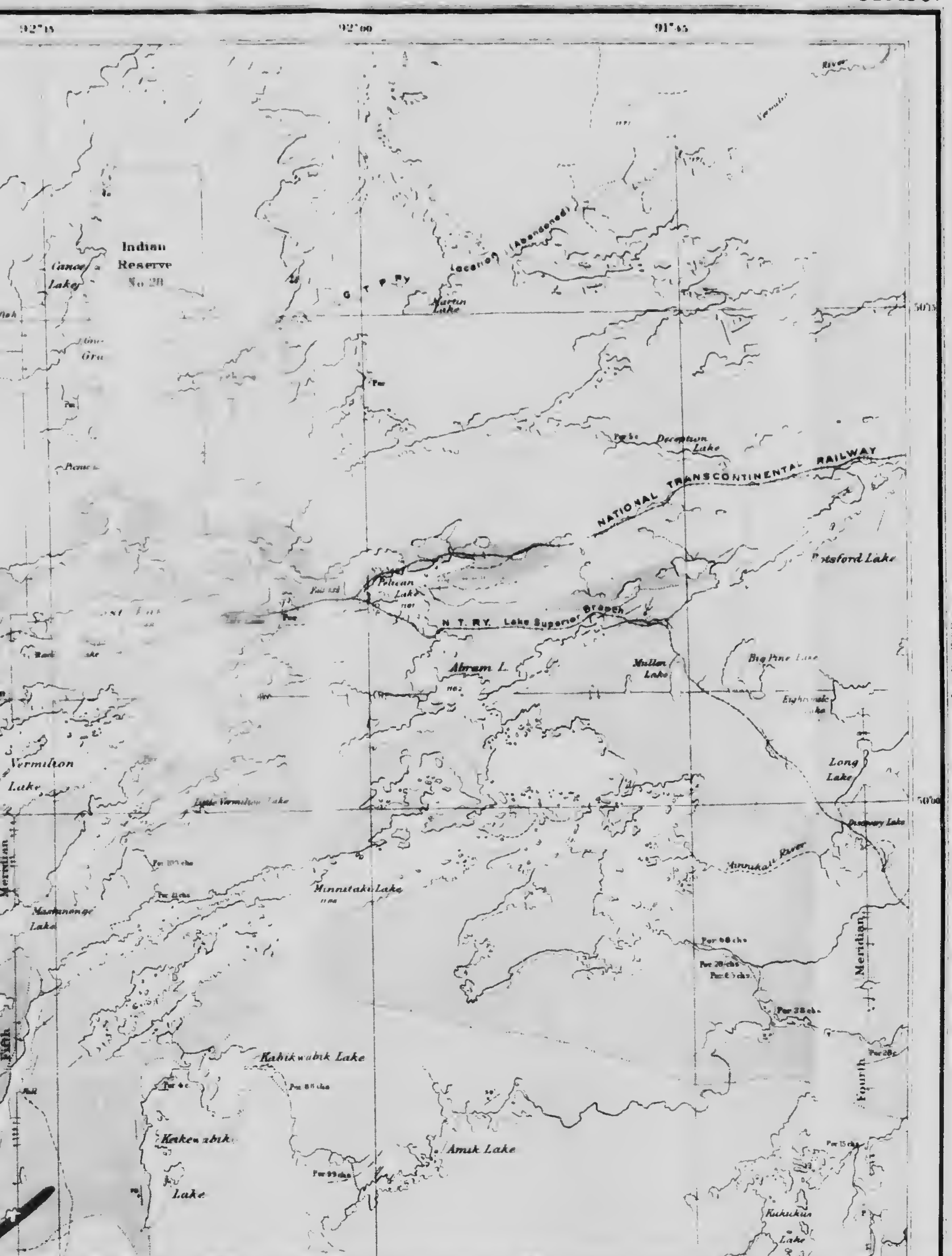
Department of Mines

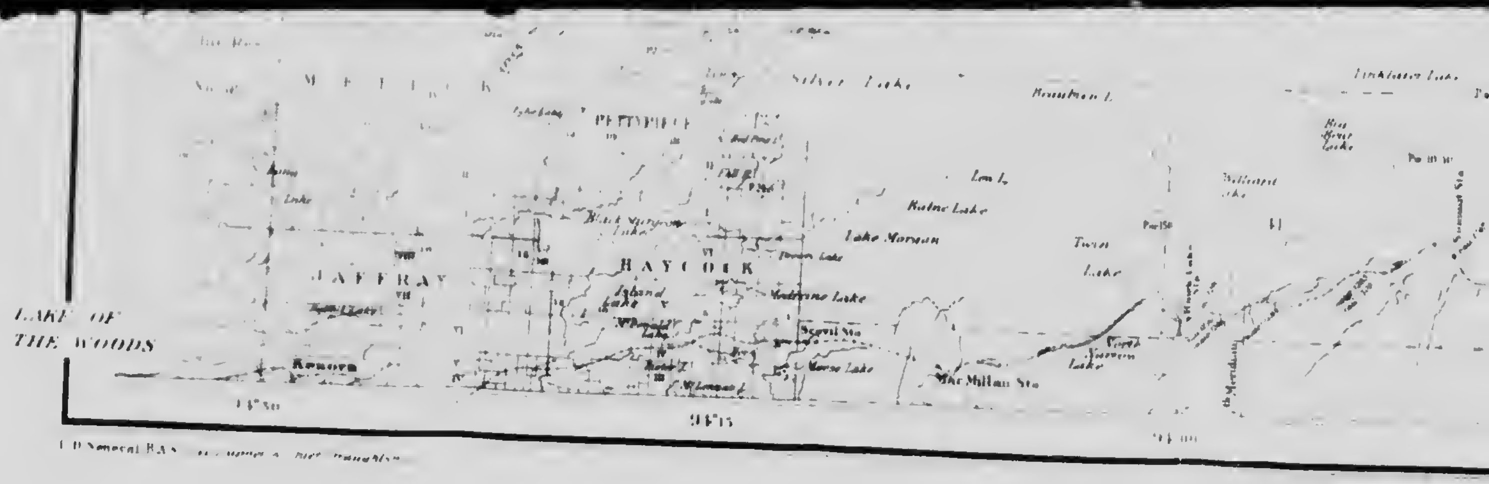
GEOLOGICAL SURVEY

1909

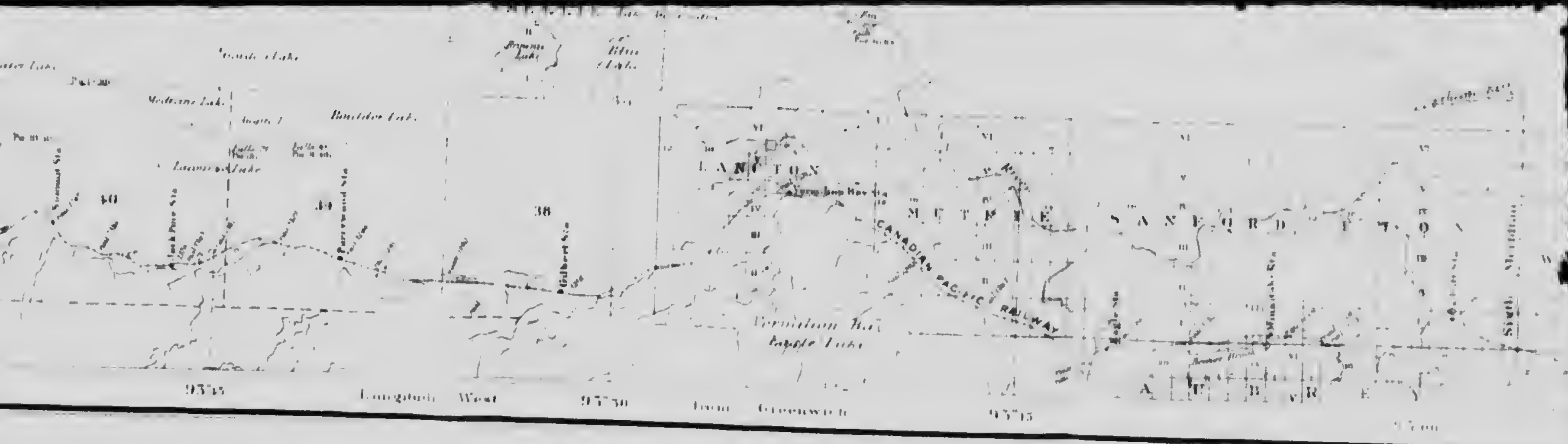


GEOLOGY


92°00
91°45
Indian
Reserve
No. 20
G. T. P. Ry.
Location (Abandoned)
Martin
Lake
Deception
Lake
NATIONAL TRANSCONTINENTAL RAILWAY
Pelican
Lake
N. T. RY. Lake Superior Branch
Abram L.
Mullen
Lake
Big Pine Lake
Long
Lake
Vermilion
Lake
Little Vermilion Lake
Minnitaki Lake
Minnitaki River
Meridian
Fourth
Kabikwabik Lake
Amik Lake
Lake



