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BARRY LAKE AREA, ABITIBI COUNTY AND ABITIBI TERRITORY

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GEOLOGICAL REPORT 14

BARRY LAKE AREA

ABITIBI COUNTY AND ABITIBI TERRITORY.

by

R. L. Milner.

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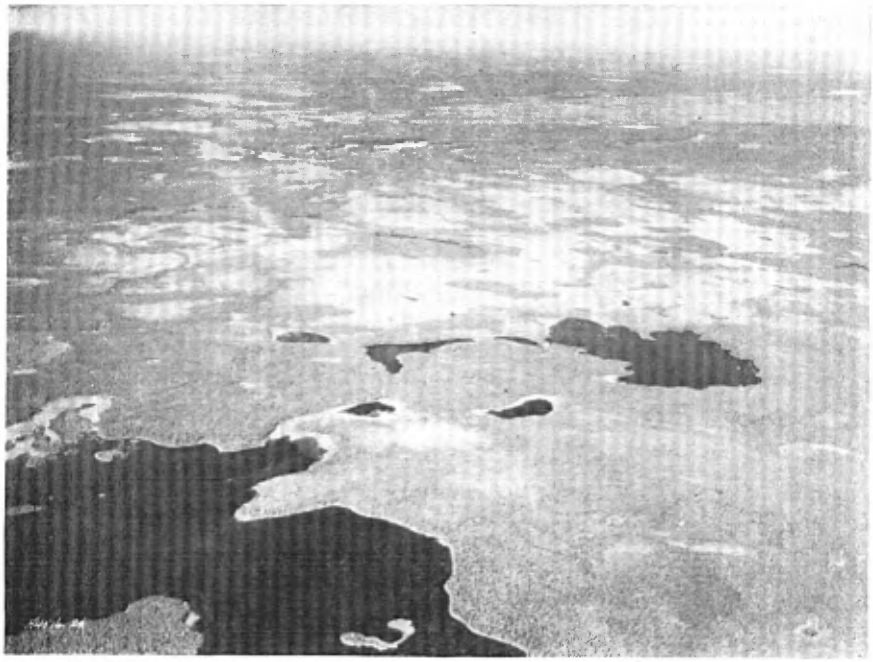

(Photo Royal Canadian Air Force)

A.—North end of Barry lake and Rouleau lake. Illustrating typical flat muskeg-covered country.

(Photo Royal Canadian Air Force)

B.—Coursol and southern Lacroix townships. Illustrating linear character of topography.

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BARRY LAKE AREA

ABITIBI COUNTY AND ABITIBI TERRITORY

by R.L. Milner

INTRODUCTION

Location, Field-Work, and Acknowledgments

During the field season of 1939 the writer mapped most of Barry, Bailly, and No.118 townships, and parts of Lacroix, Coursol, Souart, No.117, and No.119 townships, in the county and in the territory of Abitibi. The southwest corner of the map-area is approximately sixty miles north of Rouleau Siding, which is sixty miles east of Senneterre on the northern line of the Canadian National railway.

The shores of the principal lakes and rivers were examined, and the intervening ground was covered by pace and compass traverses spaced at intervals of about half a mile. Aerial photographs were used as a guide in this work, so as to avoid traversing in areas thought to be practically devoid of outcrops. The base-map on which the results of the work were plotted was compiled at the Bureau of Mines in Quebec from data supplied by the Topographic Division, Geological Survey, Ottawa, and from various township plans and waterway surveys furnished by the Department of Lands and Forests, Quebec. Aerial photographs of the district were supplied by the Royal Canadian Air Force.

Yves Fortier, Edgar Bérubé, and Gérard Corriveau, student assistants, and James Blondin and Hormidas Croft, canoe-man and cook, respectively, all performed their share of the work in excellent fashion. Supplies for the summer were transported from Rouleau Siding by Robert Morissette. The report was written at McGill University (1), and the writer is indebted to the staff of the Department of Geological Sciences of that institution for their kind assistance. The writer wishes to acknowledge his gratitude to the officials and employees of Rouleau Mines, Limited, to Mr. C.A. d'Abbadie of the Quebec Streams Commission, and to the Provincial fire-rangers stationed at Doda lake and Bertholet lake, for their many kind services during the summer.

