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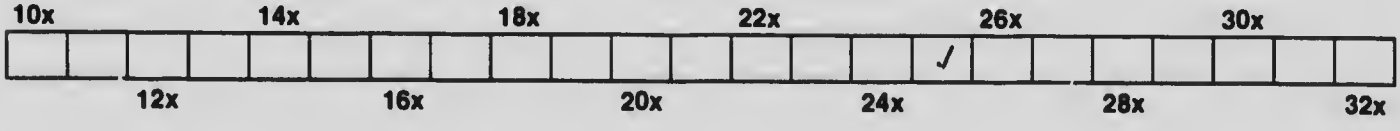

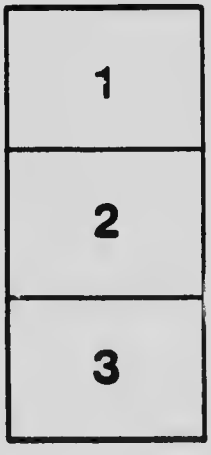

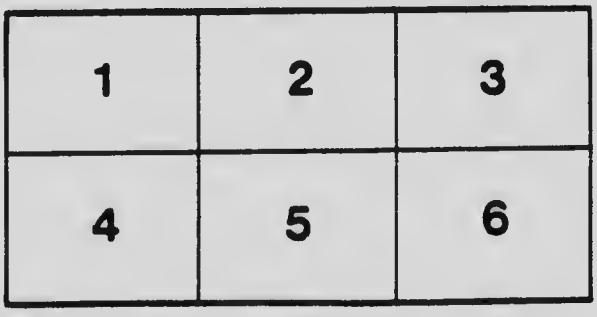

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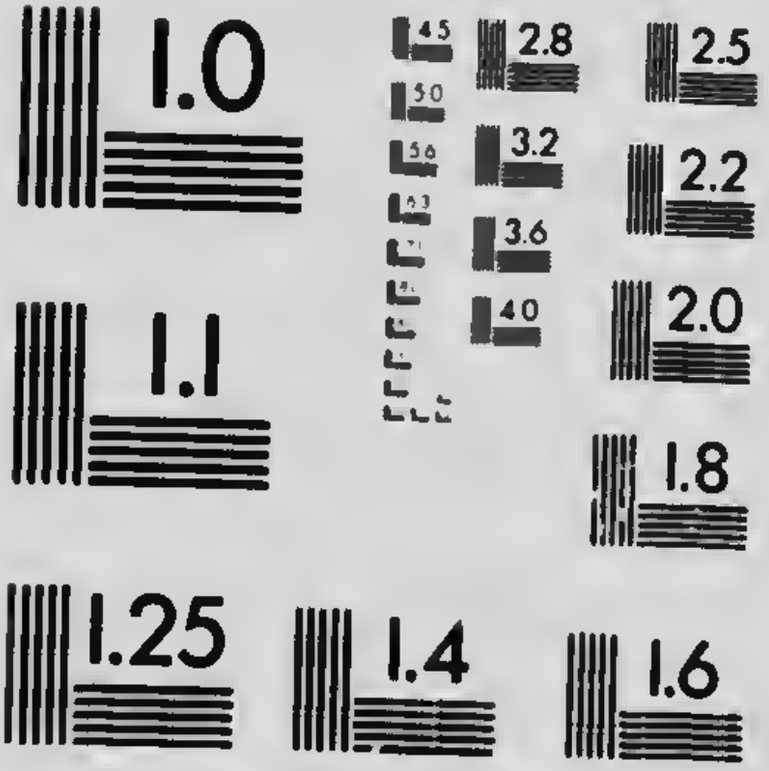

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REPORT

ON THE

GEOLOGY OF THE AREA

ALONG THE

T. & N. O. RAILWAY

ONTARIO GOVERNMENT RAILWAY

SIR JAMES PLINY WHITNEY, PREMIER

TRIAL LINE BETWEEN GOWGANDA AND PORCUPINE.

BY

J. G. McMILLAN.

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:

Printed and published by L. K. CAMERON, Printer to the King's Most Excellent Majesty

1912

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INTRODUCTION.

General Statement, Object and Methods of Work.

In June, 1911, Mr. W. B. McPherson was instructed by W. S. G. Clement, Chief Engineer of the Temiskaming and Northern Ontario Railway, to join Mr. W. R. Maher, Locating Engineer, at Gowganda and report on the geology of a territory along a trial line to be run from Gowganda north to Porcupine. Nearly a month was spent in a reconnaissance south to the headwaters of the Sturgeon river, and on July 10th the party started the survey from Gowganda north. During the months of July and August the line was run through the townships of Van Hise, Rankin and Doon, and the lines which had to be abandoned were run into the south-east corner of Marquis. The geological work was continued by the writer during the next three months, exclusive of the first half of October, which was spent in accompanying Mr. Maher in a reconnaissance of the valley of the Sturgeon. The line was run in a general north-west direction towards Wawaitan Falls on the Mattagami river; and this permitted of the mapping of a strip of country about a dozen miles in width between the Gowganda area, which was reported upon in 1908 by Mr. A. G. Burrows,[1] for the Bureau of Mines, and by Mr. W. H. Collins,[2] for the Geological Survey, and the Porcupine area mapped in 1910 by Messrs Burrows and Rogers,[3] for the Ontario Bureau of Mines.

Acknowledgment is due the Provincial Geologist and members of his staff for assistance in this report and the accompanying map.

The object of the survey was to obtain a knowledge of the topography of the region, particularly in relation to railway building, and of its resources in timber, mineral and agricultural land.

The method followed in the field was to travel along the townlines, the last of which was being run this year, and along the trial line and make note of the adjoining territory. Canoe routes which intersect the area in different directions were followed in so far as time permitted, and fairly accurate surveys of them made by compass and time allowance. The townships which are not served by canoe routes were traversed on foot and a paced compass survey of the route made, the mapping being done at once in conjunction with the notes in a cross section book.

Location and Area.

The quadrangle through which the line runs diagonally from Gowganda, N. Lat. 47 degrees 40 minutes and W. Long. 80 degrees 47 minutes, to Wawaitan Falls, N. Lat. 48 degrees 20 minutes, W. Long. 81 degrees 29 minutes, has a length north and south of 48 miles and a width of 33 miles. It lies partly in Nipissing and partly in Sudbury District, and forms part of the Temagami Forest Reserve. The

[1] Bureau of Mines,, 18th Annual Report, Part II.
[2] Geol. Survey Can.; Preliminary Report of W. H. Collins, 1909.
[3] Bureau of Mines, 20th Annual Report, Part II

six townships of the Gowganda sheet of the Bureau of Mines, include the township of Van Hise in this area; and the Gowganda sheet of the Geological Survey includes also the townships of Rankin, Raymond and Knight. The tier of townships east from Wawaitan Falls are shown in outline on the map of the Porcupine Gold Area; and during the past season the work of the Bureau of Mines has been continued to include the township of McArthur where recent gold discoveries have been made. The intervening forty miles of the sixty in a direct line between the two objective points is the part chiefly dealt with in this report.

Means of Access.

The easiest route is by gasoline boat on the Mattagami river from the Landing to Wawaitan Falls, thence the Grassy river is reached by a three mile portage from the creek which joins the Mattagami two miles above the falls. The Mountjoy creek has been cut out and used by prospectors during the past season for bringing in their supplies from the same starting point. From Porcupine the township lines form the readiest means of access for those not too heavily laden, and the best toboggan trails in the winter.

In the eastern part of the area, Night Hawk lake and river have been used to reach Kitchimine lake and points on the District Line. The southern part is reached from Duncan lake and the Montreal river by portage routes across the height of land to the different branches of the Grassy river, or from Mattagami Post by a six mile road to Sinclair lake and the Grassy river. From the North branch of the Grassy in the south of Zavitz township a lake and two portages connect with the Redstone river; and from the latter stream in the south of Bartlett a chain of seven lakes provide a good canoe route in a north-north-westerly direction across that township to the Mountjoy creek. From Papakomeka lake in this stream, six miles north, a portage route leads to two lakes in Fripp township and to the Grassy river near the High Falls. From Mushkasenda lake, the source of the stream, another cross route through Telluride lake connects with Kapiskong; while from the south end of the lake a chain of clear water lakes form a route to Sinclair lake.

Early Surveys and Recent Prospecting.

Previous to 1867 the region may be considered an Indian hunting-ground, traversed only by fur-traders going to and from Matachewan. In that year a line was surveyed by P. L. S. Duncan Sinclair from the forks on the Montreal river, five miles below that Post, to Kenogamissee Falls on the Mattagami river. Austen's Canadian Pacific Trial Line in 1880 crossed the area further to the north by way of Mushkasenda and Kitchimine lakes to the Great Northern Bend on the Montreal river. In 1896 the Nipissing-Algoma boundary line,—now the Sudbury-Nipissing line,—was run in this part by O.L.S. Alexander Niven, and the report of the accompanying geologist, Mr. E. M. Burwash,[1] accurately describes the rocks occuring along the line. In 1900, Messrs DeMorest and Sylvester of Exploration Survey Party No. 3, made a micrometer survey of the Mattagami river down to Niven's Base Line of 1899, and of the Grassy river from its mouth to Peter Long's lake, continued a canoe and log survey up the Grassy from Kapiskong lake to connect with the District line at Little Hawk lake, and from

[1] Bureau of Mines, 6th Annual Report.

the "Hawk Portages" at the divide, a canoe and compass survey down the Montreal river to Matachewan. The report of J. L. R. Parsons,[2] the geologist on this party, includes a description of the rocks along these streams.