LAKE OF
THE WOODS
HAYCOCK
Kenora
Silver Lake
Island Lake
Twin Lake
MacMillan Sta



Explored Routes
in a portion of

NORTHWESTERN ONTARI

traversed by the

NATIONAL TRANSCONTINENTAL RAILWAY

between

LAKE MINNITAKI AND LAKE OF THE WOODS

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

Miles

Kilometres

4 MILES TO 1 INCH

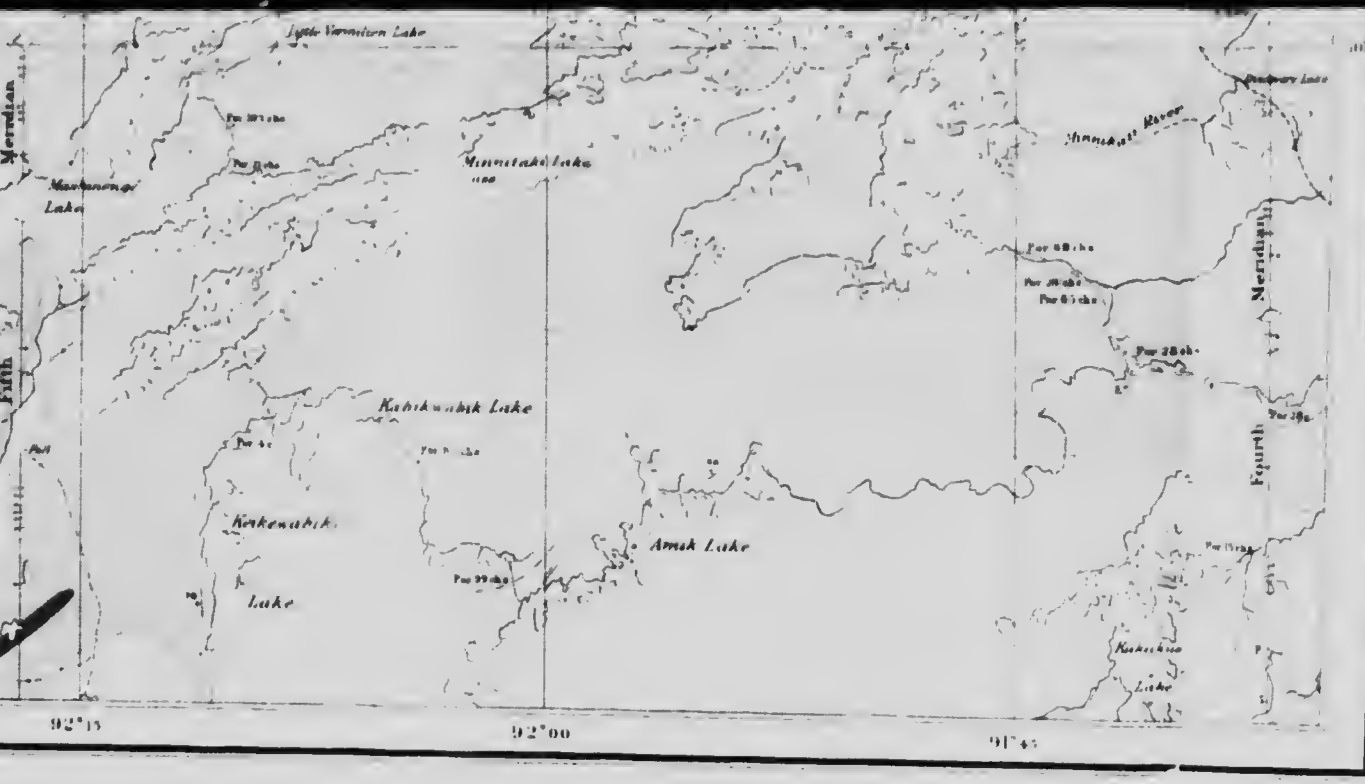
Explored Routes
in a portion of
ESTERN ONTARIO
traversed by the
ANSCONTINENTAL RAILWAY
between
AKI AND LAKE OF THE WOODS

Scale: 1/253,440
Miles
Kilometres

4 MILES TO 1 INCH

SOURCES OF INFORMATION

Compiled and drawn by H. Lefebvre *from surv*
1872 Wm McInnes, *1902 and* W. H. Collins, *1906*
Geological Survey, *and from plans of the* Dep
Crown Lands, Ontario, *the* Canadian Pacific
Transcontinental *and* Grand Trunk Pacific
Geology by W. H. Collins, Wm McInnes, R. Bell *and* A



N° 1061

MATION

from surveys by R Bell,
s, 1906-7 of the
the Department of
an Pacific National
s Pacific railways
ell and A C Lawson.

To accompany Reports N° 1059 (English) and N° 1060 (French)