Means of Access and Conditions of Travel

The area is about one hundred miles from Senneterre and the same distance from Oskelaneo, and is most easily reached by aeroplane from either of these towns. Several good water-routes provide convenient transportation into the area during the summer months. Of these, that most commonly used starts about half a mile west of Rouleau Siding, at the point where the railway crosses Kekek river. The Kekek flows into the Mégiscane, and two tributaries of the latter, the Saint-Cyr (1) and the Macho, have their

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(1) A fuller description of this area, particularly regarding petrography and metamorphism, is contained in a thesis written by the author at McGill University in part fulfilment of the requirements for the Ph.D. degree, and deposited in the University library. A copy is also on file at the Department of Mines, Quebec.

(2) The name Saint-Cyr is given to two rivers that flow north and south, respectively, from Barry lake. The river here referred to is the southward-flowing Saint-Cyr.

headwaters within the present map-area. Of the numerous shallow rapids in the Kekek, only two necessitate portages, both of which are short. Beyond this, the route follows the slow-flowing Mégiscane and Saint-Cyr rivers, which provide excellent transportation for canoes and small power-boats as far as Barry lake. The route to Aux-Loutres lake by way of Macho river is considerably longer than that to Barry lake, and involves three portages, the two previously mentioned on the Kekek, and another on the Mégiscane.

In 1935, a winter road was built from Rouleau Siding into the Chibougamau district. This road crosses the eastern part of the map-area and touches the southern end of Bailly lake, thus providing access to the area during the winter months.

Most of the numerous lakes in the area are connected by streams that are too small for canoes, but a few canoe-routes make it possible to reach nearly all parts of the area comparatively easily. The northward-flowing Saint-Cyr river flows through the northern part of Lacroix and No.119 townships, and most parts of Barry and Bailly townships are easily reached from Barry and Bailly lakes. The townships of Lacroix and Coursol are readily accessible from Lacroix lake and de l'Aigle river, and a portage of less than one mile connects Barry lake to a stream flowing eastward to Bérubé lake, from where Lacroix lake may be reached by way of Bérubé creek.

Aux-Loutres lake, in the western part of the area, may be reached directly from Mégiscane river or from Barry lake, the latter route entailing a portage of one and a half miles. A water route, broken by a few short portages, leads from the northern end of Macho river to Penache river, which flows along the northwestern border of the area. Fortier river, a tributary of the Penache, is navigable as far as Fortier lakes, although near its head the river is very circuitous and is obstructed by fallen trees.

Access to the central part of No.118 township is more difficult. A small river enters Macho river about one mile south of the surveyed county-line, and a chain of small lakes extends from the head of this river northward to the limit of the map-area. There are two portages, each about a mile and a half long, on this route.

Survey lines have been cut through the area, both north-south and east-west. Although they were cut some time ago they are still easily followed and serve as trails and as base-lines for survey purposes. The portage from Barry lake to Aux-Loutres lake is maintained in good condition by the fire-rangers, but the others in the area are either seldom used or were newly-cut during the summer.

Previous Work and Related Publications

The following reports contain information on parts of this or nearby areas:

(1) MAWDSLEY, J.B., Eagle River Area, Abitibi Territory, Que.; Geol. Surv. Can., Summ. Rept., Pt. C, 1927.

(2) MACKENZIE, G.S., Pusticamica Lake Map-Area, Abitibi District; Que. Bur. Mines, Ann. Rept., Pt. C, 1934.

(3) MACKENZIE, G.S., Currie Township Map-Area, Abitibi District; Que. Bur. Mines, Ann. Rept., Pt. B, 1935.

(4) FAESSLER, Carl, Mégiscane River Headwaters Map-Area; Que. Bur. Mines, Ann. Rept., Pt. C, 1935.

(5) LONGLEY, W.W., Grevet Area, Abitibi District; Que. Bur. Mines, Ann. Rept., Pt. B, 1936.

(6) NORMAN, G.W.H., Waswanipi Map-Area, Northern Quebec; Geol. Surv. Can., Prelim. Rept. 36-3, 1936.