The discovery of silver at Gowganda in 1908 directed prospectors to the southern part of the region. The first claims were staked for asbestos on an area of serpentine rock two to three miles north-east of Mount Sinclair. Other early stakings were made on some Keewatin iron formation a mile and a half east of the middle of Mushkasenda lake. The discovery of gold at Porcupine in 1909 started prospecting in the northern part of the region, and resulted in the staking during the following season of quartz veins on the west side of Mushkasenda, and in the vicinity of Kitchimine lake. The report early in the present year of the finding of telluride of silver and gold in a vein at the former place, led to a midwinter rush and much snowshoe staking. In the latter part of the year the chief centre of prospecting was in the townships of McArthur and Bartlett, about twenty miles directly south of Porcupine, where gold occurs in dikes of quartz porphyry. To meet the requirements of the prospectors in the matter of tie lines, the Surveys Branch has, during the past two years, blocked off the whole area into six-mile townships; and as previously mentioned, the Bureau of Mines has endeavored to supply them with maps indicating the geological boundaries. The rush of prospectors to the south and west of Porcupine has extended so far, however, that guide maps of the canoe and portage routes are supplied by two firms of surveyors, and find a ready sale.

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[2] Report of Survey and Exploration of Northern Ontario, 1900, p. 107.

SUMMARY AND CONCLUSIONS.

The area forms a part of the great Archean Shield; and as such is underlain by the very oldest rocks, the surface of which through long exposure to severe denudation has been reduced to a peneplain, leaving only a few resistant knobs at elevations of 100 to 200 feet. This basement consists of the Keewatin series of altered eruptives, a fragmental series composed chiefly of Keewatin materials folded with the Keewatin and generally resting at high angles, a series of acid instrusives comprising granite, porphyry and gneiss, and minor basic dikes which intrude all the other rocks.

In the vicinity and to the south-east of the height of land, these rocks are overlain by areas of Huronian sediments which dip at small angles to the east and south-east. These form ridges with abrupt western faces rising from 300 to 500 feet above the general level which at the divide is about 1,200 feet above sea level. They resemble those of the Cobalt district, and include in ascending order, conglomerate, some 300 feet of greywacke interbanded more or less with layers of slate and quartzite, and an upper layer of conglomerate. The lower third of the greywacke is in large part dark in colour and slaty in character, the upper two-thirds, which generally forms the tops of the hills in the district, is reddish in color and banded with quartzite. Diabase occurs in the Huronian as dikes less than 100 feet in width, but the intrusions are unimportant as compared with those of Cobalt or Gowganda.

The glaciated rock surfaces are covered in great part by a mantle of drift of varying thickness, composed of sand and boulders. Very limited areas of clay occur along the upper part of the Grassy river. The largest of these, comprising several hundred acres, lies about the lakes in the northern part of Hutt township, but through the two townships lying to the south, the narrow flats along the river would no doubt be found productive if the water was lowered a foot or two by a cutting at the rapids in the northern part of Kemp township. The prevalence of a surface covering of drift materials over the district makes it more suited for forest than for agricultural land.

Small quartz veins occur in the Keewatin schists in many parts of the area, and in the vicinity of the granitic intrusions, veins of considerable size have been located. Gold has been found in some of these, and in associated porphyry dikes. Their development has scarcely been sufficient to determine whether the gold is in paying quantities. These rocks are receiving much attention on account of the Porcupine discoveries, and will probably repay careful prospecting. Pyrite is found in considerable quantity in the Keewatin greenstone in the vicinity of Moose lake. The iron formation, so far discovered, can scarcely be considered of economic importance. Serpentine rock containing veinlets of asbestos forms a part of the Keewatin in several parts of the district. The limits of these masses should be carefully determined with a view to finding workable veins of asbestos, or deposits of chrome iron ore which often occur associated with this rock.

GENERAL CHARACTER OF DISTRICT.

Relief.

The general aspect of the Archean peneplain is so well known that its description is unnecessary in this report. The northern portion of the district differs from the southern in not having any flat lying sediments resting upon the planed down surfaces of the Archean folds. It presents a surface of low rocky ridges and isolated hills, strewn with glacial drift. The portion along the north branch of the Grassy river in the townships of Halliday, Hutt and Zavitz is generally without elevations exceeding 100 feet. A resistant knob of Keewatin 150 feet high on the portage from Kitchimine lake north to the West branch of the Night Hawk river overlooks the valley of this stream. The high ground about the township corner west of this ends in a granite hill on the contact one mile north; and lower ground, through which the Redstone river runs in a north-easterly direction, extends for some two miles to the north where the ground again rises in ridges of greenstone and serpentine extending to the vicinity of Clear lake. Along the Redstone river in Zavitz township and between this stream and Mushkasenda lake some greenstone ridges show among others formed of glacial sand, which covers a portion of this part to a depth of one hundred feet. From a Keewatin hill in the south-west corner of Bartlett township, looking across the lake, Sinclair mountain and other ridges about the height of land may be seen at a distance of twenty miles to the south and south-east. Six to ten miles to the north of this hill several of less prominence lie between the two branches of the Mountjoy creek. The granite hill at the five mile post on the Fripp-McArthur townline which is the most noteworthy of these, and Serpentine mountain in the centre of McArthur township overlook this stream and the country as far north as Porcupine.

The relief of the southern part of the district is increased by ridges and hills, which represent erosion fragments of faulted blocks of the Cobalt series of rocks. The most prominent of these ridges have heights ranging from 300 to an extreme of possibly 600 feet above the general level of the country, which is here between 1,100 and 1,200 feet above sea level. Sinclair mountain is typical of these ridges. It presents on its western side a bald face about 300 feet high, with the beds of greywacke and slate dipping about 5 degrees to the east, and on its eastern side a slope corresponding roughly to that of the beds. The southern and highest part of this face, known as Mount Sinclair, which lies two and a half miles west and one mile north of the south-east corner of Montrose, has a height of between 300 feet and 400 feet above the divide, which is here at an elevation of 1,200 feet above the sea. From this point the ridge extends with slightly diminishing height beyond the northern limit of the township. The southern end of a similar ridge of equal height and one quarter of the length, lies nearly three miles in a direction N 20 degrees W. from Mount Sinclair; and that of another of somewhat greater height lies north of this in Hincks township. A minor one of these ridges lies east of Elizabeth lake in the township of Midlothian. These features in the vicinity of the head of Duncan lake have been described by Collins in his report, referred to above as follows:—"The ridge in Doon, as being 400 feet in height with abrupt cliffs on its north-westerly side, and a south-easterly slope corresponding with the dip of the beds; the one in Midlothian, as 350 feet in height; and the one extending south of the townline into Raymond township, as 350 feet in height with steep easterly face." As seen at a distance of one or more miles, the lower

of the two latter blocks would appear to incline to the east, and the higher of the two to be horizontal or slightly inclined to the north. The latter hill is the most prominent feature locally; other conspicuous hills form part of the height of land north-east of Little Hawk lake, and through the next township to the west. Sansawaju, (The square mountain), a round topped hill with square sides resembling Chaminiss in the Larder Lake district, which stands half a mile east of the Grassy river, at $3^1/_4$ miles on the townline of Mond and Kemp would appear to be the highest point in the district, as it is the most prominent land mark.

Between these ridges about the head of Duncan lake, an extensive sand plain reaches northward to the vicinity of Sinclair's line which crosses the Montrose-Bannockburn line at $2^1/_4$ miles. A creek with two branches, one rising in the north-east part of Midlothian and the other in lakes in Montrose township, winds its way through this plain.

Drainage.

The lakes of this district are of two classes, the one filling depressions in the folded surface of the Archean rocks and the other filling pot-holes and other depressions in the accumulations of glacial drift. The former class are irregular in outline, and usually not more than six miles in extent. The latter are regular in outline, small in extent, and either irregularly placed or in distinct chains which often form connecting canoe routes between the different rivers.

The streams of the area represent a transition from the succession of lake rapids characteristic of those of the greater part of the Archean region, to those of a true fluvial character of the Hudson's Bay basin. They have their rise in lakes of the first type, the only exception being the Redstone which has its source in a chain of glacially formed lakes lying between Mushkasenda and Sinclair lakes, but which afterwards enters basins of the first type.

Three streams—the Whitefish, the Night Hawk, and the Redstone—rise within the district and pursue tortuous, but roughly parallel courses northward to discharge into the Frederick House river through Night Hawk lake. The source of the main Whitefish stream is in the lake on the east side of Mount Sinclair, but another branch rises in lakes in Argyle and Bannockburn townships, and connects by a portage route with a stream which flows into the Montreal river a few miles above the Great Northern Bend. The source of the main branch of the Night Hawk is in Austen and Kitchimine lakes on the District line. The two latter rivers form rather difficult canoe routes in the upper portion of each, and the Redstone in its middle portion, on account of the number of small rapids and the amount of fallen timber in the beds of the streams.

The main stream of the Mountjoy river has its source in Mushkasenda lake, the west branch in Bruce and Quartz lakes in Fripp township, and the east branch in Clear lake in McArthur township. The upper portion of the stream is partly basin and rapid, and partly tortuous creek. In its lower part, it flows in a very tortuous course through sand plain to discharge into the Mattagami river at the Landing. Like the Redstone, the upper portion of this stream was not originally navigated by canoes, but this year the fallen timber has been partially cut out of the stream and portages made past the rapids so as to utilize it throughout the whole of its course.

The Grassy river flows in a circuitous manner about the head waters of the Redstone and Mountjoy rivers, being joined during its course by several branches which rise in lakes in the vicinity of the Height of Land. The North branch of the

Grassy river flows from a long narrow marsh in the town-ship of Zavitz, one and a half miles west of Kitchimine lake, which marsh may also be the source of the West branch of the Night Hawk. It takes a winding course to the south for twenty miles through narrow marshy flats and lake-like expansions, in a flat country. This branch may have once been a part of the Frederick House waters which was reversed in its course by accumulations of glacial materials.

