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WETENAGAMI LAKE AREA, SOUART, MOQUIN AND LABRIE TOWNSHIPS, ABITIBI-EAST COUNTY

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Department of Mines

Honourable Jonathan ROBINSON, Minister

A.-O. DUFRESNE, Deputy Minister

GEOLOGICAL SURVEYS BRANCH

I. W. JONES, *Chief*

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GEOLOGICAL REPORT 29

**WETETNAGAMI LAKE MAP-AREA**

**SOUART, MOQUIN, AND LABRIE TOWNSHIPS**

**ABITIBI-EAST COUNTY**

by

**R. Bruce Graham**



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1947



WETETNAGAMI LAKE MAP-AREA

Abitibi-East County

by R. Bruce Graham

TABLE OF CONTENTS

	Page
INTRODUCTION .....	3
Location of area .....	3
Means of access .....	3
Timber, fish, and game .....	4
Field work and acknowledgments .....	4
Previous work .....	5
Description of the area .....	5
Topography and drainage .....	5
GENERAL GEOLOGY .....	6
General statement .....	6
Table of formations .....	6
Keewatin(?) .....	7
Distribution .....	7
Volcanic flows .....	7
Gabbro .....	8
Greywacke .....	9
Tuff and agglomerate .....	11
Post-Keewatin(?) intrusives .....	12
Hornblende granodiorite .....	12
Biotite granodiorite gneiss .....	13
Quartz diorite .....	14
Albite granite .....	14
Granophyre .....	15
Pegmatite and aplite .....	16
Diabase .....	16
Pleistocene and Recent .....	18
STRUCTURAL GEOLOGY .....	19
ECONOMIC GEOLOGY .....	20
BIBLIOGRAPHY .....	20
ALPHABETICAL INDEX .....	22

MAP AND ILLUSTRATIONS

Map No.616.-Wetetnagami Lake Area ..... (in pocket)

Plates

(After page 12)

Plate A.-Pegmatite (P) and biotite granodiorite gneiss (G) cutting hornblende granodiorite (D); west shore of Wetetnagami lake.

Plate B.-Finely banded tuff, west side of the river flowing into lac Gaillard.

Plate C.-Rapids on Saint-Père river, Moquin township.

Plate D.-Looking toward south end of Betty lake; esker ridge in centre background.

Plate E.-Looking north on lac Mazères.

Plate F.-Oblique aerial view, looking southwestward from near northeast corner of Souart township; Macho river and lac Mazères at left.

Plate G.-Vertical aerial view, Saint-Père river and Jonction lake, Moquin township.

Plate H.-Vertical aerial view, north end of Wetetnagami lake, Labrie township.

Plate I.-Vertical aerial view, north end of lac Castonguay, Labrie township.

Plate J.-Vertical aerial view, northwest part of Labrie township, between Labrie and Papillon lakes.

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WETETNAGAMI LAKE MAP-AREA

SOUART, MOQUIN, AND LABRIE TOWNSHIPS

ABITIBI-EAST COUNTY

by R. Bruce Graham

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INTRODUCTION

Location of Area

The Wetetnagami Lake map-area is approximately fifty-five miles northeast of Senneterre, on the Canadian National railway. Its north boundary (1) is one mile north of the 49th parallel of latitude, and from west to east the map-area extends from one mile east of longitude 76°30' to half a mile east of longitude 75°50', to include the townships of Labrie, Moquin, and Souart. Their combined area is approximately 260 square miles.

Means of Access

The area is best reached by canoe from Forsythe, on the Canadian National railway some forty miles east of Senneterre. The route follows lac Attic, lac Valmy, and Macho river to lac Mazères, in the southeast corner of the map-area. This involves three, or at most four, portages in dry seasons. The portages are well cut and are kept in repair by the forest rangers.

From Senneterre, there are two alternate routes into the western part of the area. One is by way of Bell river to the mouth of its tributary, Tonnancourt river, and thence in a general eastward direction to Cuvillier and Labrie lakes. The other follows Bell river to the northeast end of Parent lake, ascends Robin river to its headwaters, and continues eastward by way of Cuvillier lake to the southwest corner of the map-area. These routes are circuitous and involve much portaging, and for these reasons they are not to be recommended.

Within the area, the western part of Souart township may be reached from lac Mazères by following Anna creek, which empties into the northwest corner of this lake. Westward from Anna creek there is a three-quarter-mile portage to Anna lake, beyond which there are two other portages before reaching Betty lake. Access by canoe into the northeast corner of Souart township is more difficult. Macho river is followed northeastward to its head, from whence rivière au Panache is reached by a few short portages. From there, Corriveau creek, which empties into rivière au Panache a few miles north of

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(1) At the time the investigation described in this report was made, the line along this northern boundary also formed the boundary between Abitibi county and Abitibi territory. Subsequently, in 1944, Abitibi county was divided into the counties of Abitibi-East and Abitibi-West, and the boundary between the county of Abitibi-East and Abitibi territory lies now about 100 miles north of the map-area.

the map boundary, may be followed into the northeast corner of Souart township. By this circuitous, though easily travelled canoe route, a distance of thirty miles is covered in comparison to a straight-line, mostly overland, journey of eight miles northward from lac Mazères.

Wetetnagami lake, an extensive body of water just west of the central part of the area, is accessible from Betty lake by following Dazemard or Albert river north to its junction with Wetetnagami river (some five miles due north of the map-area, but about double that distance along this canoe route), and continuing upstream (in a southerly direction) along Wetetnagami river to the lake. This route involves numerous short portages.

The central and western portions of Labrie township may be reached from Wetetnagami lake by way of two portages, a quarter of a mile and a little more than three-quarters of a mile long, to lac Chapiteau nearly two miles west of the bay on the west-central side of Wetetnagami lake. A navigable creek flows out of the southwest side of lac Chapiteau into lac Gaillard.

Betty lake, Wetetnagami lake, and lac Gaillard provide good north-south water routes. Lac Papillon (just north of lac Gaillard), Wetetnagami lake, and lac Mazères are large enough to provide suitable landing surfaces for aeroplanes.

The north line of the three townships of the map-area, and the west line of Labrie township, were surveyed a number of years ago, but the lines are no longer easy to follow. A heavy windfall, due to a hurricane which swept the area in 1935, forms a strip about a mile wide along the north border of Souart township and makes travel in this region very difficult.

#### Timber, Fish, and Game

The best stands of timber are in the valley of Saint-Père river, where there are many tall, straight spruce and jack-pine suitable for timber and pulp. Forest growth is also heavy from lac Mazères westward to Wetetnagami lake (Plate H). The west shore of Wetetnagami lake marks the eastern margin of an extensive brulé, which includes most of the west half of Moquin township and all of Labrie (Plate J). Here and there are occasional isolated stands of timber which were protected from the fire by swampy muskeg.

Pike and pickerel are present in the larger lakes and rivers. Trout were seen in only a few of the smaller streams.

Considerable trapping has been done in the area during the past few years. Beaver workings are not uncommon and muskrats are plentiful. Many moose, an occasional bear, and signs of otter, were seen by members of the party during the field season.

#### Field Work and Acknowledgments

The field work on which this report is based was done in 1941. Pace-and-compass traverses, spaced wherever possible at half-mile intervals, were made over the whole area. A canoe was used for work along the shores of the lakes, rivers, and main streams. Traverses were generally run to

cross the strike of the formations, but the distribution of the water routes did not always permit this.