(7) NORMAN, G.W.H., Opawica-Chibougamau Map-Area, Northern Quebec; Geol. Surv. Can., Prelim. Rept. 36-6, 1936.

The Opawica-Chibougamau sheet mapped by Norman includes the northern half of the Barry Lake area, but the Penache-de l'Aigle River belt of greenstones is only briefly mentioned in his report. Faessler mapped an area extending from the Canadian National railway as far north as Barry lake, and described the greenstones and gneiss around Barry and Lacroix lakes. The reports by Longley and MacKenzie deal with areas to the west, which have certain features in common with the Barry Lake area. During the field season of 1939, B.C. Freeman mapped the region adjoining the present map-area on the east.

Topography and General Character of the Area

The general topographic features of the area resemble those of many other parts of the Canadian Shield. Although there are numerous subdued ridges and knolls, only a few rise as much as one hundred feet above the general level of the lakes and streams. At the southwest end of Barry lake a prominent hill attains a height of about two hundred feet above the level of the lake, and another, somewhat higher and marked by a broad, rolling summit, extends eastward from Fortier lakes as far as Croft lake.

The rather monotonous topography of the country is broken by a series of low hills north of Fortier river and around the chain of lakes north of Croft lake. The Penache and other smaller streams have cut deep, narrow valleys through these hills, and their courses are obstructed by many small rapids. The elevations in Coursol township are slightly above the general average, and consequently the southeast corner of the area is drained somewhat better than other sections. There are also a few low hills south of Sauvage Bay.

Because of the low relief, the drainage is poorly developed. There are several medium-sized lakes, the largest of which, Barry lake, has an area of about twelve square miles. Much of the country is swamp or muskeg. The lakes drain northward into Opawica and Waswanipi rivers, or southward into the Mégiscane, but all the water eventually reaches James bay by way of Bell and Nottaway rivers. Aux-Loutres lake drains only into the Mégiscane river, but Barry lake, although properly included in the southern drainage system, empties into the northern system as well.

The bed-rock is almost everywhere covered by glacial deposits from a few feet to a few tens of feet thick. Such outcrops as occur are widely scattered, and are difficult to find because of the absence of prominent hills. They are most abundant in the northwestern corner of Barry township, around Barry lake and Aux-Loutres lake; in the northern part of Coursol township; and north of Fortier river and around Fortier lakes, in No.118 township.

Travelling across country is tedious because of the thick cover of green timber, chiefly small spruce, and in many places the ground is strewn with windfalls. Recent windfalls, strewn over a patch as much as a mile wide and extending from Petit Lac Hébert to Windfall lake, are a serious obstacle to travel in that section.

GENERAL GEOLOGY

The consolidated rocks in the area belong to one of two major divisions, (1) folded and schisted rocks, believed to be of Keewatin age, and (2) a series of later intrusives. Exposures are so widely scattered that it is difficult to establish boundaries and relationships between the various formations within these two divisions, and the following classification must therefore be regarded as provisional.

Table of Formations

Pleistocene and Recent	Sand, gravel, and boulders
	Great unconformity
Post-Keewatin (?)	Granite, aplite, and pegmatite dykes Basic 'feldspar porphyry'; diabase Fine-grained albite granite Syenite, diorite, hornblendite Oligoclase granite and quartz-diorite gneiss Banded hornblende-rich gneiss
	Intrusive contact
Keewatin (?)	Hornblende schist and gneiss, amphibolite } May be partly Mica schist and gneiss } post-Keewatin Tuff and greywacke Tuff, breccia, agglomerate Acidic lavas, minor acidic intrusives Intermediate to basic lavas, and associated basic intrusives

Keewatin (?)

The oldest rocks in the map-area are folded and schisted lavas, tuffs, breccias, and greywackes, which resemble the Keewatin rocks in the Rouyn-Bell River area to the southwest. Although, as a matter of convenience, these rocks are referred to in this report by such specific names as andesite and greywacke, they are actually meta-volcanics and meta-sediments. They form a belt seven to twelve miles wide which crosses the centre of the area in a general east-northeast direction. The belt extends both east and west beyond the limits of the map-area, and is part of the Penache-de l'Aigle River belt mapped on the Opawica-Chibougamau sheet (1).