About six miles in a direct line from its source, the stream is joined by the Kiahkusagainda branch, which is one of those shallow tortuous creeks containing much fallen timber so characteristic of the Height of Land country. It flows to the northward out of Kiahkusagainda lake to a shallow expansion named on the plan Seven-inch lake, then to the north-west into Moose lake on the District line, making in this part several crossings of Sinclair's line. From this round lake its course is south-west into one nearly square in shape which has been named Wellington lake, and then westward and northward to the forks. The stretches of creek average about two miles each in a direct line, and the lakes about one mile in length. Short portages are used to pass the rapids at the outlets of the three lakes of the basin type. Within a mile of the forks, the combined stream flows that distance to the westward and rather more southward in an expansion known as Canoe-shed lake. A stream which flows from Washagami lake, within the elbow, and empties into a bay on the west side of this lake, is the only important tributary received by the Grassy in the whole of its course from the inside of the bend. From the outlet of this lake which appears on Sinclair's line the river flows for four miles through burnt country with sandy soil and occassional outcrops of greenstone, then for six miles with a width of one to two chains through a marshy flat with protruding knobs of greenstone, to the branch from Little Hawk lake which joins the main stream in Mond township near the middle of the north boundary.

Considered simply as the Little Hawk branch this stream is little over a mile long, draining a lake three miles in length; but about a mile from its mouth it is joined by another stream, which has its source in the large irregularly shaped lake in the southern part of Midlothian. It flows out of a bay of the lake situated three miles north and two east of the south-west corner of the township, the rapids at the outlet being passed by a portage over half a mile long. Dumb-bell lake on the district line two miles north of the corner, and a small lake north of the townline two miles west of the corner, are parts of this stream.

Below this fork the river bends to the westward but presents the same character. A basic eruptive rock outcrops on the north bank two miles down stream. After entering the township of Kemp at a point 65 chains south of the corner, it winds to the south-west through a grassy flat, passing within a mile of Sansawajn mountain which stands just north of the middle of the east boundary of the township. At an old cabin on the west bank a short distance down stream the soil is quite sandy, and conglomerate of the Cobalt series outcrops on the east bank. The river here again turns westward in a lake expansion a mile long, known as Kebskwashi-sing or Grassy lake, which has an extension three miles southward receiving the waters of the lakes to the south of Sinclair lake. For another three miles in a north-west direction the river maintains its marshy character, then the current quickens and half a mile below the first portage is reached. This is one of five chains on the north bank, here about a quarter of a mile south of the middle of the townline.

The river crosses the line within the next half mile and passes through Loonwing lake, one mile in extent in a north-west direction. A narrows connects with Net lake which extends for a mile to the west and from which the river discharges

by a rapid passed by a 26 chain portage on the north bank. The soil about these lakes is composed of glacial drift, well wooded with mixed timber. In less than a mile the river enters the corner of Sinclair lake, and turning sharply to the north around Indian Point which is timbered with Red and White pine of good size, flows out to the north. Rock was seen at the inlet to the lake but was not examined. Parsons calls it a graphitic slate, and mentions outcrops of flat lying slates in the next two miles down stream. These notes and the fact that boulders of conglomerate are strewn on the last portage would indicate that rocks of the Cobalt series occur in this vicinity.

The section of the river between this point and the canoe-route to Mushkasenda lake was not travelled by the writer. From the description given by Parsons and the plans of the Crown Lands Department, it would appear to consist of several narrow lakes, connected by portions of river occupying a fault line in Laurentian gneiss, running 10 degrees west of north. The largest of these lake portions is the one four miles long in Moher township. Kapiskong is the original name applied to this section, and also to the river below.

In the northern part of Beemer township the river leaves this direct line and makes a circuit of two miles to the west, returning again to it in Peter Long's lake which it enters a mile from the south end. A small rapid in this part is passed by a 10 chain portage. The lake comprises a part four miles long, a narrows formed by high ridges of gneiss, and a part one mile long at the outlet. Similar ridges here cause a succession of heavy rapids, with a total fall given as 30 feet, which are passed by a half mile portage along the top of one of these ridges at a height of about 100 feet. One mile of river is followed by rapids and a quarter mile portage, also on the east bank; then half a mile of river is followed by another rapid and a quarter mile portage near the north townline of Musgrove. Granite was noted at these rapids in a cursory examination made when travelling by canoe.

The river flows with a slow current below low banks through Fripp township. Near the fourth mile on the northern boundary two falls and a succession of rapids make a total descent of over 100 feet. These are passed by a half mile portage on the west bank or by a mile portage on the east side.

Below the High Falls the river has eroded its banks to a depth of 80 to 100 feet, and flows over a gravelly bottom with a current so rapid that this portion is rarely used in ascending the river, a portage being made instead from the Mattagami. The ten miles to its junction with this river provide a magnificent canoe ride in descending the river.

Forests.

Except in parts recently burned the district is well forested. Stony areas or those with a soil composed of glacial material containing many boulders, which in this district are the most extensive, produce a mixed growth comprising the various conifers together with birch and poplar. The sand plains are covered chiefly with Jack Pine. Flat areas and the parts along the water courses are wooded chiefly with spruce and cedar.

White and red pine are the most valuable trees, but their distribution is not extensive, and they grow only on the high ground where they are most liable to be destroyed by fire. Some good blocks found on the ridges about Duncan lake have already been partially destroyed. Similar blocks and patches on the high ground in the western part of McArthur township have suffered greatly from the fires

Falls on Wapus River.

Doon ridge from head of Duncan Lake.

View southwest from Mount Sinclair, showing Kiahkusagainda and Druredin Lakes. Collins Mountain on the left.

Mount Sinclair, through Elizabeth Lake.

Lake lying northeast from Mt. Sinclair.

of the last two summers. Scattered trees are to be found among the other timber on most of the higher ground. Jack pine has the wildest distribution of all the trees, growing as it does with the poplar and birch on the high stony ground and with spruce on much of the low ground. Spruce grows everywhere, but is most plentiful along the streams and lakes. Strips of country wooded chiefly with birch and poplar are probably burnt areas of half a century ago. A strip one to two miles wide, west of Mount Sinclair in the townships of Montrose and Hutt, extending as far as the recent brulé along the Grassy river is likely one of these areas.

The largest area of spruce lies along the North branch of the Grassy river. At the boundary of Hutt and Zavitz townships, this area has a width of a mile on either side of the stream. From the top of Mount Sinclair the whole country from Seven-inch lake north-west to the Redstone, as well as that along the Grassy to the south appeared wooded with conifers. As there was no opportunity of examining this part in detail, it is difficult to form an idea of the proportion wooded with Jack pine and that wooded with spruce.

The north-western part of Zavitz township, for a mile east of the Redstone and north to the lakes on the boundary is mainly old brulé and windfall. The central part of the township is wooded with spruce and mixed timber in alternating strips according as the ground is high or low; but for a mile west and north-west of Kitchimine lake in the north-eastern part, the timber has been burned or blown down.

The country about the south end of Mushkasenda lake, for two miles to the east and two to the south, consists of sand plain wooded with Jack pine mostly under a foot in diameter. The canoe-route leading to Sinclair lake was followed to the south through eight or nine lakes and the connecting portages, starting with two small lakes and portages of twenty, ten and five chains. On the shore of the next lake which is irregular in shape and two miles long, the only rock seen outcropping through this glacial sand occurs as a hill of greenstone. About this lake in the southern part of English township, there is a good growth of mixed timber, with some patches of thrifty young red pine. The lakes on the route in Semple township are surrounded by a sand area, timbered chiefly with young birch and poplar.

The part between Peter Long's lake and Mushkasenda was burned in 1898. This burning may have extended through Musgrove into Bartlett and McArthur townships, as brulé of about this age crosses the Musgrove-Bartlett line and extends for about six miles northward along the lakes and creek. The advent of the prospector has greatly extended these burnt areas in the last two years. So fierce have been the fires of this year that in the townships of Deloro and Shaw even the timber in the swamps has been destroyed. It seems unfortunate that such large areas of timber should be burned for lack of that knowledge of woodcraft which has preserved them as forest for so long a time.

A very small proportion of the timber of the district is of mature age. On the eastern slope of the Mount Sinclair ridge, white pine thirty inches in diameter and spruce a century and a half old are quite numerous. In the ravines running down the slope the cedar are also of large size. Many of the pine trees scattered through the other timber on the high ground, and occurring as clumps among it, appear to be remnants of an earlier forest growth, for none of the other trees are over a century old. The scattered nature of the pine, and the fact that in the northern townships where it is most accessible, the best has already been destroyed, greatly reduces its value. On the whole, the areas of spruce must be considered the best resource in timber of the district.

Commercial Possibilities.

Two water powers are being developed to supply power to the mines at Porcupine; one on the Mattagami river at Wawaitan Falls, and the other at the High Falls on the Grassy river. Both of these provide a head of 100 feet, and an ample supply of water for the development of a larger number of horse power than will be required for some years to come. The thirty-foot fall on the Grassy in Musgrove township and Kenogamissee Falls on the Mattagami, thirty miles above Wawaitan Falls, are other available sources of power. The areas of spruce timber suitable for pulpwood along the Grassy river and its tributaries, and in lesser extent along the other rivers of the district, are a source of wealth immediately available with the aid of these water powers.

GENERAL GEOLOGY.

Outline of Geological History.

The examination of the rocks of the area goes to show that they fall into five main divisions, differing widely from one another.

The oldest division, the Keewatin, consists of metamorphosed eruptive rocks, both intrusive and extrusive in origin. They vary in colour from dark green to grey, and range in texture from soft, fissile, chlorite and sericite schists to altered massive diabase and gabbro. Wherever the schistosity is developed, they dip at angles approaching 90 degrees. Joint planes and torsion cracks are also present in the rocks of some localities. Their dark colour is due to their age and altered character, as much as to the basic nature of the rocks. Distinctly acid types of intrusives, such as quartz porphyries, present much the same uniform green colour, except when very fine-grained, when they look not unlike quartzites. Amygdaloids form part of the rocks of this division in certain localities, and ash rocks have been noted by Burwash in the vicinity of the District line in the southern part of the region. These represent ancient lava flows and deposits of volcanic ejectamenta. Areas of serpentine rocks of considerable extent have been formed from eruptive rocks of the extreme basic type. Iron formation in limited quantity is the only material of sedimentary origin; this may be the result of chemical precipitation. The attitude of the schists indicates that the present surface of the Keewatin is one formed by the planing down, by long-continued erosion and denudation, of an intensely folded region.