The base-map on which the results of the field work were plotted, and to which minor changes have been made by the writer, was compiled by the Quebec Department of Mines from a map supplied by the Bureau of Geology and Topography, Department of Mines and Resources, Ottawa, and from stream and line surveys of the Department of Lands and Forests, Quebec. Vertical aerial photographs, taken by Canadian Airways Limited for the Royal Canadian Air Force for the preparation of the Bureau of Geology and Topography map, were used extensively during the field season.

George Springer, senior assistant, Jean Lavallée and Gérard Corriveau, student assistants, Ubald Turpin, cook, and James Blondin gave efficient service throughout the summer. The writer is indebted to the Department of Geology, University of Toronto, for assistance given him, and for the use of its facilities, in preparing this report.

#### Previous Work

The area is bounded on the east by the Barry Lake area (5), on the north by the Wetetnagami River Area (2), and on the west by the Tonnancourt-Holmes area (4). Souart township and a considerable area to the south and east were examined in the course of a reconnaissance survey by Faessler (1) in 1935.

These and other publications dealing with adjacent areas are listed in the bibliography at the end of this report.

#### DESCRIPTION OF THE AREA

##### Topography and Drainage

The eastern half of Souart township forms part of the basin of Macho river and lac Mazères. Here the country is flat and swampy except for one prominent north-northwest-trending ridge of greenstone which, about three-quarters of a mile long, is 1,500 feet east of and 140 feet higher than Lunch lake (Plates E and F). This flat topography continues westward (Plate G) to the vicinity of Wetetnagami lake, except for that part of the area south and west of Betty lake (Plate D). There, hills rise 50 to 200 feet above the surrounding muskeg. Some of the smaller hills have very steep sides, and on the summits of many of the ridges there are kettle lakes.

The topography immediately surrounding Wetetnagami lake is more rugged than elsewhere in the area, with rounded hills rising from 100 to 300 feet above the lake. Farther to the west there is greater uniformity in elevation, but here also granite ridges rise 100 to 200 feet above the surrounding country; it is in this part of the area that outcroppings of bed-rock are most abundant (Plates I and J).

The drainage of the area follows a predominantly north-south course and is controlled by glacial deposits. With the exception of Macho river, which flows southward, all the larger rivers of the area flow north. Lakes other than lac Mazères and Wetetnagami lake are shallow, and there are many swampy muskegs throughout the area.

(5) Numbers within brackets refer to Bibliography at end of report.



GENERAL GEOLOGY

General Statement

The consolidated rocks of the area are all believed to be of Precambrian age. The oldest are of volcanic and sedimentary origin, with some minor intrusives that are believed to be of the same general age as the volcanics. These rocks, which are to be found in narrow bands, in the eastern and western parts of the map-area, are similar to those which, elsewhere in the Canadian Shield, are classified as Keewatin, and, for purposes of the present report, they are tentatively considered as such. Younger than these, and by far the most widespread rocks in the area, are large intrusive bodies of granitic rock (albite granite, quartz diorite, granodiorite, and rocks of related type) which are here classified as post-Keewatin. Also classed as post-Keewatin, but known to be younger than at least most of the other rocks in the area, are minor intrusions of diabase which resembles the Keweenawan diabase of other regions. Numerous dykes of this rock were seen, but only two are of sufficient size to be shown on the accompanying map.

These consolidated rocks are covered to a great extent by muskeg, clay, sand, gravel, and boulders, which present a serious handicap to accurate geological mapping.

Table of Formations

Quaternary	Pleistocene and Recent	Clay, silt, sand, gravel, boulders, eskers
Great unconformity		
Precambrian	Post-Keewatin(?) Intrusives	Diabase (Keweenawan?)
		Albite granite, granophyre pegmatite, aplite
		Biotite granodiorite gneiss, quartz diorite, pegmatite, aplite
		Hornblende granodiorite
Intrusive contact		
	Keewatin(?)	Tuff, greywacke, agglomerate Gabbro Hornblende schist, hornblende-feldspar schist and gneiss, derived from intermediate to basic lavas

Keewatin (?)

Distribution

The rocks of Keewatin type in the area probably form remnants of a belt that may originally have spanned a distance of thirty miles in an east-west direction between the Barry Lake area (5) and the Tonnancourt-Holmes area (4). They now occupy less than one-eighth of the map-area and are confined for the most part to three belts or zones which are separated from one another by granitic intrusions.

The most prominent of these three zones enters the map-area from the east, being the westward continuation of a wide belt of these rocks mapped by Milner (5) in the southern part of the Barry Lake area. Where it enters Souart township at the east boundary of the area it has a width, north-south, of seven miles. About three and a half miles west of there it is split by a granitic intrusion into two branches. The northern branch, about half a mile wide for most of its length, extends northwestward from Lapointe lake for a distance of twelve miles through the northwest quarter of Souart township to a point midway across, and just south of the northern boundary of, Moquin township. The southern branch, with a width of about a mile and a half, extends southwestward from the mouth of Macho river to and beyond the southern boundary of the map-area. It may there swing westward to join the second main zone of Keewatin-type rocks.

This second zone, trending northwestward with a width of about 2,000 feet over most of its length, extends for nearly seven miles from the southern boundary of the map-area, in the southwestern part of Souart township, to a point about three and a half miles west and two and a half miles north of the southeast corner of Moquin township.

The third prominent zone of Keewatin-type rocks is in the west-central part of Labrie township and is the southeastward continuation of a belt of these rocks mapped by Longley (4) in the adjacent Tonnancourt-Holmes area. At the western boundary of the present map-area, the belt is a mile and a half wide. It maintains this width in its southeastward course for two and a half miles, almost as far as lac Gaillard, beyond which it narrows abruptly and, in a distance of less than three miles, finally tapers out.

Small patches and short, narrow belts of Keewatin-type rocks, some of which are sufficiently large to be indicated on the accompanying map, are to be found also at widely separated places within the areas of predominantly granitic rocks.

All these rocks of Keewatin-type have been highly metamorphosed and, consequently, they have lost much of their original character. The metamorphism is believed to have been mainly of a regional type, but the various granitic magmas had a further, local, metamorphic effect on the rocks they intruded.

Volcanic Flows

Excepting possibly about half of the rocks in the belt in the western part of Labrie township and those in a band

half a mile to one mile wide in the southeast corner of Sourart, most of the Keewatin-type rocks ('greenstones', as they are conveniently termed) represent volcanic flows. They are now typically dark-green weathering, fine to coarse grained, hornblende schists, and hornblende-feldspar schists and gneisses, varying from compact to friable. They often display a sheen on fresh surfaces, due to parallel alignment of needle-like hornblende crystals.

In general, these schists and gneisses do not retain any original structures of textures. Occasional outcrops west of Macho river and southeast of Lapointe lake have pitted surfaces suggesting vesicles, or are splashed with small, whitish weathering patches suggesting amygdules, and in some outcrops of coarse hornblende schist southeast of Labrie lake there are flow-like lines similar to those characteristic of extrusive rocks.

Examined in thin section under the microscope, the presumed amygdules are seen to consist of aggregates of finely crystalline epidote and zoisite, which together make up about 15 per cent of the section. They are distributed through an equigranular, mosaic-like groundmass of oligoclase and quartz, which also contains smaller, scattered grains of epidote and zoisite and needle-like crystals of hornblende, the latter in parallel orientation.