(1) Norman, G.W.H., Geol. Surv. Can., Prelim. Rept. 36-6, 1936.

These Keewatin-type rocks may be subdivided into two groups, a dominantly volcanic series, and one or more sedimentary series. At present, the stratigraphic relationships between these series are not clear, and all the folded and schisted rocks exposed in the area, whether volcanic or sedimentary, are considered to be of Keewatin age.

The sedimentary rocks have been grouped as one map-unit, but areas shown on the map as sedimentary contain both tuffaceous and clastic deposits as well as some volcanics. In places, the volcanics and greywackes have been converted into hornblende schists and amphibolites, which have been grouped as one map-unit, irrespective of their origin.

Volcanics and Associated Intrusives:

Andesite and basalt are the most commonly occurring types in this series, but flows of intermediate to acidic composition are locally abundant. Small bodies of volcanic tuff and breccia are interbedded with the lavas, but cannot be traced very far.

Most of the basic flows are fine-grained and more or less schistose, although a few occurrences of porphyritic andesite were noted with phenocrysts of feldspar as much as one quarter of an inch long. Massive, very weakly sheared, andesites are exposed in the northern and southern flanks of an open anticlinal fold along the northern part of Macho river and for a few miles down the Penache.

In nearly all their occurrences, the lavas are of uniform texture, with little variation in grain size from top to bottom. Flow structures, where they were present, have been almost completely masked by the metamorphism and deformation of the rock. Pillow structure is common in the basic lavas north of Fortier river and in a few exposures about one mile north of the southwest end of Barry lake. As a rule, the shape of these pillows is of little service as a basis for determining the tops and bottoms of the flows. Amygdaloidal andesite is well exposed at the narrows of Rouleau lake. Contacts between flows can be recognized in a few places, and generally, though not always, they are marked by a flow breccia. Throughout the area, the lavas contain small, scattered patches of soft, buff-coloured material. Some of these patches consist of rock fragments; others represent variolitic segregations.

The basic lavas were arbitrarily classified as andesite or basalt, depending upon the proportions of dark-coloured constituents present, but the rocks are so altered that the original minerals can seldom be recognized. Pale green hornblende (or tremolite), or else chlorite, is the chief constituent, and both minerals occur as large, frayed crystals with feldspathic material bounding them. In a few thin-sections, remnants of andesine or labradorite feldspar can be recognized, but as a rule the feldspar is clouded by alteration products, chiefly epidote and zoisite.

Light coloured, fine-grained acidic flows form a large proportion of the lavas around the shores of Aux-Loutres lake and that section of Macho river between the head of Aux-Loutres lake and the Abitibi county line, and others are exposed near Rouleau lake and on the north side of Chanceux lake, north of Lacroix lake. Flow structures are practically absent in these rocks, and

where strongly-sheared they are difficult to distinguish from siliceous tuffs.

The acidic flows are composed of amphibole and much-altered sodic feldspar, with diverse amounts of quartz and a little biotite. Some of the very light-coloured varieties have a cherty appearance, and under the microscope are seen to be composed of a fine-grained aggregate of quartz and clear, untwinned feldspar, probably oligoclase. This is very similar in appearance to the groundmass of the metamorphic rocks in the same region, and these cherty rhyolites, certainly recrystallized, may have attained their present character as the result of metasomatic processes.

A prominent bed of tuff-breccia is interbedded with the lavas on Macho river, about one and a half miles south of the surveyed county-line, and another fragmental bed, either breccia or conglomerate, may be seen about two miles northeast of the junction of Penache and Fortier rivers. The latter rock consists of abundant well rounded pebbles of rhyolite, an inch to two inches long, in a medium fine-grained groundmass of hornblende and chlorite, and is probably a water-sorted agglomerate.

Dykes and sills of diorite and gabbro are common in the greenstones, and in many places it is difficult to distinguish these intrusive rocks from the coarse-grained lavas, from which they differ very little in composition or degree of alteration. Their strike is parallel to that of the flows, and, like the latter, the intrusives are more or less schistose. They thus antedate the folding of the greenstones, and are possibly co-magmatic with the lavas.