The second division comprises a series of fragmental rocks, consisting of conglomerate, greywackes, and a few quartzites, and composed chiefly of worn down Keewatin materials. The conglomerates are sometimes rusty from the presence of included pebbles of cherty iron formation. The largest area of these sediments occurs about Kiahkusagainda lake, on the southwest side of Mount Sinclair. Many observations of the attitude of these beds showed that they dip at high angles, usually between 60 and 70 deg., to the north-east or east-northeast. The strike of the Keewatin schists in the same locality is north-east; so that the present attitude of these beds is, at high angles, nearly transverse to the folds of the Keewatin. They are distinguished from the Keewatin by their fragmental character, which is best seen on weathered surfaces.

Similar rocks in the Cobalt district, which have received considerable attention from Dr. W. G. Miller, have been called by him the Temiskaming series.[1] This name will be adopted in this report. If the term Huronian—so widely used for the pre-Cambrain sediments—were applied to them, they would be classed among the lowest of these rocks.

Considered from an economic point of view, they act as a part of the Keewatin, both at Cobalt and at Porcupine. Structurally, they differ from the Keewatin in not having been subjected to so intense folding.

The third division consists of granites and allied crystalline rocks of considerable variety in composition and structure. They are intrusive into the Keewatin, the immediate vicinity of the contact being characterized by hornblende schists streaked with acidic bands, and the Keewatin to a considerable distance being cut by dikes of porphyry and felsite. Granites do not show at the surface in the region

[1] *Eng. and Min. Journal*, Sept. 30, 1911.

about the Height of Land where the Temiskaming is best developed, nor were they seen cutting any of the isolated patches of this series in the northern part of the district; but the general absence of material of this nature in the fragmental rocks of the Temiskaming point to a later age for the eruptives. In one locality, at the west end of Kiahkusagainda lake, granite pebbles were seen in conglomerate of the Temiskaming series; so that some of these intrusions may have preceded the laying down of the Temiskaming sediments.

The fourth series consists of conglomerates and greywackes similar to those of the Cobalt district. They are distinguished from those of the Temiskaming series by the abundance of granitic material in their composition, by their unaltered character, and by their nearly horizontal attitude. The dip of the beds is generally from 5 to 10 deg. to the east or southeast. Locally, there are exceptions to this; along lines of faulting and in the vicinity of basic intrusions the dip is increased to 20 deg. or even more, and some parts have been altered and hardened. The greywackes vary greatly in composition, and range from impure quartzites at the one extreme to slates at the other.

The youngest rocks of the district are represented by basic dikes, usually less than 100 feet in width. These are not always of typical diabase, but are sometimes quite coarsely crystalline in structure and contain a considerable proportion of red felspar. Only in the Montreal River basin are these intrusives of greater extent, and here they resemble in character the diabase of the Cobalt and Gowganda silver regions. Where, as in the greater part of the district, the Cobalt series is absent, the age of these eruptives is uncertain and can be judged only by their comparative freshness.

Long periods of erosion have preceded the deposition of the sedimentary series and equally long periods have followed since the formation of the later of the two series. The areas of Upper Huronian must be considered as remnants of a much more extensive covering of these sediments. The rock surface over the greater part of the area is covered with an irregular mantle of glacial sand and gravel, and the products of weathering of the present surface.

Table of Formations.

The rocks of the district are all pre-Cambrian in age, and may be classified in descending order as follows:

Basic Intrusives.

Diabase and gabbro dikes cutting all the other rocks.

Cobalt Series (Upper Huronian).

Conglomerate, and greywackes ranging almost from slates to impure quartzites, generally dipping at low angles.

Acid Intrusives.

Granites, syenites and porphyries: all older than the Cobalt series and most of them younger than the Temiskaming series.

Temiskaming Series (Lower Huronian).

Conglomerate, greywacke and quartzite composed chiefly of Keewatin materials, and generally dipping at high angles.

Keewatin Series.

Metamorphosed eruptive rocks, comprising greenstones, quartz-porphyries, amygdaloids and their schistose derivatives, together with iron formation.

Keewatin.

Rocks of Keewatin age occupy the greater part of the rock surface in the district, and would be practically continuous, except for the intrusions of granite, if the Huronian remaining near the Height of Land were eroded. As it is, they cover nearly all of the northern part of the area, and some smaller areas isolated by the overlying sediments.

These rocks present considerable variety in different localities. In general, the areas lying east of Sinclair mountain are characterized by a nearly even development of altered quartz porphyries and greenstones, together with serpentine rocks; the part about the District line by amygdaloids and grey sericitic schists, similar to those of the Pearl Lake area at Porcupine; and the western part, particularly in the vicinity of Mushkasenda lake, by altered diabase and gabbro, together with green schists.

A small area of Keewatin, near the middle of the portage south of Mount Sinclair, contains crystals of tourmaline—still fairly perfect—in a greyish-green ground mass, and appears to be a much altered granite or quartz porphyry.

In the Keewatin area lying west of Dunedin lake, two greenstone hills stand out prominently on the south side of the east and west portion of this body of water. On the shore opposite the schisto-sity is well marked in a N. 80 deg. E. direction. The shores of the arm extending north-west of the outlet are formed partly of serpentine rock, in which torsion cracks are developed. At the outlet of the Half-mile lake, immediately north-west, an exceptionally heavy weathered grey schist occurs; and at the opposite end of this lake, talc schist strikes E.-N.-E. and dips 70 deg. to the north. Quartz porphyry on the 10-chain portage between the last two lakes has the same strike and a dip of 85 deg. north.

To the north of Kiahkusagainda lake the schistosity in the Keewatin more nearly approaches a north and south direction. At 3 M. 51 chains on the townline, grey sericite schist on edge has a strike N. 35 deg. to 40 deg. E., close to the contact with greywacke-conglomerate of the Temiskaming series. Twenty chains north of a point ten chains east of this the schistosity is north and south along a ridge of amygdaloidal basalt. In the area between this and the District line grey schist on edge outcrops at intervals, with a strike to the north or north-northeast. Considerable of the cleavability of these schists is due to the development of micaceous minerals during their alteration.

Greenstones outcrop at intervals along the creek flowing out of Moose lake. These are amygdaloidal on the east side of Wellington lake. About one-third of the way down this stream to its junction with the Grassy dolomitic rock occurs, and just below a small lake expansion in the stream banding in a north and south direction was noticed in the schist. About one-third of the way or one mile from the mouth it flows over rock, which appeared to be a quartz porphyry much jointed and broken. Dolomitic rock again outcrops on the Grassy midway between the creek and the lake expansion at the townline of Zavitz and Hutt. At the west end of the portage out of this lake, on the route to Austen and Kitchimine lakes, the rock is quite silicious.

Amygdaloid, containing calcite in the cavities and with a schistosity developed north and south, occurs on the south side of the first lake on the route. Half a mile south of the second portage, and near the townline, assessment work for some mining claims has been performed on some small quartz leads and showings of pyrite in an altered silicious rock. The rocks north-west from these lakes to the Redstone river consist of greenstone, and fine-grained silicious rocks, probably

altered quartz porphyries. Small patches of breccia occur east of the bend of the Redstone, in the north-western part of Zavitz township.

Some of the greenstone on the north-west side of Mushkasenda lake is much fresher than the rest, and resembles a much weathered gabbro rather than the typical Keewatin. Its extent and altered character, with schistosity developed in an E.-N.-E. direction, lead to its inclusion in the Keewatin. Somewhat similar masses of limited extent along the creek to the north cannot be classified with assurance without a microscopic examination in thin section. Considerable masses of serpentine occur in association with the greenstone at various places in this part of the area, as, on the east shore of Marceau lake, in the north-east of Bartlett township, and forming the large hill in the centre of McArthur township. Iron formation occurs in English township, extending half a mile south from the middle of the third mile on the north boundary.

Temiskaming Series.

Relatively, the rocks of this series form a very small portion of the present surface. In addition to the principal area in Midlothian township, there are isolated remnants or islands in the north-eastern part of Bartlett and in McArthur township. Other small areas probably occur, but are apt to escape notice, and are not easy to distinguish from brecciated members of the Keewatin.

The conglomerates of the series are readily distinguished in the field, as weathering develops differences of colour between the different pebbles even where no inequality of surface may be present. The greywackes, composed of fragments of a variety of silicates, usually small in size and ranging down to the finest products of weathering, are often hard to distinguish from fine-grained eruptive rocks. The presence of small fragments of quartz always dark in colour is often a distinguishing characteristic of the finer-grained greywackes. Differences in attitude and the absence of reddish felspars readily separate them from the greywackes formed after the intrusion of the granite. Slaty members of the series are distinguished only by their attitude or by their association with other beds.

A rock on the south shore of Mitre lake, which is banded like a fine-grained gneiss and dips 50 deg. to the northeast, contains an abundance of rhombic prisms of arsenopyrite.

Sedimentary beds of this series, dipping at angles of from 55 deg. to 85 deg., outcrop in the vicinity of Kiahkusagainda lake for a width of over two miles. This would indicate a thickness of at least 7,000 feet. It is quite possible that this thickness should be formed along the shores of a Keewatin continent, from the products of disintegration of the rocks of that period.

Acid Intrusives.