Highly altered lavas which exhibit no extrusive features in hand specimen give little indication of their original nature even when examined in thin section. They are now composed essentially of hornblende (40-60 per cent), plagioclase (10-20 per cent), and a mosaic of quartz, epidote, and zoisite (10-20 per cent), with accessory amounts of chlorite, sericite, pyrrhotite, zircon, and apatite.

A thin section of hornblende schist from an exposure near a contact with intrusive biotite granodiorite gneiss in the southeastward-trending band of Keewatin-type rocks southwest of Betty lake shows plate-like crystals of hornblende containing abundant, minute crystals of zircon surrounded by pleochroic halos. Quartz, altered plagioclase feldspar (saussuritized oligoclase-andesine), and epidote fill interstices between the hornblende crystals. The presence of zircon and of euhedral to subhedral crystals of apatite (2 to 3 per cent) is indicative of emanations from the adjacent intrusive body. Examination of thin sections of hornblende schists from exposures at some distance from their contact with the intrusive rocks shows that they have essentially the same mineral composition and mosaic-like texture as the schist described above, but contain no zircon or apatite.

#### Gabbro

Outcrops of a body of altered gabbro were found along the southwestern shore of Lapointe lake, on the small island near the middle of the lake, and at irregular intervals over an area extending for half a mile north and a mile and a half east of the lake. A small, sill-like mass of similar rock outcrops nearly two and three-quarters of a mile northeast of the lake. Typically, this gabbro is a coarse grained, grey-green rock which, on weathered surfaces is mottled green and grey. It consists essentially of hornblende and feldspar.

Specimens from the several localities mentioned were examined in thin section. They showed various stages of alteration of the rock. In the least altered types, the feldspar, showing a minimum of recrystallization, was found to range in composition from andesine to labradorite. The crystals are euhedral to subhedral, and many of them are zoned. They are invariably fractured, some to such an extent that, while the original crystal outline has been retained, the crystal itself has been broken into a jumble of grains which have sutured contacts against one another. With increasing metamorphism, the original crystals are granulated and recrystallized into a fine-grained mosaic of quartz and feldspar, or are completely replaced by a fine mat of saussurite. The hornblende occurs as plates and prisms which assume ragged edges with increasing metamorphism and show various stages of alteration to chlorite.

No section examined contained more than 10 per cent quartz; it is all secondary, closely associated with the recrystallized feldspar. Other minerals present in small amount are titanite, magnetite, ilmenite, leucoxene, hematite, pyrite, limonite, and apatite.

One fresh-looking specimen examined in thin section was found to consist essentially of labradorite, in clear crystals, and tremolite, the latter making up as much as 50 per cent of the rock. The abundant tremolite would suggest alteration of a pyroxene-rich rock.

On the north side of the large hill 1,000 feet east of the south end of Lapointe lake, cross-cutting relations of the gabbro with hornblende schist were observed. Along the southwest side of the lake, gabbro was seen intruding hornblende schist in lit-par-lit fashion. A mile and a half northwest of this, a sill-like body of gabbro was found intruding compact hornblende schist. It is therefore believed that the gabbro is, in part at least, younger than the hornblende schist. It is possible, however, that offshoots from the gabbro magma acted as feeders for lava flows younger than those it intruded but still of the same general age. In other words, the gabbro, like the volcanics, is possibly of Keewatin age. This possibility is supported by the fact that the gabbro exhibits about the same intensity of metamorphism as the volcanics, whereas, in the other intrusive (post-Keewatin?) rocks of the area, metamorphism is much less marked.

#### Greywacke

Outcrops of greywacke (or meta-greywacke, to use a more precise designation) are to be seen in the southeast corner of Souart township. They apparently form a band 6,000 feet wide at the southern margin of the map-area. While, because of lack of outcrops, this band has been indicated on the map as terminating before reaching the eastern boundary of the area, it is probable that it continues in an eastward direction to form a faulted extension of the band of greywacke mapped by Milner (5) east of lac aux Loutres, in the Barry Lake area, only about two miles east of the Souart-Barry township-line. South of the map-area, similar greywacke has been observed along the east and west shores of lac Mazères, but it is not known how far the band extends in that direction. There are some indications that it may

turn westward, and, if the zone of volcanic rocks in the southwestern part of Souart township joins that in the southeastern part of the same township, the band of greywacke may narrow and taper out not far south of the map-area.

For most of its length within the present map-area, this band of greywacke is believed to be bounded on both sides by volcanic rocks, but at the southern boundary of the area, near the eastern shore of lac Mazères, the northwestern side of the band is in contact with intrusive biotite granodiorite gneiss. This condition probably continues for about 1,000 feet northeastward along the strike, but beyond that it is believed that the bordering rocks are volcanics. Along the southeastern margin of the band, it is only at the southern boundary of the map-area, two miles east of lac Mazères, that intrusive rock is known to be in contact with the greywacke. This may be the case southwestward, beyond the boundary of the map-area, but northeastward the contact is believed to be between greywacke and volcanic rocks.

Outcrops of the greywacke farthest away from the intrusive rocks weather grey to blue-grey and are well banded, with the bands generally one-eighth of an inch to three inches in width. This banding is rendered conspicuous by differential weathering, differences in grain size, and differences in mineral composition. Bands rich in hornblende, or less commonly biotite, alternate with feldspar-rich bands. As the contact with the granitic rocks is approached, the banding becomes less and less conspicuous until the rock is a buff weathering, biotite-feldspar schist. Locally, the greywacke is traversed by stringers of pegmatite and veinlets of quartz containing pyrite.

A number of specimens of the greywacke outcropping along the east shore of lac Mazères near the southern boundary of the map-area, and at points northeast of the lake and south of Macho river, were examined in thin section. All of them displayed alternation of bands differing in grain size and in mineral composition. There is no marked sorting of grain size within individual bands, but the grain size varies for different bands. Some bands are rich in hornblende or biotite, others in quartz and/or plagioclase ( $Ab_{80}$  to  $Ab_{60}$ ), and still others in tremolite, epidote, and zoisite. Calcite, sericite, and chlorite are generally present as accessory minerals. The chlorite is an alteration product of the hornblende. The mineralizing effect of the nearby intrusive granite was evident in some sections, from the presence of such minerals as apatite, tourmaline, and pyrite.

The rock is classed as meta-greywacke because its material appears to have been derived from basic rocks. This is indicated by the presence of hornblende, tremolite, and plagioclase of intermediate composition as the products of alteration, and to a lesser extent of recrystallization, of the sedimentary material of which it was originally composed. In proximity to the intrusive rocks, the banding has been destroyed and mineralizing solutions from the igneous magmas had their effect on the invaded rocks. Away from the intrusions, however, the banding has been preserved and it is seen that the metamorphism of the rock has resulted mainly from the regional stresses to which it and the other rocks of the area have been subjected.

Strikes of the banding in the meta-greywacke, and of the schistosity in the meta-lavas, are parallel, and dips of both banding and schistosity are to the south. This would suggest that the sediments and the lavas are conformable. The interbedding of lavas and greywacke to be seen in outcrops extending for half a mile northward from lac Mazères supports this conclusion.