Small dykes and sills, termed felsite and feldspar porphyry in the field, are associated with the rhyolites in the southern part of this belt of Keewatin volcanics. They closely resemble the rhyolites, but their age relationship to the flows could not be satisfactorily determined.

Tuff and Greywacke:

There are widely separated outcrops of greywacke (possibly tuffaceous), tuff, and, in lesser amount, lavas, across the northern part of the greenstone belt, in townships Nos. 117, 118 and 119. They apparently are part of a belt of sedimentary rocks which extends across the northern part of the area and into the adjoining area on the east. Very few outcrops of these rocks were found between Croft lake and the northward-flowing Saint-Cyr river, but the belt has been indicated on the accompanying map as being continuous, although it may, as in the area farther east, be cut off in one or more places by the granitic gneiss.

The contact between the volcanics and the sedimentary rocks is not exposed in the map-area. There is, however, no apparent discordance in strike between the two series, and, as coarse-grained clastics and conglomerated are absent, it is probably that the contact is gradational. At the western end of the northern part of the greenstone belt, the lavas on either side of the sedimentary belt face toward each other, thus indicating a synclinal fold in this region. This relationship could not be checked elsewhere in the area, but if this interpretation of the structure is correct, then the sedimentary series is younger, though conformable with, the volcanics.

The tuff and greywacke of this series are fine-grained,

dark to light-grey, finely banded rocks, with a secondary banding or foliation that has, to a large extent, obliterated the primary features of the rock. As a rule, the tuff and greywacke are so similar in appearance that they cannot be distinguished from one another with any degree of assurance. The darker-coloured varieties of both are composed of hornblende, clouded plagioclase feldspar, and quartz, whereas the lighter-coloured types are more siliceous, with biotite and white mica in place of the hornblende.

Greywacke, partly tuffaceous, and siliceous tuff are exposed in a few places along the southern side of the greenstone belt, from Aux-Loutres lake to the eastern boundary of the map-area, but they do not form any well defined band such as that described above. The most persistent occurrence of these rocks is in a small, rudely lenticular area, extending from Aux-Loutres lake to the southwest end of Barry lake. The rocks have been recrystallized and are now hornblende schist and fine-grained hornblende gneiss, but the sedimentary nature of the rock is still apparent in many outcrops. These meta-sediments appear to be interbedded with the volcanics.

Siliceous tuffs are exposed around Rouleau lake and Lac Morissette, and also at the northwest end of Chanceux lake. They are finely banded, buff-coloured rocks, composed of quartz, altered sodic feldspar, and sericite.

Hornblende Schist and Gneiss; Amphibolite:

Medium to coarse-grained metamorphic rocks, rich in hornblende and mapped as amphibolite or hornblende schist, are common in the western half of the greenstone belt, particularly in those areas adjacent to the granitic masses. The origin of these rocks is known from examination of some outcrops concerning whose original nature there can be no doubt, but in many occurrences the primary features of the rocks have been destroyed, and their mineralogical composition affords little clue to their original nature. These metamorphic rocks have been derived indiscriminately from basic lavas and intrusives, tuffs and greywackes.

The division into amphibolite and hornblende schist is largely arbitrary. Both are dark-green rocks ranging in texture from a uniform fine-grained type, containing abundant tiny crystals of green hornblende, to a coarse variety containing amphiboles half an inch long. Intermediate varieties are characterized by elongated crystals of hornblende in a fine-grained matrix of quartz and feldspar. The hornblende schists differ little from the amphibolites in composition, but have a more foliated structure and as a rule contain a greater proportion of hornblende.

Under the microscope, both types are seen to consist of abundant bluish-green amphibole, quartz, and feldspar. The proportions of these minerals are very diverse: some specimens consist almost entirely of hornblende, whereas others contain as much as fifty per cent of light-coloured constituents. Other minerals commonly present in lesser amount are biotite, chlorite, garnet, calcite, and epidote. Augite was seen in one thin section. The feldspar is clear and, as a rule, untwinned, so that it resembles quartz, and it is difficult to estimate the relative amounts of the two minerals present. The feldspar, where its properties can be determined, is chiefly oligoclase, although albite and andesine were noted in a few thin sections.