In the Montreal River basin Mr. McPherson mentions a fairly coarse hornblende granite of reddish colour as occurring along the trial line, between the foot of Obushkong lake and the West branch of the Montreal river. This rock, which merges towards syenite, is described by Collins in his report as follows: "The hornblende granite is a medium-grained, fresh-looking rock of speckled appearance, owing to the black hornblende crystals which lie scattered through the main mass of light grey feldspar and quartz. It is of uniform colour, local variations of colour and texture being insignificant."

A dike of grey granite porphyry, 15 feet in width, with which galena is associated, cuts the Keewatin in a direction 10 degrees east of north on the West branch of the Whitefish river, at the eastern corner of Hincks and Montrose townships.

The granite area which crosses the District line in Geikie township was examined at its contact with the Keewatin, on the portage north from Kitchimine lake. Eight chains over the crest of the greenstone hill on this portage, the rock is streaked with granitic material, and lower down on the northern slope granite intrudes the greenstone. To the north of a small swamp at the foot of the declivity the granite becomes continuous. This rock, as outcropping at intervals for five miles along the District line, is described by Burwash, as a coarse-grained, reddish, hornblende granite. On the west side of the stream, here 12 feet wide and probably the West branch of the Night Hawk river, at one mile and three-quarters on the townline, the greenstone has the appearance of being near the contact. Granite outcrops in Zavitz south of the westerly of the two lakes on the townline, but whether this is an isolated outcrop or a part of the surface of the same granite mass could not be determined, on account of the heavy covering of glacial drift. On the west townline of Geikie, the southern boundary of this granite intrusion forms the top of a hill at the end of the first mile. The greenstone near the contact is altered to a hornblende schist, containing narrow bands of granitic material. The granite has narrowed here to one and a half miles or less, the north boundary being at the Redstone river. What is thought to be the point of this tongue was seen two miles west in Bartlett township, at the narrows between the first two of a chain of lakes. It consists of a centre of granite with a southern margin of brick-red porphyry cutting Keewatin rocks of variable character, in which are dikes of reddish felsite. The intrusion is here a quarter of a mile wide, and does not appear on the west side of these lakes. A dike of later diabase either intrudes the porphyry or has it for its northern wall. The schistosity is developed in the Keewatin in a north-easterly direction, and in places nearly easterly. The felsite dikes cut across to north-north-east.

A dike of coarsely granular rock composed chiefly of felspar and containing pyrite, cuts across the English-Zavitz townline in the third quarter of the first mile. At 15 chains from its south boundary it is fine-grained, dark in colour, and contains red felspar.

Another area of acid intrusion occupies portions of the townships of Bartlett, Mu[illegible]ve, Fripp and McArthur. It lies about one mile west of the Mountjoy creek, and in all probability is continuous with the granite area along the Grassy and Mattagami rivers. Its eastern boundary is characterized by differences due to basic segregation in the magma itself, rather than by any development of gneissic structure. Some portions of the intrusive are so basic as to resemble a gabbro, and to be distinguished with difficulty from later diabases on the one side, and from contact phases of the Keewatin greenstone on the other. Without a microscopic examination of thin sections of these rocks, the geological boundaries must here be considered as only approximate. The edge of the granite was located east of the lake in the north-west corner of Bartlett, as between Keewatin schist half a mile from the inlet and a granite outcrop ten chains nearer the lake, and also in the last ten chains of the first mile on the line between McArthur and Fripp, between an outcrop of syenite at 70 chains and one of hornblende rock at the mile post. The last 44 chains of the sixth mile on the north townline of Bartlett, are undoubtedly occupied by granite. The outcrops in the last 12 chains of the fifth mile were classed as gabbro in traversing the line, and whether they are of later age or simply basic phases of the same intrusion was not determined.

The hill 80 to 100 feet high in the middle of the fifth mile was described as of fine-grained diabase, greenish in colour, and is probably a basic intrusion of later age than the granite. The lake basins in the south-east part of Fripp are occupied by Keewatin greenstone, some of which near the edge of the granite resembles a hornblende gneiss or schist and is very much jointed. North from the lake lying one and a quarter miles west of the township corner, the granite outcrops on both sides of the creek; and a hill of hornblende schist or basic gneiss situated 24 chains west of the McArthur-Fripp line in the last quarter of the fourth mile, is likely close to the contact.

The most typical portions of this intrusion consist of grey hornblende granite. Plagioclase felspar, somewhat waxy in appearance, and dark green hornblende form the chief constituents in the syenite phase of the eruptive, and these together with bluish coloured quartz in the granite. This blue colour in the quartz is very distinct in fresh fractures and forms a means of identifying the more basic phases as parts of the same magma. Biotite occurs in minor quantity in some of the samples. For three miles south of the township corner the granite keeps the same general character; but in the second mile west, it presents considerable variety. Muscovite gneiss forms the west shore of the lake, and both grey and red granite occur at 70 chains in this mile. The 100-foot hill in the fifth mile on the McArthur-Fripp townline is composed of porphyritic red granite with scattered crystals of orthoclase an inch across, and smaller crystals of quartz in greater numbers. At the beginning of the sixth mile this contains a dike of more basic granite, containing the blue quartz typical of the granite further south.

Cobalt Series.

The distribution of these rocks has already been sufficiently discussed. The basal member of the series is a conglomerate not readily seen in the region covered in this report. It shows at the base of the ridge on the east side of the creek flowing out of Elizabeth lake, where it contains coarse pebbles of granite, together with others of basic rocks cemented by greywacke, which here forms the overlying strata. The ridges in the vicinity of Rankin and Duncan lakes are described by McPherson as being of Huronian rocks varying from slate upwards into hard, reddish arkose and quartzite, medium in grain and with little evidence of stratification. The strike is mentioned as being variable, but usually 15 degrees to 20 degrees west of north. This is the succession of strata already mentioned as forming Sinclair mountain. The reddish strata mentioned is more properly described as greywacke with some layers of quartzite. No arkose was seen except on the large island near the middle of Duncan lake. What is mentioned by Parsons as a crushed granite forming a high rocky bluff on the east shore of Little Hawk lake, is probably an arkose. The upper member of the series is a conglomerate which forms an inconsiderable portion of the surface as compared with the greywacke member. It is found on the slopes of the ridges and rarely on hills. The quartzitic portion of the greywacke being the more resistant usually forms the crest of the ridges. For a fuller description of this series reference is made to the reports on the Gowganda district previously mentioned.

Basic Intrusives.

For a discussion of the quartz diabase of the Montreal [illegible] er basin, reference is made to the reports of Collins and of Burrows. Basic [illegible] cutting the rocks of the Cobalt series in the vicinity of the Height of Lan[illegible] rare, while ei[illegible]

under 100 feet wide and fresh looking, were found cutting the Temi-kaming and Keewatin rocks about Kiahkusagainda lake. From this it would appear that small dikes do not readily penetrate the Cobalt series of sediments. In the territory between this and the Mountjoy creek only a half dozen dikes were seen, though it is many times the other area. The difference may be in part due to the greater extent of drift covering.

More extensive outcrops of diabase occur in two localities along the Mountjoy river in Bartlett township. The first of these lies midway between the outlet of Mushkasenda lake and the portage to the Bartlett lakes. Within half a mile of the portage, coarse gabbro cutting through quartzitic Keewatin rocks forms a hill 100 feet high on the east bank of the stream. A quarter mile south where the river makes a sharp bend to the west, similar rock forms the point on that bank, and at a distance of half a mile an outcrop occurs on the east shore of an expansion of the river. The first two outcrops are evidently connected, but the country is too flat to see the relation of the third to the others. The other locality is near the north boundary where a diabase hill forms the west bank of the river 16 to 20 chains south of the fourth mile post, and another outcrops through the sand a quarter of a mile east. An outcrop at the creek ten chains west of the post is a part of the first ridge, and the rock forming the hill at 36 chains was classed with this in the field.

Pleistocene.

The rock surface over much the greater part of the area is covered with glacial sand and gravel, in which no arrangement was seen. This material often forms plains such as the one extending for eight or nine miles north from the head of Duncan lake. Another area, very flat in character, forms the upper part of the Grassy River basin. Sand ridges surrounding lakes and ponds of the pot-hole type separate this valley from that of the Redstone. In the central part of Bartlett some of the ridges are probably eskers, and the lakes here mostly form a chain extending north-north-west. The sand plain in the southern part of the township, which crosses the boundary in the second mile, is probably continuous with the much larger one lying south of Mushkasenda lake. In general, there is a parallel arrangement, approximately north and south, in these deposits which conforms with the direction of motion of the ice as shown by glacial striae.

Glacial boulders are scattered over the surface almost everywhere. They are usually of rock which has been carried a comparatively short distance. The nearness of a granite area, such as that in Geikie township, is readily told when approaching it from the south by the number of granite boulders in the drift. Some of the boulders in the west part of McArthur township are of immense size; among these are huge masses of the peculiar dike rock in the granite ridge near the fifth mile post on the west boundary, which have been carried a distance of one to two miles.

Structural Features.

The arrangement of the Huronian in nearly parallel ridges with steep western faces and gradual eastern slopes, suggests faulting along north and south lines, and sinking of the eastern side of the blocks. Lines of faulting are determined with difficulty in the Archean; but the parallel courses of the streams, particularly of Mushkasenda lake and creek, the Kapiskong section of the Grassy, and Kenogamissee lake is evidence of similar faults in the older complex. It is interesting

to note that diabase outcrops along the former of these three, in much the same way as it does along Duncan lake in the Montreal river basin. Collins suggests a large anticlinal structure, whose arch lie a little west of Duncan lake, broken by lateral or vertical displacement as an exp nation of the position of the Huronian strata. Their nearly horizontal position in the central part of Raymond township may be suggestive of the crest of an anticline, but it is difficult to see why the beds on the western limb should be entirely removed. Nothing remains to suggest a succession of blocks whose western side is let down, unless the preservation of a small area of Huronian on the eastern side of the Kapiskong fault, to the north of Sinclair lake be so considered. The absence of Huronian sediments in most of the Mattagami basin, coupled with their attitude on the other side of the Height of Land, would seem to point to this having been the margin of the sea or of a large glacial lake in which they were laid down.