#### Tuff and Agglomerate

Finely banded tuff with some associated agglomerate outcrops in the western part of Labrie township. These rocks are believed to form a band along the southwestern side of the belt of Keewatin-type volcanics of which mention has been made on an earlier page. Adjacent to the south shore of Labrie lake, at the western boundary of the area, the band has a width of about three-quarters of a mile. Along its southeasterly trend it gradually narrows until, at a point about ten miles southeast from the boundary, it apparently tapers out. From Labrie lake to a point on the southwest side of lac Gaillard, the rocks bordering the tuff band on its northward side are for the most part volcanics, but from there to the point where it tapers out, about two miles southeast of lac Gaillard, they are granitic intrusives. On its southward side, the band is bordered throughout its length by granitic rocks.

Tuffs are also to be found in an area of small extent about half a mile northwest of lac Gaillard.

Only two exposures of agglomerate were seen: one at the southwest corner of lac Gaillard; the other a quarter of a mile south of the southeast corner of Labrie lake, near the middle of the western boundary of the map-area. In these outcrops, the larger fragments in the rock, up to six inches in diameter, have lenticular to sub-angular shape as the result of squeezing. They weather a lighter green than the matrix. The latter is a finely banded hornblende schist, in which the planes of schistosity curve around the fragments. The agglomerate outcropping on the southwest side of lac Gaillard grades eastward along its strike into finely banded, tuff-like, hornblende schist, which, toward the east, where satellitic bodies of intrusive granite are increasingly abundant, commonly becomes coarser in texture.

The tuff is typically a compact, finely banded rock, often having a slaty cleavage (Plate B). On the fresh surface, it has a grey to blue-grey colour. In outcrops near granitic intrusions, the rock has a faint but characteristic sheen, due to the presence of needle-like crystals of hornblende in parallel orientation.

Specimens from outcrops along the west shore of the broad river flowing into the south end of lac Gaillard, and from others west of the lake, were examined in thin section. The chief minerals present are hornblende, biotite, plagioclase feldspar, and quartz, with alternating bands consisting predominantly of hornblende and biotite (either or both), and of quartz and feldspar. The hornblende, in part altered to chlorite, occurs as subhedral prisms oriented parallel to the banding. Biotite is less common than hornblende. The feldspar ranges in composition from albite to andesine and

is commonly more or less altered to a mat of sericite or to epidote. The bands rich in feldspar and quartz usually have a mosaic-like texture.

A specimen taken at the southern margin of the tuff band, very close to its contact with the granite, showed, in thin section, a pseudo-porphyrific texture resulting from the presence of clusters of clino-pyroxene crystals, with or without some plagioclase, in a groundmass of hornblende and altered (saussuritized) plagioclase.

The banding in the tuffs has the same strike as the schistosity in the coarse hornblende schists (altered flow rocks) which lie to the north of them. It is to be noted, also, that the only outcrops of agglomerate observed are at or near the northern margin of the band of tuffs. Three oriented specimens of the tuff, taken across the strike of the formation, were examined in thin section. In two of them, gradation in grain size indicated that the top of the formation faces to the south; in the third, sorting was not sufficiently well developed for accurate determinations. If reliance can be placed on these determinations, it would seem that this band of tuff conformably overlies the altered lavas to the north.

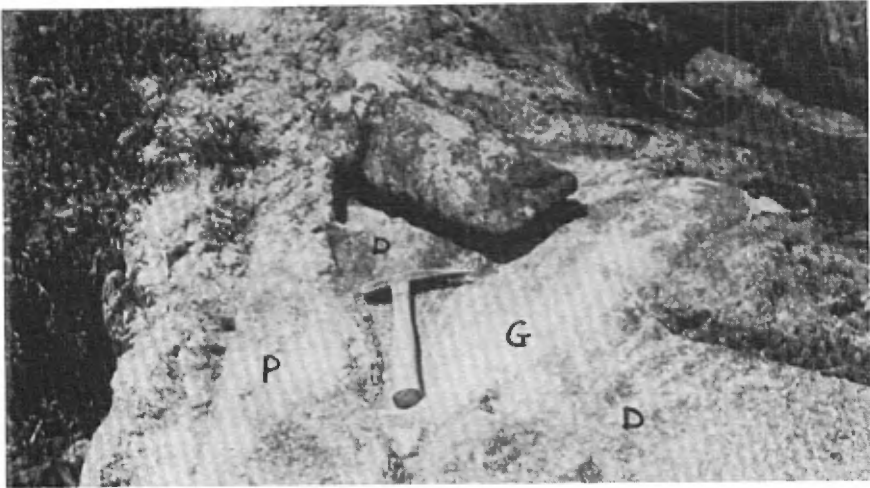
#### Post-Keewatin(?) Intrusives

Rocks of granitic type are by far the most widespread in the map-area. They occupy sixty per cent of Souart township and from ninety to ninety-five per cent of Labrie and Moquin townships. Wherever seen in contact with the greenstones, they are clearly intrusive into them.

Several types of granitic rock are represented in the map-area and are abundantly developed also in the surrounding country, but a general similarity in mineral composition characterizes the whole series of intrusions. Sodic plagioclase is the dominant feldspar, with potash feldspar rarely forming more than 30 per cent of the rock. Quartz ranges from 20 to 35 per cent, and hornblende and biotite (either or both) from 10 to 20 per cent. This similarity in composition suggests that all these granitic rocks are genetically related. While in this area, and to some extent in adjoining areas (2, 4, 5), it has been possible to establish a sequence of intrusion for the several types present, there is little to indicate any extensive lapse of time between the successive periods of intrusion. As established for the present map-area, the sequence was: (1) hornblende granodiorite; (2) biotite granodiorite gneiss, with gneissic quartz diorite facies; (3) albite granite. There are other, minor granitic intrusives whose age relationships are not definitely known.

#### Hornblende Granodiorite

Hornblende granodiorite occurs as an elongated north-westerly trending body, about five miles long and from half a mile to one mile wide, crossing the southwestern part of the main body of Wetetnagami lake. It is a gneissic, coarse-grained, grey to pink weathering rock with a granitic texture. A distinct foliation, marked by bands consisting of



A.—Pegmatite (P) and biotite granodiorite gneiss (G) cutting hornblende granodiorite (D); west shore of Wetnagami lake.

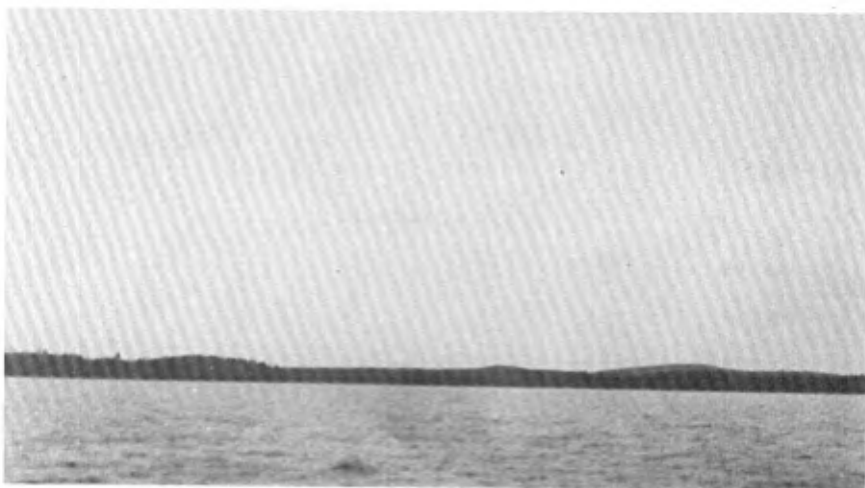


B.—Finely banded tuff, west side of the river flowing into lac Gaillard.