The best exposures of amphibolite are on the property

of the Barry Lake Mining Company, at the southwest end of Barry lake, where they have been derived from pillowed lavas, either basalt or basic andesite, by a process of recrystallization and metasomatism. The texture of the rock is exceedingly variable, the coarsest-grained, and most altered, type occurring in or adjacent to the pillow rims, with a gradual fading in intensity of the alteration away from the rim, toward both the interior of the pillow and the matrix of the flow. The finer-grained parts of the rock, which most closely approximate the original lava, are equigranular hornblende schists, composed chiefly of hornblende. The coarser-grained parts are porphyroblastic in texture, with large crystals of hornblende in a quartz-feldspar groundmass. Intermediate facies show the growing crystals of hornblende filled with inclusions of the groundmass, giving the rock a sieve-like structure.

Hornblende schists are common in the pillowed lavas near Penache river, at a point about one mile north of Fortier river. The intense deformation of the pillow rims here suggests that the hornblende schists were formed under conditions, of stress, in contract to the mode of origin of the amphibolites. Locally, the hornblende has been replaced by chlorite, the result of retrograde metamorphism.

Along the shores of the Fortier lakes, the hornblende schist has been intruded by granite and pegmatite as lit par lit injections and irregular masses. The surface of the rock has a fine, corrugated appearance due to the differential weathering of hornblende-rich and feldspathic layers. The original nature of the rock is unknown.

The tuffaceous greywacke east of the Fortier lakes has been altered to a well-foliated hornblende schist, slightly more feldspathic in composition than the schist near Fortier river and lakes. Around Aux-Loutres lake there are numerous outcrops of fine-grained hornblende schist or gneiss, containing as much as fifty per cent by volume of quartz and feldspar. These rocks are harder, and more massive in appearance, than any of the metamorphic rock-types found elsewhere in the area. The primary features of the rocks have, to a very large extent, been obliterated, but in part at least they are of sedimentary origin.

The basic dykes and sills associated with the lavas are also susceptible to alteration. They are rather massive, medium-grained rocks, consisting of large hornblende crystals in a fine-grained groundmass of quartz and feldspar. The hornblende is in the form of short, stubby crystals, and has probably replaced augite. The original texture of the rock is preserved to a much greater extent than is that of the altered lavas, and the decrease in grain-size toward the walls of the dykes can still be seen.

Micaceous Schist and Gneiss:

Rocks of this type are uncommon in the area. A few outcrops of biotite-hornblende schist occur on the southern shore of Bérubé lake, and are the altered equivalent of the greywacke in that region. About one mile southeast of the southern end of Bailly lake, there are a few exposures of micaceous gneiss, composed of biotite, hornblende, quartz, and feldspar. This rock differs from the surrounding gneiss and may represent sedimentary material that has been modified by the gneiss. At one place, the micaceous gneiss was seen to be cut by small dykes of reddish

granite. The age of this micaceous gneiss is not definitely known, but it is included in this section because of its similarity to the Keewatin-type schists.

Post-Keewatin(?) Intrusives

The belt of Keewatin-type rocks is bounded on both the north and the south by granite gneiss, and a small stock of granite splits the belt into two parts at the western border of the area. In addition to these major bodies, there are within the area numerous smaller intrusive masses and dykes.

Barry Lake Gneiss:

Light grey, coarse-grained gneiss underlies the greater part of Barry, Bailly, Lacroix, and Coursol townships. The rock is composed of diverse proportions of quartz, biotite, and oligoclase or andesine feldspar, and hornblende is locally a prominent constituent and may entirely take the place of the biotite. The feldspar is only slightly altered, chiefly to epidote and zoisite, and in general the rock has a fresh appearance. Although commonly referred to as granite gneiss, the rock in its several occurrences would be more correctly described as quartz-diorite gneiss or oligoclase-granite gneiss.

The contact with the greenstones is exposed only in two places, and at both the granite intrudes the greenstones. Elsewhere, the intrusive relationship is established by the metamorphism of the adjacent greenstones, and by the presence in the latter of granite and pegmatite dykes. At the southwest end of Barry lake, the contact zone consists of greenstone injected by a series of granitic dykes, and, near the shore of the lake, this gives place quite abruptly to a coarse-grained gneiss. Another contact is exposed on the south shore of Bérubé lake, where a long tongue of micaceous schist (altered greywacke) projects into the granite. On the northern side of this tongue, the contact is sharp and the schist dips beneath the gneiss; on the southern side, numerous small dykes and irregular masses of granite intrude the altered greywacke.