Minor east and west faults are suggested by the east and west portions of the Montreal river and other streams. One of these faults forms the peculiar turn in Dunedin lake in the centre of Midlothian, and is continued to the east across the line of Elizabeth lake, where it is bordered on the south by a greywacke hill with the strata dipping slightly to the south As along other fault lines in this district, the part between the lakes is largely occupied by swamp. The direction corresponds with the strike,—which is 10 degrees north of east,—of the Keewatin schist on the north side of this portion of Dunedin lake, and that of the Huronian beds at the east end of this portion, which have the exceptionally high dip of 50 degrees to the north.

ECONOMIC GEOLOGY.

Precious Metals.

The deposits of native silver in veins in the diabase of the Gowganda district have been the subject of several reports of a geological or economic character, and so, will simply be mentioned here.

Mention has been made in this report of small quartz veins occuring in the Keewatin. Considerable prospecting has been done on such veins in grey sericite schist in the vicinity of the District line, a few miles south of Moose lake. In the small part of the area examined, no large bodies of quartz were seen. Similar veins varying in width up to two feet have been located in rock of a less schistose nature, between the portage route and the south line of Zavitz in the third mile, and prospected by stripping and the sinking of test pits. Mining claims were staked at an early date in the vicinity of Kitchimine lake, but these were not visited and interest in them seems to have subsided.

The Nelson claim at Telluride lake was staked on quartz veins, aggregating 16 to 20 feet in width, banded with schist. The finding of telluride of silver and gold in this lead precipitated a rush in the middle of last winter, which could only result in the staking of much barren rock and sand plain. The necessary assessment work has been performed on many of these claims, but with what result is not known. A ten-foot vein of quartz was located on the west side of Mushkasenda lake, but it does not appear to be mineralized. Quite recently, considerable development work has been done on the Nelson discovery, but the writer can only speak if its condition several months past.

The prospecting of the past season in the townships of McArthur and Bartlett has resulted in several discoveries of gold. The most promising are those of Chouinard and Irwin at Clear lake, in the south-east corner of McArthur township. The gold is associated with dikes of coarse quartz porphyry,— which are likely offshoots from a granite mass,—in the Keewatin country rock. What is called locally a dome of quartz has been exposed on Chouinard's claim; as seen after a deep fall of snow this appeared to have a maximum width of about 60 feet, and to be 150 or more feet in length. But whether these dimensions represent fairly the size of the body, or the surface of a flat mass of quartz could not be determined. Gold could be seen in stringers of quartz cutting across the porphyry dikes, but nothing is known of the value of the large mass of quartz. If this carries payable values the property should compare favorably with those of Porcupine. It was understood to be under option of purchase to responsible parties, and will, no doubt, be tested as to values. Other discoveries have been made two miles west of these in Bartlett township.

Iron Ore.

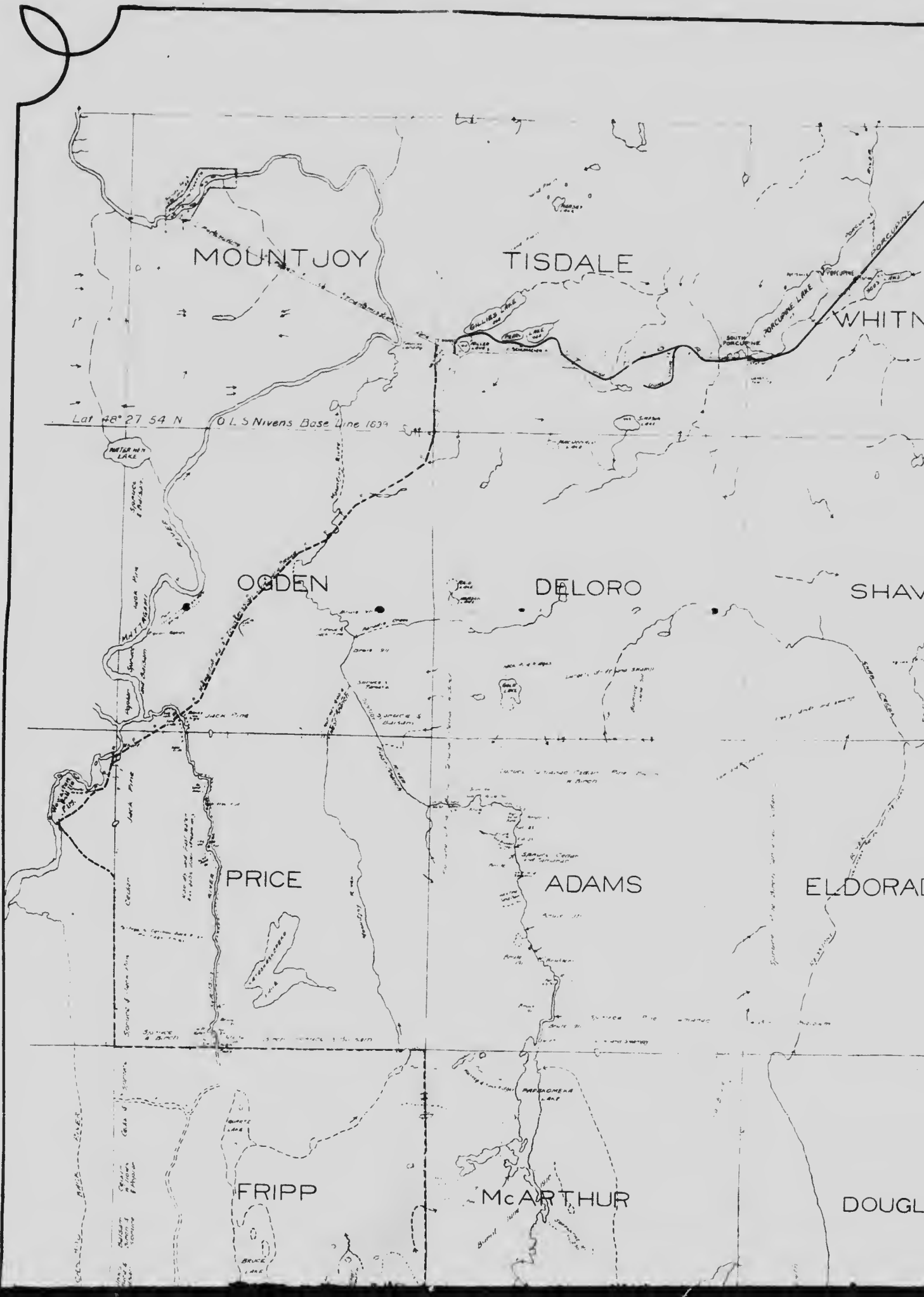
The Cropsey claims have been located on iron formation in the township of English. These are situated on the north boundary in the middle of the third mile, and the showings extend for half a mile south in the township. The formation consists of banded silica together with a little jasper, and iron ore occuring both as magnetite and as hematite, in bands mostly a fraction of an inch in width. Green rock material with a spotted appearance on a weathered surface forms a considerable part of the formation, which has here a width of 50 feet. Consider-

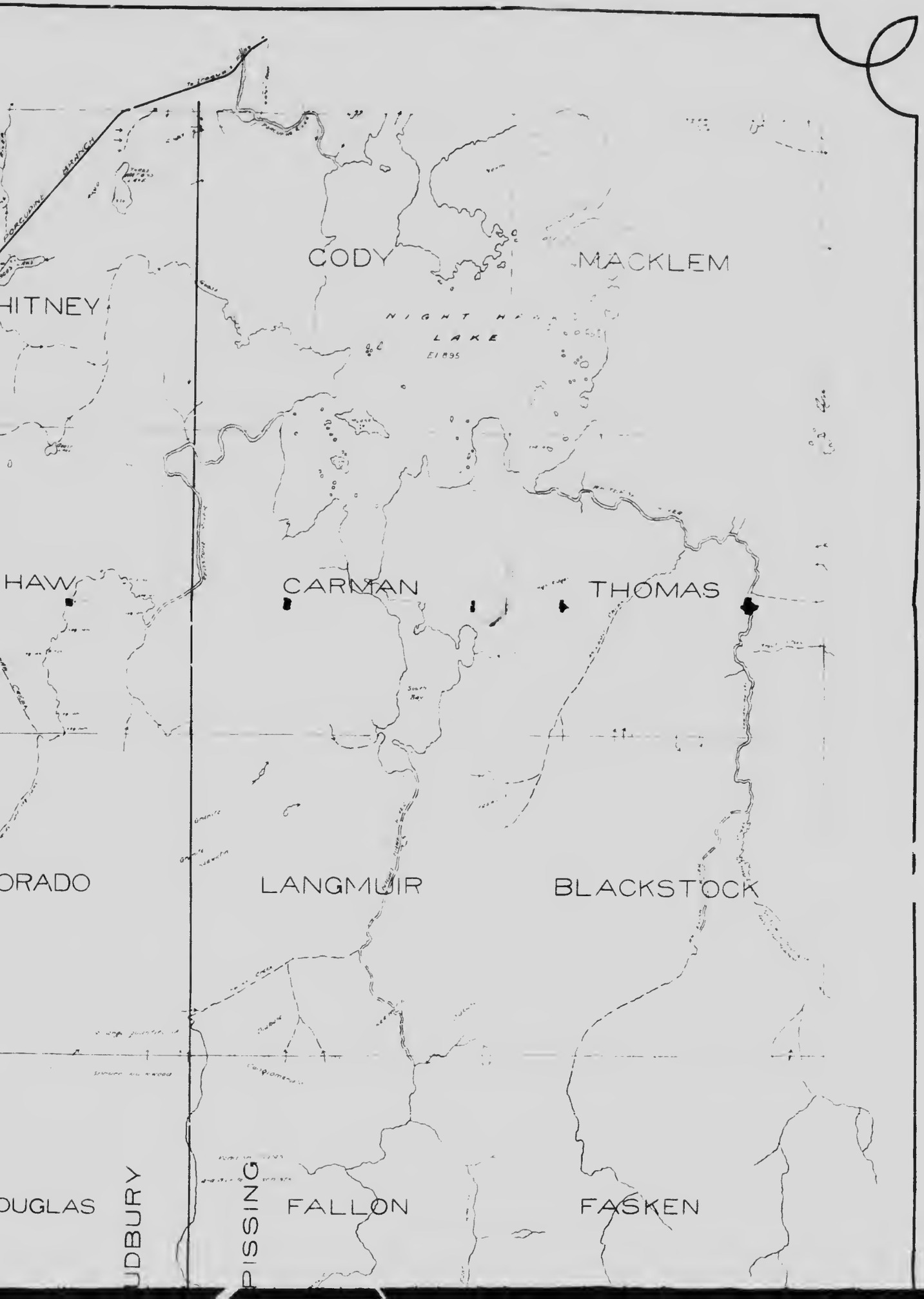
able pyrite occurs banded with silica on the east side, and as large cubes scattered through the rock. In an outcrop 16 chains south of the other, the strike has altered from the general north and south direction and is nearly north-east. At this point the iron ore and green rock material both occur as pockets in much contorted banded silica, the width being about the same. At a point 12 chains north of the first outcrop the iron ore occurs as a cement, binding brecciated portions of the banded silica, and at 16 chains north there is 100 feet in width of this breccia, composed of iron formation. Similar breccia outcrops 4 chains north of this point and 12 chains from the line where the iron formation is lost in a spruce flat.