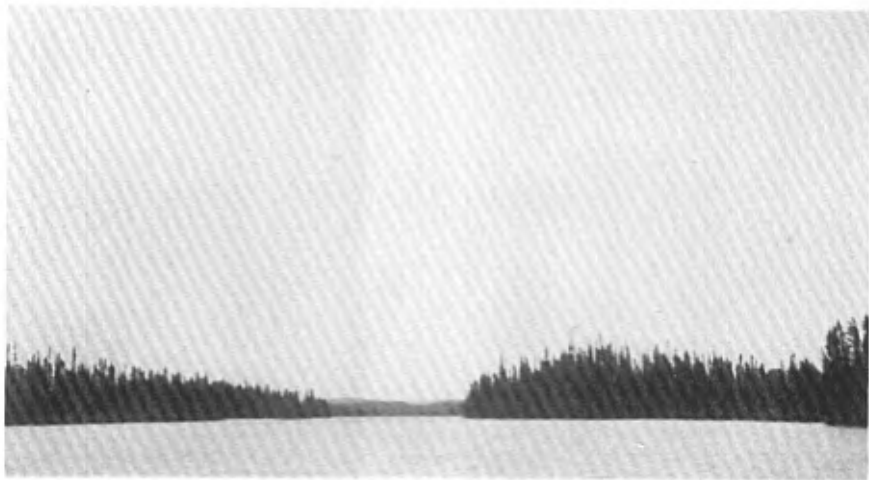


C.—Rapids on Saint-Père river, Moquin township.





D.—Looking toward south end of Betty lake; esker ridge in centre background.



E.—Looking north on lac Mazères.



(R. C. A. F. Photo.)

F.—Oblique aerial view, looking southwestward from near northeast corner of Souart township;  
Macho river and lac Mazères at left.



(R. O. A. F. Photo.)

G.—Vertical aerial view, Saint-Père river and Jonction lake, Mcquin township.



(R. C. A. F. Photo.)

H.—Vertical aerial view, north end of Wetetnagami lake, Labrie township.



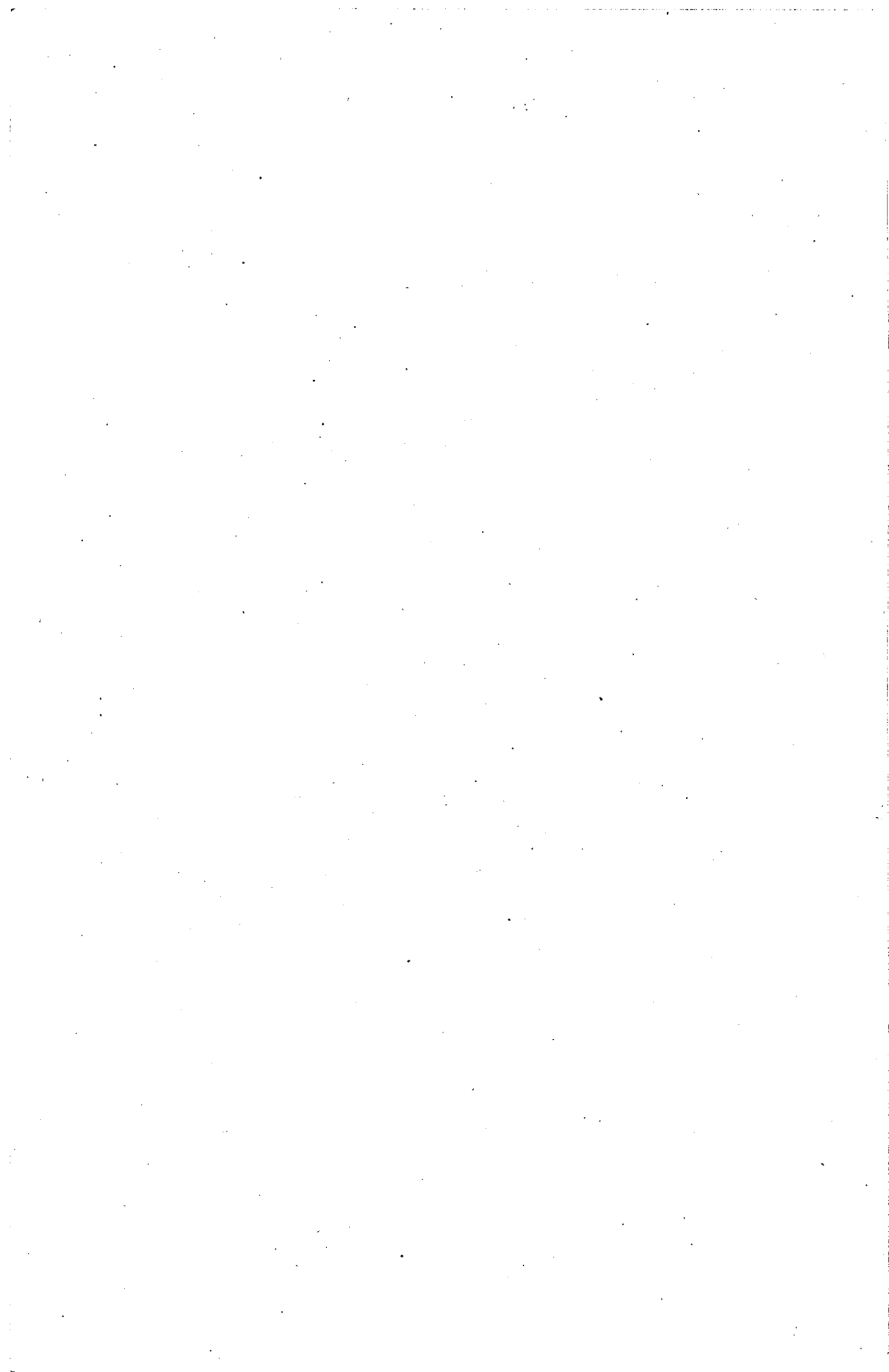
(R. O. A. F. Photo.)

1.—Vertical aerial view, north end of lac Castonguay, Labrie township.



(R. C. A. F. Photo.)

J.—Vertical aerial view, northwest part of Labrie township, between Labrie and Papillon lakes.



hornblende crystals in parallel orientation, is not uncommon.

Thin sections of this rock were found to consist of hornblende (or its alteration product, chlorite), 20 per cent; plagioclase (generally oligoclase), 35-45 per cent; potash feldspar (microcline), 5-30 per cent; quartz, 5-30 per cent; and up to 20 per cent of epidote and zoisite, chiefly resulting from the alteration of the feldspar. Other minerals present, but in small amount, include biotite, magnetite, apatite, titanite, and carbonate. Of these, only apatite was noted in all the thin sections examined.

The texture is uniformly granitic. Quartz grains usually show some fracturing. Microcline occurs both as large single crystals and in clusters of small crystals, the cluster as a whole being smaller than the large single crystals. Intergrowths of quartz and feldspar are common.