The foliation of the gneiss is due to a rudely parallel orientation of the biotite, and, to a lesser extent, of the grains of quartz and feldspar. The texture is in general gneissose, but, in a few thin-sections, undulatory extinction of the quartz grains, and the broken twin lamellae of the feldspars, show that the rock has been deformed after its consolidation. Locally, the gneiss has been more severely crushed, and thin sections show a 'mortar' structure.

Along the south shore of Barry lake, west of the narrows between it and Bailly lake, are a few outcrops of much weathered reddish gneiss, composed of quartz, sodic feldspar, biotite, muscovite, and a little microcline. Similar reddish gneiss occurs southeast of Bailly lake. The contact between this microcline-bearing gneiss and the grey gneiss is not exposed, but the two types are probably part of one intrusion.

Numerous dykes of granite, pegmatite, and aplite intrude the gneiss, but they are too small to be considered as separate map-units. They are closely related in age and origin to the gneiss they intrude. A small dyke composed almost entire-

ly of small, shiny-black crystals of hornblende cuts the granite at the southwest end of Sauvage bay, and segregations of hornblende-rich material were seen in the gneiss at this locality.

Pink, fine-grained granite, aplite, and porphyry are of common occurrence as dykes and small stocks in the gneiss and greenstones around the southern end of Aux-Loutres lake. They are composed chiefly of quartz and feldspar (oligoclase or albite), but in places contain sufficient epidote to give the rock a greenish tinge. A pink albite granite, with a porphyritic appearance, forms a step cliff at the southwestern end of Aux-Loutres lake, adjacent to a fault which appears to displace the granite-greenstone contact. Under the microscope, the rock is seen to be severely crushed, and has a well developed mortar structure, presumably due to the faulting. Faessler (1), in mapping the area to the south, noted the occurrence of soda aplites and albitite along a fault that extends south from Aux-Loutres lake and it is likely that these and the rocks just described have a common origin. Minute quantities of molybdenite have been found in some of these intrusives at the southern end of Aux-Loutres lake.

Northern Gneiss:

The northern border of the map-area is underlain by grey, coarse-grained gneiss, intrusive into the rocks of Keewatin type. In its general appearance, it resembles the Barry Lake gneiss, but the mineralogical composition is more variable. Although the majority of exposures are oligoclase granite, with abundant hornblende and little biotite, there are some of hornblende diorite, quartz-diorite, and syenite. All of these rocks are probably part of one intrusive mass. The feldspar is chiefly oligoclase, more or less altered to a fine-grained aggregate of epidote, zoisite, and sericite. Albite occurs in some of the rocks, and microcline is a minor constituent of a few of the thin sections examined. Numerous small dykes of pegmatite, aplite, and granite intrude both the gneiss and the adjacent greenstones.

The contact zone between this body of gneiss and the greenstones is exposed on the northeast flank of a large hill about one mile west of Croft lake. On the greenstone side, the zone is about five hundred feet wide and consists of much-altered greenstone, now hornblende schist and gneiss, cut by many lit par lit injections of granite and pegmatite. This gives place toward the south first to hornblende schist and then to chloritic greenstones.

Foliation is less distinct in this gneiss than in the Barry Lake gneiss, although this may be due partly to the small amount of biotite in the rock. In a few places, apparently massive granite was found on closer examination to have a distinct foliation, made evident by the parallel orientation of the feldspar grains. The foliation is parallel to the border of the mass, and is either vertical or dips steeply south. Throughout most of this section of the map-area, the outcrops of gneiss and greenstone are so widely separated that it is not possible to determine whether the intrusion is or is not conformable in structure with the greenstones, but it appears to be conformable, at least in that part of the mass west of Fortier river.