Pieces of iron ore of good quality were found by some members of the party in the eastern part of the district, but nothing is known of their source.

Asbestos.

Serpentine formed by the alteration of very basic igneous rocks has been mentioned in several localities in the Keewatin. In some of these places as on the east shore of Marcean lake in Bartlett, and on the east boundary of the same township, the product is a green serpentine rock so soft that it may be written upon. The large hill in the centre of McArthur township is formed of this rock with the serpentine coarsely fibrous. North-east of Mount Sinclair several claims have been staked for asbestos. At four and a quarter miles on the east townline of Montrose, a black, altered, igneous rock occurs at the edge of the greywacke. This rock, which is composed entirely of ferro-magnesian silicates and coal-black in colour, is largely altered to serpentine a few chains west of the line where a pit has been sunk in prospecting. Differentiations of this rock occupy the rest of this mile, and are altered in part to serpentine in which veinlets of asbestos occur. The time available for examination was very short, and none of the other boundaries were determined. Collins mentions in his report that Mr. George Rahn had found asbestos of very good quality in this locality. These areas of serpentine have received little attention from prospectors, and from the nature of the economic products likely to be found in them require the most careful examination.


MOUNTJOY
TISDALE
WHITN
Lat 48° 27 54 N O L S Nivens Base Line 1639
OGDEN
DELORO
SHAV
PRICE
ADAMS
ELDORAD
FRIPP
McARTHUR
DOUGL


CODY
MACKLEM
HITNEY
NIGHT HAWK LAKE
El 835
HAW
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THOMAS
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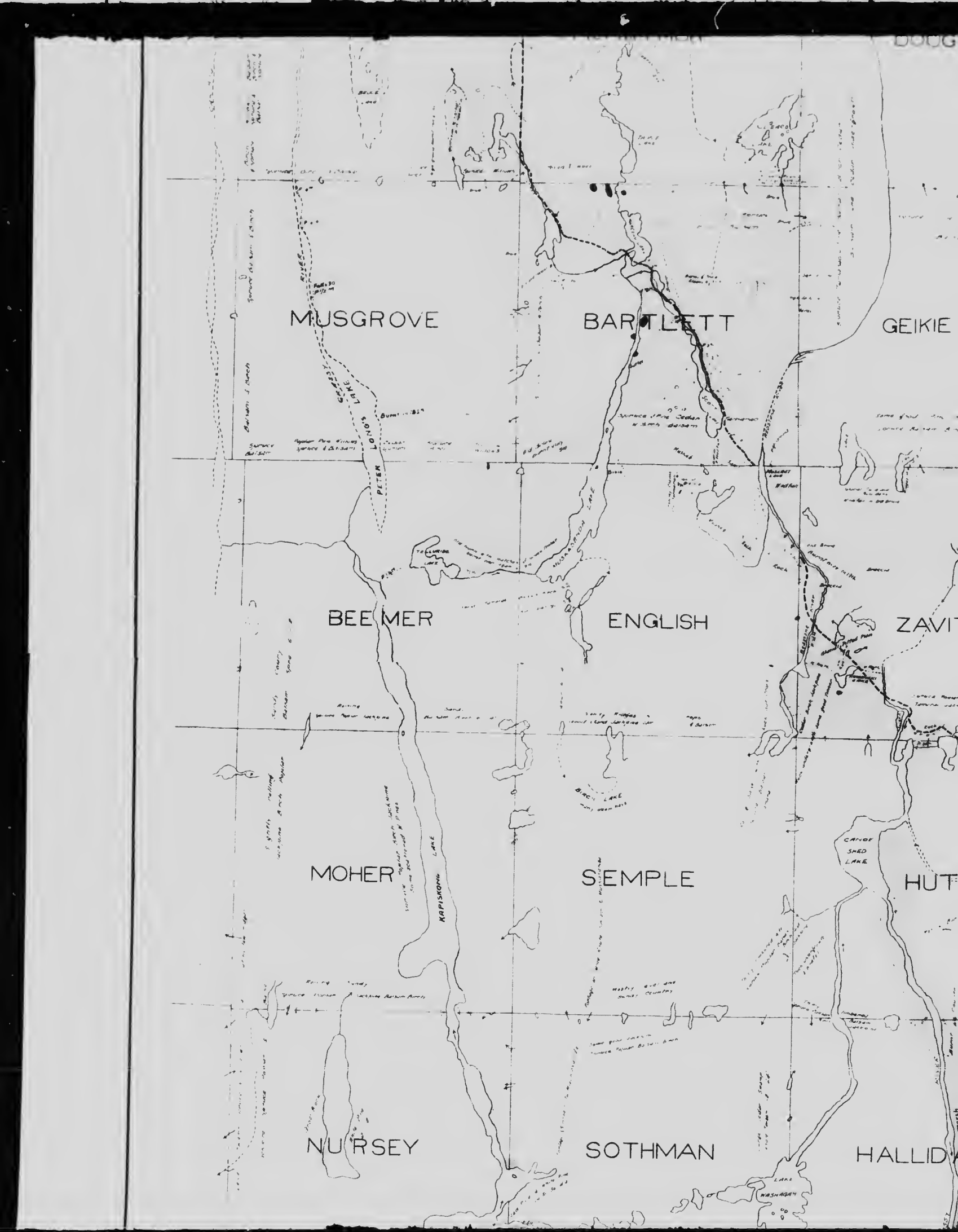
LANGMUIR
BLACKSTOCK
DUGLAS
UDBURY
PISSING
FALLON
FASKEN