In the sections examined there was considerable evidence of introduction into the granodiorite of material from the younger 'granites' which surround it. Microscopic veinlets of titanite, and others consisting of albite, microcline, quartz, carbonate, and apatite, cut the rock. In a thin section traversed by a veinlet of the latter type, clear, small anhedral albite fill the interstices between saussuritized and albitized plagioclase and form up to 10 per cent of the section. In slides in which there is little or no evidence of the introduction of material, the feldspar is not saussuritized. Field evidence that the granodiorite is older than the granitic rocks that surround it is even more conclusive. It occurs as inclusions in both the biotite granodiorite gneiss and albite granite, and stringers and tongues of these two rocks cut the hornblende granodiorite (Plate A).

#### Biotite Granodiorite Gneiss

Biotite granodiorite gneiss and related rocks predominate in all parts of the area except the southwestern and northeastern parts of Labrie township and the eastern part of Souart. These rocks, which are all believed to belong to a single intrusive body, range in composition from biotite granodiorite gneiss to biotite-quartz diorite gneiss.

The rock is distinctly foliated. This feature is especially well displayed in the rock exposed south and west of Wetetnagami lake, in which there is pronounced cleavage parallel to lamellae of biotite and spaced from a few inches up to 5 feet apart. The rock is generally grey to pink, with medium to coarse grain.

In thin section, the rock is seen to be composed essentially of (in per cent): plagioclase, 20-40; quartz, 25; and biotite, 25. Any or all of the following minerals may be present in small amount: muscovite, epidote, chlorite, magnetite, apatite, pyrite, zoisite, and hematite. The feldspar is oligoclase or albite, and usually it is somewhat clouded by alteration products. The interstitial quartz grains have wavy extinction and some of them are fractured. Quartz also occurs as flame-like, vermicular, or bleb-like intergrowths with the feldspar. Unlike the interstitial



grains, this quartz has sharp extinction and shows no evidence of strain. The biotite flakes have rudely parallel orientation.

#### Quartz Diorite

A body of quartz diorite, occupying an area about two and a half square miles, outcrops in the northeast corner of Souart township. The outcrops weather light grey. The rock is medium to coarse grained and is vaguely to distinctly foliated, due to parallel lamellae of biotite or hornblende crystals. A typical specimen from an outcrop just south of the northern boundary of the map-area, at a point one mile east of Corriveau creek, was examined in thin section. It consisted (in per cent) of oligoclase, 50-55; quartz, 20; biotite, 15; and microcline, 2; with minor amounts of epidote, apatite, chlorite, muscovite, calcite, and sericite. The rock has an ill-defined porphyritic texture, with relatively large phenocrysts of highly altered oligoclase distributed through a matrix of quartz, oligoclase, biotite, and epidote. It thus approaches the biotite granodiorite gneiss in composition, differing from that rock chiefly in its porphyritic texture, the intense alteration of the plagioclase, and the absence of microcline. Megascopically, the difference is more pronounced. The rock is more compact than the biotite granodiorite gneiss, and dark minerals are less conspicuous.

Due to the lack of critical exposures, the age relationship of the quartz diorite to the biotite granodiorite gneiss could not be determined. The 'contact' was crossed in two places and, as far as could be determined, it is gradational. In passing from the quartz diorite to the granodiorite gneiss, the diorite becomes coarser in grain, less gneissic, and seems to blend into a coarse biotite granodiorite gneiss which then becomes more medium grained and typical of the granodiorite gneiss of the area.

A small body of similar quartz diorite, about 1,500 feet in diameter, intrudes the Keewatin-type greenstones half a mile northwest of Lapointe lake.

#### Albite Granite

Intruding the biotite granodiorite gneiss and hornblende granodiorite are bodies of massive, medium grained, pink albite granite. The largest of these, of batholithic size, extends from some point north of the map-area into the northeast corner of Labrie township and thence south and southeast across Wetetnagami lake to the southwestern part of Moquin township. It has a length within the map-area of about eleven miles and a width, for the most part, of two to three miles. A stock of similar rock, about a mile in diameter, has been mapped about two and a half miles east of the outlet of Wetetnagami lake, and another, about half a mile wide and a mile and a half long, forms the eastern side of, and extends southeast from, Lavallée lake. These two stocks are in Moquin township. There are several smaller masses of the albite granite, a quarter to half a mile in diameter, in Labrie township. Locations of these are: on both sides of Wetetnagami lake where it narrows near its

southern end, about a mile and a half north of the southern boundary of the map-area; half a mile north of the eastern end of Chapiteau lake; a little more than half a mile west of Papillon lake; about a mile west of the north end of lac Gaillard; and just north of this lake. The southwestern corner of Labrie township, over an area of about four square miles, is also occupied by this albite granite, part of a body which extends west and southwest for an unknown distance beyond the boundaries of the map-area. A small stock of intrusive rock in the southeast corner of Souart township was mapped by Milner (5) as albite granite; it is so indicated on the map accompanying the present report, but, in the field, it is not distinguishable from certain facies of the biotite granodiorite gneiss which underlies a large part of the area.

Along its contacts with the biotite granodiorite gneiss, the main body of albite granite has so intimately intruded the gneiss that, in many places, no sharp contact between the two rocks can be defined. Stringers, dykes, and tongues of albite granite intrude the biotite granodiorite gneiss and inclusions of the latter in the albite granite are abundant. Mixing of the two types by assimilation takes place to a lesser degree. Due to the difficulty in defining a sharp contact in areas of intensive contact action, such areas have been designated on the map as 'mixed' zones. The abundance of mixing of the two rock types, and the occurrence of several isolated bosses of albite granite near the main batholith, indicate that, for a considerable distance east and west of its exposed portion, the batholith lies at no great depth beneath the surface.

The bosses or stocks of albite granite (except those exposed, respectively, east of Lavallée lake, at the south end of Wététnagami lake, west of lac Gaillard, and in the southeast corner of Souart township) are likewise surrounded by zones of mixed rock types.

The albite granite consists essentially of albite, with lesser microcline, and quartz. Minor constituents are biotite, muscovite, epidote, chlorite, magnetite, and apatite. Micrographic intergrowths of quartz and albite, and bleb-like inclusions of quartz in microcline, are common. The grains of interstitial quartz, and in lesser degree those of albite and microcline, are fractured. Chlorite is a common alteration product of the biotite.

### Granophyre

A small body of granophyre outcrops in an area extending northward for a mile and a quarter from a point about three-quarters of a mile north of the outlet of Wététnagami lake. Its greatest width is half a mile. It is a pink-weathering rock, massive, and medium grained.

In thin section, the rock is seen to consist of quartz (30 per cent) and albite (60 per cent), with varying amounts of magnetite, apatite, chlorite, epidote, and biotite. Micrographic intergrowth of quartz and feldspar is the outstanding textural feature. The quartz enclosed in the albite is in clear single grains, rounded as the result of partial resorption, or in composite grains, which may be fringed with

chlorite. The albite is clouded by minutely crystalline alteration products.

The granophyre intrudes the biotite granodiorite gneiss, but no contacts between it and the albite granite were observed. Its occurrence at the margin of a body of albite granite and its similarity to that rock in mineral composition suggest that the two are related in origin. It is likely that the granophyre is a late differentiate of the albite granite.

#### Pegmatite and Aplite

Pegmatite, and to a lesser extent aplite, dykes and stringers cut the granitic rocks of the area. Generally, they contain only quartz, potash feldspar, and biotite, but some epidote and pyrite may be present. In the pegmatite dykes, the crystals of quartz and feldspar are usually two to three inches in diameter; rarely, they are as much as half a foot by two feet.

Westward from lac Mazères, in Souart township, pegmatites increase in abundance as the albite granite at Wetetnagami lake is approached, until, within a distance of seven miles of the granite, there is scarcely an outcrop in which pegmatitic or aplitic intrusions cannot be found. They remain equally numerous westward from the albite granite batholith to the western boundary of the map-area.

These pegmatites also cut the albite granite. Contacts with the granite may be sharp or gradational.

The increase in the number of pegmatite dykes as the albite granite is approached, and the gradational contacts referred to, suggest that the pegmatite is an offshoot from the albite granite. Supporting evidence that some, at least, of the pegmatites are genetically related to the albite granite is furnished by some striking exposures a short distance east of O'Sullivan river, in which pegmatite and albite granite stringers cut biotite granodiorite gneiss and mutually cut each other. In hand specimen, the pegmatite stringers cutting and cut by the albite granite are indistinguishable.

It is possible that the pegmatite dykes and stringers occurring in the area are not all of the same age. As is evident from the occurrence just described, some of them are definitely later than the biotite granodiorite gneiss, earliest of the granitic intrusions, and appear to be genetically related to the albite granite, youngest of these intrusions. Whether or not there was an earlier injection of these dykes, genetically related to the biotite granodiorite gneiss, could not be determined owing to lack of critical exposures.

#### Diabase

There are two diabase dykes of mappable size in the area. One, 90 to 125 feet wide, has been traced for a length of nine miles in a direction 15 to 20 degrees east of north across almost the entire north-south width of the map-area. It enters the area at its southern boundary, about a mile and a half west of Wetetnagami lake. Continuing northward, for the most part about half a mile west of and paral-

Following the main body of the lake, it meets and crosses the northwest arm of the lake and is traceable to a point about a mile and three-quarters south of the northern boundary of the map-area.

The other relatively large dyke is exposed at the north end of the unnamed lake in the extreme southwest corner of the area, immediately west of the north end of Castonguay lake. It is 80 to 100 feet wide and, trending 20 to 30 degrees north of east, is traceable in this direction for about a mile.

Smaller diabase dykes were observed in several localities, particularly in the eastern and southern parts of Labrie township.

On weathered surfaces, the diabase is reddish-brown in colour. Wherever seen in contact with other rocks, it is intrusive into them and, adjacent to the contact, is characteristically fine grained as the result of chilling. It is similar in all respects to the diabase which, in other parts of the Canadian Shield, is considered to be Keweenaw in age.

Three specimens of the largest dyke, taken at intervals along its strike, were examined in thin section. At the contact with the intruded rock, the diabase is fine grained and appears minutely porphyritic. Away from the contact, it is coarse grained and exhibits a moderate to well developed ophitic texture.

The 'phenocrysts' of the chilled rock are seen in thin section to consist of small groups of augite crystals. Augite is an important constituent also of the groundmass, in which it forms a fine grained mat with clouded plagioclase, chlorite, and magnetite.

Thin sections of the specimens taken at some distance from the chilled edge of the dyke show ophitic texture, with crystals of augite (10 to 40 per cent) penetrated by stubby laths of plagioclase (55 to 60 per cent). The augite is in part altered to tremolite. As a general rule, the plagioclase is so altered to sericite and epidote that its original nature cannot be determined, but occasional less altered crystals were found to have the composition of andesine. Magnetite and hematite are commonly present, amounting to as much as 15 to 20 per cent of some of the sections. Minor constituents are chlorite, pennite, biotite, titanite, apatite, and pyrite.

This dyke is similar in mineral composition to, and is in strike with, the large diabase dyke mapped by Fairbairn(2) in the Wetetnagami River area, immediately to the north of the present area.

The dyke referred to above as occurring in the southwest corner of the map-area was found, when examined in thin section, to be a quartz diabase. Its main constituents are (in per cent): andesine, 55; augite, 35; magnetite, 5; quartz, 3 to 5; and small amounts of biotite and chlorite. The andesine is much clouded by alteration products. The quartz appears to have been introduced some time after consolidation of the rock.

### Pleistocene and Recent

Viewed broadly, the Wetetnagami Lake area is covered by unconsolidated glacial material through which humps, knolls, and ridges of bed-rock project. This glacial material, as examined on hills and in stream-cuts, is composed of boulders, gravel, sand, silt, and a minor amount of clay.

Three eskers were mapped in the area. One was traced south of Betty lake, in the southwest corner Souart township, for a distance of two miles. It consists of a series of sinuous ridges, four to five feet wide at the top, with sides sloping at 45 to 55 degrees from the horizontal. Kettle lakes occur along these ridges, sunken about fifty feet below their summits and having quite precipitous banks. The material of the esker is chiefly sand, with lesser amounts of gravel. Boulder deposits occur locally in depressions.

A second esker, in the northeastern part of Moquin township, was traced in a southwesterly direction for a distance of about four miles from the west arm of Albert lake. Kettle lakes and boulder heaps are common along this esker, which, like that south of Betty lake, consists chiefly of sand.

A third esker, in the northeast corner of Labrie township, was traced for a distance of two miles northward from Wetetnagami lake to almost the north boundary of the map-area, and for a mile and a half southward, in which direction it forms a point, an island, and part of a second point, on the west side of the north arm of the lake. This esker is much richer in gravel than the other two. Should a local need arise in the future for gravel for road making or other uses, a search would doubtless reveal deposits of suitable grade at some points along the esker.

South of Betty lake, near the southern border of the map-area and extending westerly to a mile east of Saint-Père river and from there northward to about the centre of Moquin township, there are a series of morainic hills consisting largely of unsorted boulders, up to ten feet in diameter. The hills are 40 to 70 feet high east of St-Père river and 100 to 200 feet high south of Betty lake.

St-Père river winds its way through sand-plain or jack-pine flats which extend for a distance of about seven miles and have a width of two miles. Several good cuts are exposed along the river, showing stratified sand. The stratification is horizontal and is marked by alternating layers of fine and coarse sand. As exposed in these cuts, there is a gradual increase in the thickness of the layers, from half an inch or somewhat more at the top to upwards of a foot in the lower beds. The coarse sand will pass a screen with openings of 0.1 inch. At one place, a band of stiff, grey clay two inches thick was observed. Elsewhere, the sand is very clean. The sand forming this plain is considered to have been deposited from sand-laden waters left behind in the retreat of the glacier that formed the moraines and eskers to the east.

The original drainage pattern of the area was disrupted by the thick mantle of debris left in the wake of the retreating glacier. The main drainage now has a north to

northeasterly trend, imposed by the valleys and ridges of unconsolidated glacial deposits.

Glacial striae were observed at numerous localities in the area. They generally trend 10 to 20 degrees west of south, which is in agreement with observations in adjacent areas.

#### STRUCTURAL GEOLOGY

The regional structure in Moquin and Labrie townships, and in the western portion of Souart, has a southeast trend. In the eastern part of Souart, it changes to south and southwest. Except as noted below, the greenstones dip eastward, generally at 70 to 80 degrees.

The greenstones of the area are all schistose. In general, metamorphism has obliterated the original banding, but, where this was seen, it and the schistosity are parallel.