MUSGROVE
BARTLETT
GEIKIE
BEEMER
ENGLISH
ZAVI
MOHER
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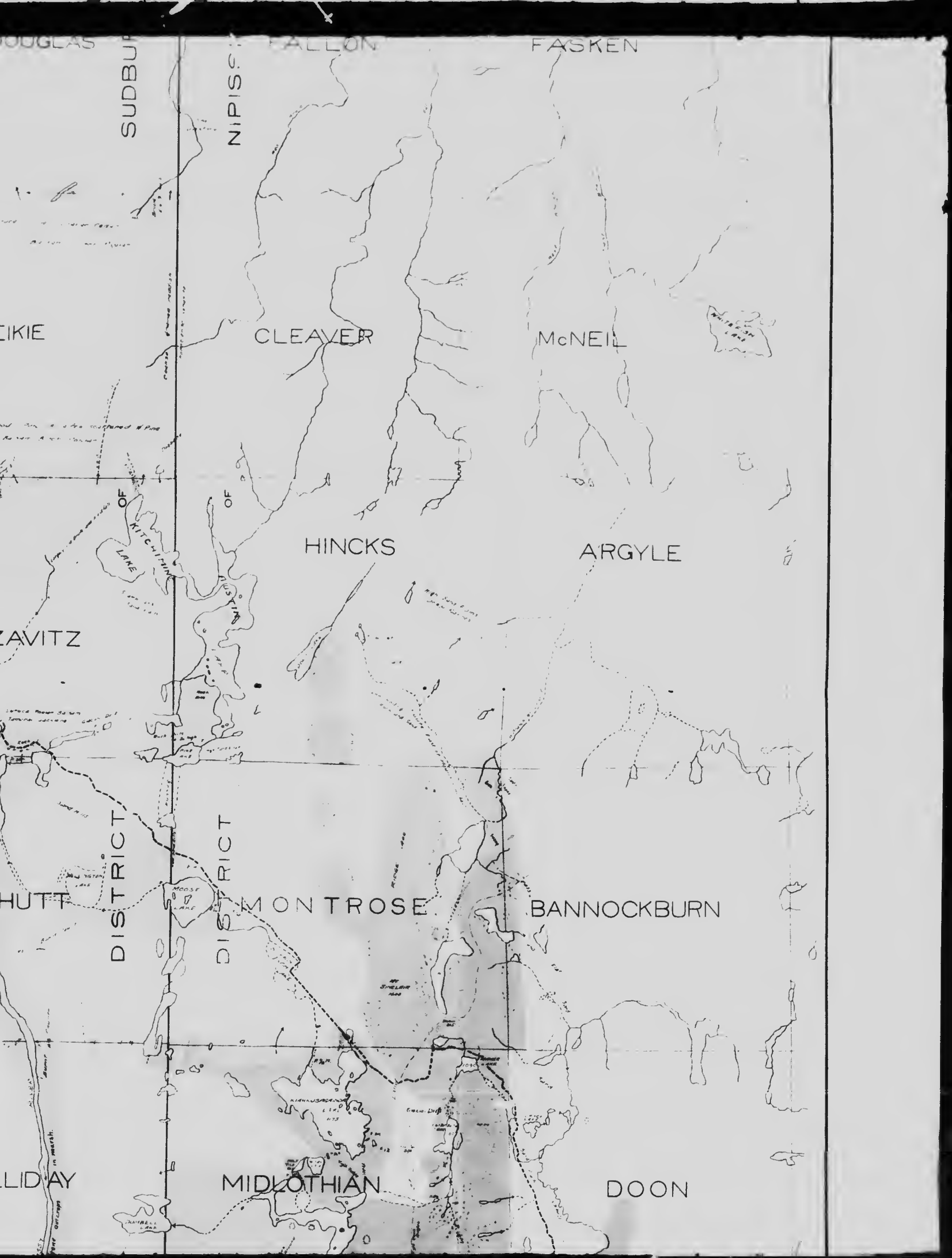
NURSEY
SOTHMAN
HALLID
PETER LONG LAKE
KAPISKONG LAKE
CANOE SHED LAKE
WASHAGAMI LAKE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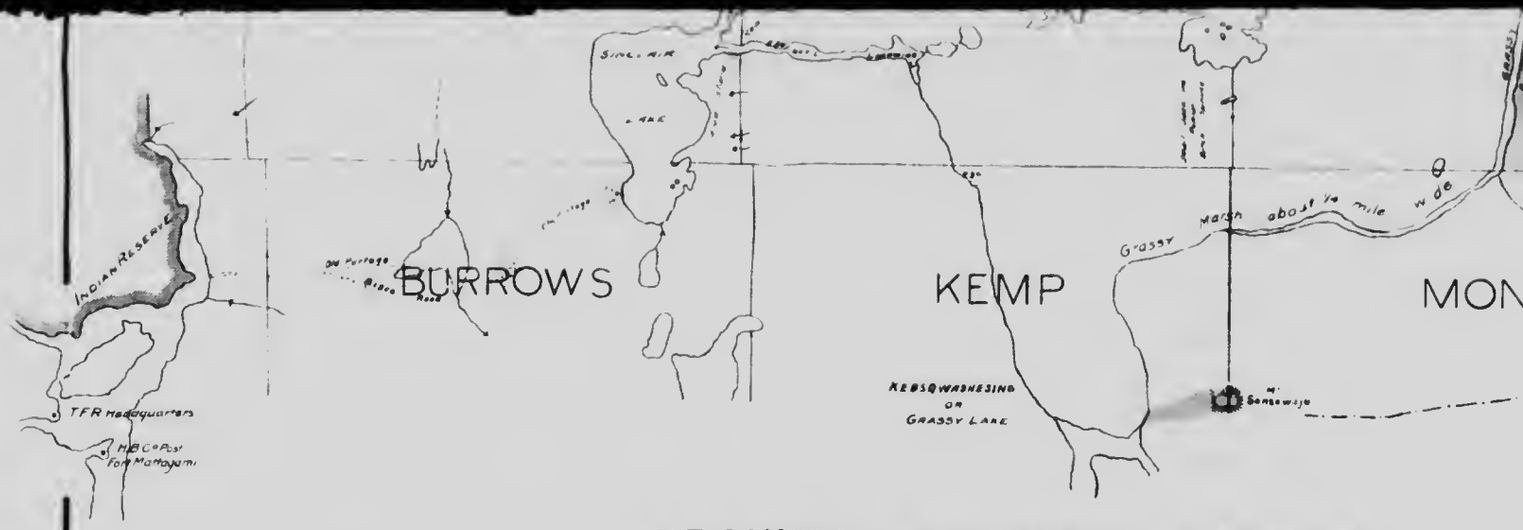
FASKEN
SUDBURY
NIPISSING
CLEAVER
McNEIL
HINCKS
ARGYLE
OF
OF
DISTRICT
DISTRICT
MONTROSE
BANNOCKBURN
MIDLOTHIAN
DOON



PROVINCE ONTARIO, CANADA

Sir JAMES PLINY WHITNEY, Premier.

T. & N. O. Ry.

MAP

of part of the area between

GOWGANDA AND PORCUPINE

showing

ENGINEER W.R. MAHER'S

TRIAL LINE

with **GEOLOGY** by

J. G. McMILLAN

Scale - 2 miles to an inch

To accompany Annual Report of Chief Engineer for the year 1910-1911

LEGEND

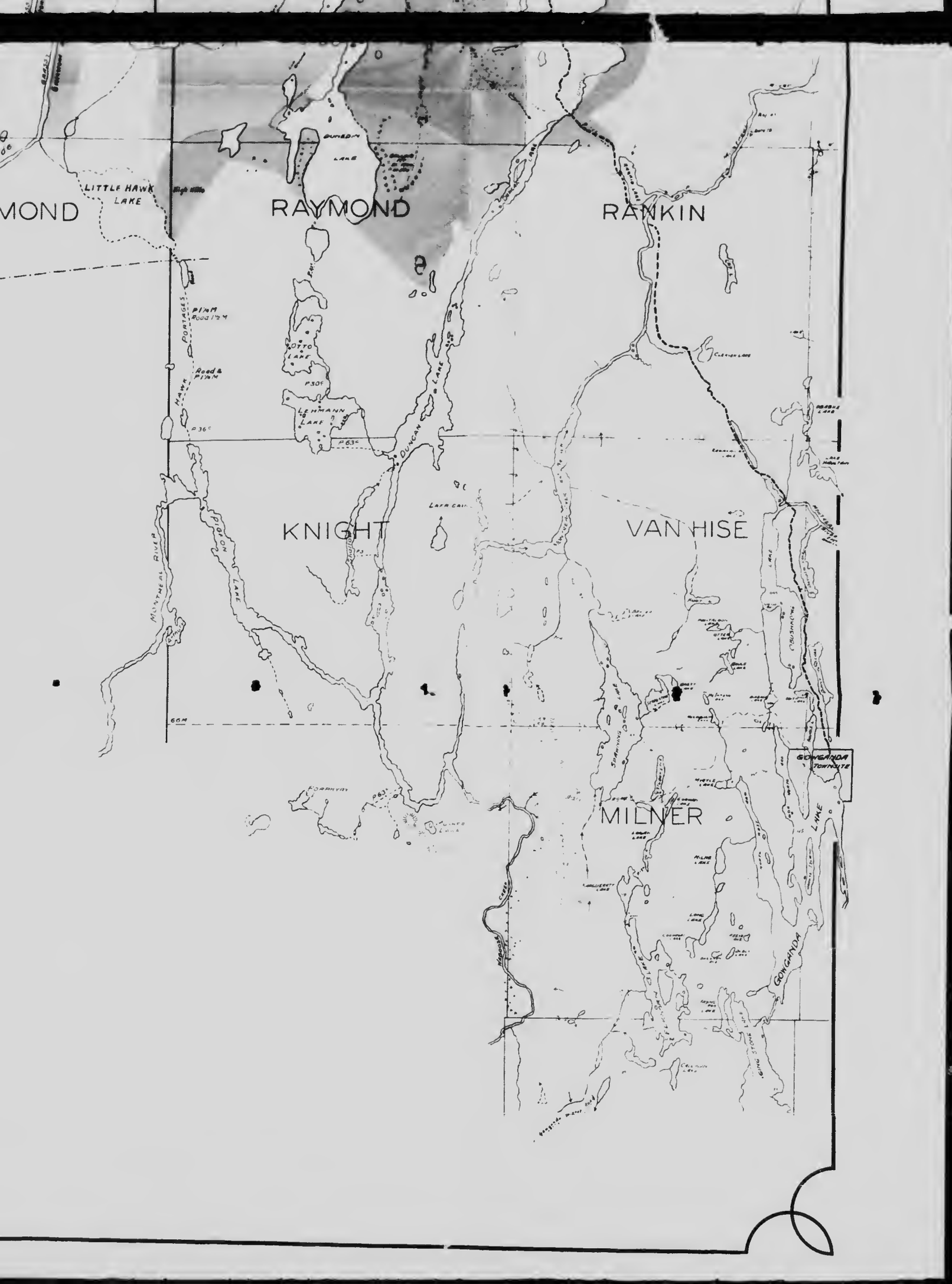
PRE - CAMBRIAN

- Basic Intrusives Diabase and Gabbro — Dikes cutting all the other series
- Cobalt Series (Upper Huronian) — Conglomerate and greywackes ranging from slates to impure quartzites, generally dipping at low angles
- Acid Intrusives Granites, Syenites, and Porphyries — All older than the Cobalt series and most of them younger than the Temiskaming series
- Temiskaming Series (Lower Huronian) — Conglomerate, greywackes, and quartzite, composed chiefly of Keewatin materials and generally dipping at high angles
- Keewatin — A series of metamorphosed eruptive rocks, comprising greenstones, quartz-porphyries amygdaloids, and their schistose derivatives, together with iron formation

SOURCES OF INFORMATION

Surveys by W. R. Maher and J. G. McMillan, 1911.
Topography of Adams and McArthur Townships by W. R. Rogers.
Gowganda and Porcupine maps of the Bureau of Mines.
Gowganda map of the Geological Survey.
Plans of the Department of Lands Forests and Mines.
Assistant on Surveys, W. B. McPherson.

L. H. HARCOURT CO. LTD. LITHO. TORONTO


MOND
LITTLE HAWK LAKE
RAYMOND
RANKIN
KNIGHT
VAN HISE
MILNER
PINM Road 124
PORTAGES
Road & PINM
LOTTO LAKE
LEHMANN LAKE
DUNCAN LAKE
MUSKEG RIVER
PIDGEON LAKE
GOWGANDA TOWNSITE
GOWGANDA