Granitic intrusions control the strike and dip of the greenstones adjacent to them. This is illustrated in Souart township, where a blunt nose of granodiorite projects into the greenstone east and north of lac Mazères. Strikes closely follow the contour of the nose, and dips are nearly always away from the intrusive body. Again, in the northern part of the township, the banding and schistosity in the greenstone parallel and dip away from the contact with a broad, southward projection of the granitic rocks. Where gabbro intrudes the greenstone, the same conditions obtain, although somewhat modified by the later intrusion of the granodiorite.

The biotite granodiorite gneiss of the area almost invariably has a foliated structure, made evident in hand specimen by schistose bands of (chiefly) biotite. The strike of the foliation parallels the contact of the gneiss with greenstone and with albite granite. The dip varies from horizontal to vertical and is generally to the north, northeast, or east. The horizontal attitude is most common in the vicinity of Betty and Albert lakes. South and southwestward dips were noted in the foliated gneiss north of the greenstone tongue in Labrie township, and in the foliated quartz diorite of unknown age in the northeastern part of Souart township.

Jointing is not uncommon in the granitic rocks, especially in Moquin and Labrie townships, and it is well developed in the granodiorite southwest of the albite granite batholith in the eastern part of the latter township. Plotting of the trend of the jointing throughout the area revealed no well defined system or systems of joints. Most commonly, however, their trend is either between 30 and 50 degrees east of north, or between north-south and 10 degrees west of north.

The large dyke of diabase that crosses the northwest arm of Wetetnagami lake has an average strike of north 20 degrees east, which conforms to the general pattern for diabase dykes of the region. The smaller dyke, west of the north end of lac Castonguay, strikes north 70 degrees east.

### ECONOMIC GEOLOGY

As already noted, greenstones are restricted to relatively small sections of the map-area. As a consequence, there is little favourable ground for prospecting.

Quartz veins in the granitic rocks were found to be barren, except in two localities: on the east shore of lac Mazères, in Souart township, and on the west shore of Wetetnagami lake, in Labrie township, both near the southern boundary of the map-area. In these localities, lenticular quartz veins, not exceeding one foot in width and four to five feet in length, are mineralized with pyrite, in disseminated crystals less than a quarter of an inch in diameter.

Along the southern shore of Lapointe lake, in Souart township, some of the hornblende schist has a silicified selvage containing abundant small grains of pyrite. Inshore a few hundred feet, two narrow, discontinuous quartz veins were seen containing a small amount of disseminated pyrite. The hornblende schist in the vicinity of the veins is considerably altered to iron oxide and carbonate, and disseminated pyrite occurs in the rock close to the quartz veins. Also in Souart township, at the north end of a small lake three miles east of the north end of Altherr lake, some disseminated pyrite was seen in an outcrop of hornblende schist intruded by quartz and granite stringers.

No claims have been staked in the area, nor were any signs of prospecting observed during the present investigation. The relative difficulty of travel has probably been a deterrent factor.

The most favourable ground for prospecting is probably in the greenstones, adjacent to their contact with biotite granodiorite gneiss, between lac Mazères and Lapointe lake, in Souart township. The tongue of greenstone in the western part of Labrie township probably should not be overlooked. Though no mineralization was observed there, the tuffaceous rocks in the southern part of the tongue have a favourable 'brittle' appearance.

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-



ALPHABETICAL INDEX

Page	Page		
Acknowledgment .....	5	Granitic	
Agglomerate .....	6,11,12	rocks .....	6
Albert lake .....	18,19	stringers .....	20
Albite .....	13,15,16	Granodiorite .....	6,13
granite .....	6,14,16,19	Granophyre .....	15,16
Altherr lake .....	20	pegmatite .....	6
Andesine .....	9,11,17	Greenstones .....	8,19,20
Anna creek .....	3	Greywacke .....	9,10,11
Apatite .....	9,13,15,17		
Aplite .....	6	Hematite .....	9,13,17
Attic lake .....	3	Hornblende .....	9,10,12,13
Augite .....	17	granodiorite .....	6,12,13
		feldspar schist .....	6,8
Barry lake .....	5	schist .....	6,8,11,20
Bell river .....	3		
Betty lake .....	3,4,8,19	Ilmenite .....	9
Bibliography .....	20,21	Iron oxide .....	20
Biotite .....	10,12,14,17		
feldspar schist .....	10	Keewatin(?) .....	7
granodiorite gneiss .....	6,12,19		
		Labradorite .....	9
Calcite .....	10,14	Labrie lake .....	3,8,11
Carbonate .....	13,15	Labrie township .....	7,12,15,19
Castonguay .....	17,19	Lapointe lake .....	7,9,14,20
Chapiteau lake .....	4,15	Lavallée lake .....	14,15
Chlorite .....	8,10,13,17	Lavallée, Jean,	
Claim staking .....	20	student assistant .....	5
Consolidated rock .....	6	Lavas, intermediate to basic .....	6
Corriveau creek .....	3	Leucoxene .....	9
Corriveau, Gérard,		Limonite .....	9
student assistant .....	5	Location of area .....	3
Cuvillier lake .....	3	Longley, W.W. ....	7,20
		Loufres lake .....	9
Dazemard .....	4		
Description of area .....	5	Macho river .....	3,5,7,8,10
Diabase .....	6,16	Magnetite .....	9,13,15,17
Drainage .....	5,18	Mazères lake .....	3,9,16,20
Dykes,		Means of access .....	3
albite granite .....	15	Meta-greywacke .....	9,10,11
diabase .....	6,17,19	Microcline .....	13,14,15
quartz diabase .....	17	Milner, R.L. ....	7,9,15,20
		Moquin township .....	3,7,14,19
Economic geology .....	20	Muscovite .....	13,14,15
Epidote .....	8,12,13,17		
Eskers .....	18	Norman, G.W.H. ....	20
Faessler, Carl .....	5,20	Oligoclase .....	8,13
Fairbairn, H.W. ....	17,20	O'Sullivan river .....	16
Field work .....	4		
Feldspar .....	8,11,12,13	Panache river .....	3
Formations, table of .....	6	Papillon lake .....	4,15
		Pegmatite .....	10,16
Gabbro .....	6,8,9	Pennite .....	17
Gaillard lake .....	4,11,15	Plagioclase .....	8,11,13,17
General geology .....	6	Pleistocene and Recent .....	6,17
General statement .....	6	Potash feldspar .....	12,13,16
Gneiss .....	6,8	Post-Keewatin(?) intru-	
Granitic intrusions .....	7	sives .....	12

	Page		Page
Previous work .....	5	Table of formations .....	6
Prospecting .....	20	Timber, fish, and game .....	4
Pyrite .....	9,10,17,20	Titanite .....	9,13,17
Pyrrhotite .....	8	Tremolite .....	9,10,17
Quartz .....	7,9,15,17	Tonnancourt river .....	3
diorite .....	14,20	Topography .....	5
diorite pegmatite .....	6	Tourmaline .....	10
Recent, see Pleistocene.	6,17	Tuff .....	6,11,12
Robin river .....	3	Valmy lake .....	3
Saint-Père river .....	18	Volcanic	
Saussurite .....	9	flows .....	7
Sericite .....	8,12,14,17	rocks .....	10
Souart township ...	4,8,15,19	Wettnagami	
Structural geology .....	19	lake .....	5,12,16,19
Sproule, J.C. ....	21	river .....	4
Springer, George,		Zircon .....	8
senior assistant .....	5	Zoisite .....	8,10,13