The only exposure of granitic rock in the northeast corner of the area is a coarse-grained banded gneiss that crops

(1) Que. Bur. Mines, Ann. Rept., Pt. C, 1935.

out on the north side of a small stream flowing from Lac Blondin into the northward-flowing Saint-Cyr river. In this rock, bands of dark-coloured hornblende diorite, as much as five feet wide, alternate with light-coloured granite and a little garnetiferous granite. Some of the granite bands contain sufficient carbonate to cause the rock to weather a light-buff colour. Here and there are irregular-shaped patches of dark chloritic material, which appear to be remnants of green schists. The gneiss as a whole has the appearance of being of composite origin, and probably represents part of a wide 'contact zone' between the greenstones on the south and the intrusive rocks. A few miles northeast of the Fortier lakes, a low ridge, with a general northeast trend, is composed of dark-coloured hornblende diorite. This rock is quite fresh in appearance and of uniform coarse-grained texture throughout. Its contact with the surrounding gneiss is not exposed, but it is thought that the diorite intrudes the gneiss.

Around the shores of the Fortier lakes, numerous dykes of pegmatite, granite, syenite, and diorite intrude the greenstones near their contact with the gneiss. A small and isolated outcrop of a much-weathered ultrabasic rock on the north side of the lake is possibly related to these dykes, although it may belong to an earlier period of igneous activity.

Souart Stock:

What is here termed the 'Souart stock' crops out in a few places on the extreme western side of the map-area, near the surveyed county-line. The rock is a light coloured, coarse-grained granite, slightly gneissic in structure, and as a rule it is much weathered. The feldspar - albite-oligoclase - is altered to an aggregate of sericite and calcite, and the biotite is partly altered to chlorite. The shape of the mass could not be determined, but its nature and location suggest that it is an off-shoot of the Barry Lake gneiss, and as such it may be of interest to prospectors.

Minor Intrusives:

Small dykes of granite, diorite, and gabbro are common in the greenstone belt, as has already been mentioned in discussing the Keewatin-type formations and the granitic gneisses. A series of diabase and gabbro dykes, with some of dark-coloured 'feldspar porphyry', occur at the head of Macho river and along the upper reaches of the Penache. These rocks are fine-grained with almost glassy selvages, and have a fresh and massive appearance in hand specimen. However, thin sections show that they are much altered and faintly foliated. The chief constituents are hornblende, chlorite, epidote, zoisite, calcite, and altered plagioclase feldspar. In some of the porphyries, the feldspar is sufficiently clear to permit determination of its optical characters, which are found to correspond generally with those of andesine, or, in a few of the sections examined, with albite or oligoclase. These dykes intrude the Keewatin-type greenstones and may be a series related to the Souart stock, the nearest intrusive of considerable size. A few small dykes of syenite, diorite, and gabbro were noted in various places throughout the greenstone belt, but they are of minor importance.

Age Relationships of the Gneisses:

The relative ages of the gneisses, and their rela-

tionship to the structure of the country rock, are problems which would require a type of mapping and study not necessary for the purposes of this report. Inasmuch as the two main bodies of gneiss are separated by a belt of greenstone, their relative ages cannot be determined within the limits of the present map-area. Nevertheless, the two masses have certain features in common that suggest very strongly that they are closely related, both in age and in origin.

Both the Barry Lake gneiss and the Northern gneiss were evidently intruded under stress, and since, as far as is known, only one orogenic convulsion has affected the area, it is reasonable to assume that their intrusion took place during the closing stages of this deformation.

The mineralogical composition of the granites may afford some criteria assisting in their correlation. In all the thin sections of the granites examined, the feldspar is predominantly oligoclase or albite, and potash feldspar, either orthoclase or microcline, is very rare, except in certain of the more leucocratic types, and then is present only in small amount. Thus the granites appear to be relatively rich in soda, a feature characteristic of the Algoman granites of the Rouyn-Bell River region (1). Also, MacKenzie (2), has reported albite-rich granitic rocks in the Pusticamica Lake area, which he considers to be of Algoman (post-Temiscamian) age. The granitic gneisses of the Pusticamica lake area are probably an extension of the Northern gneiss of the Barry Lake area. It is therefore possible that the intrusives of the Barry Lake area are genetically related to these albite-rich rocks of the Rouyn and other adjacent areas, and hence that they may be of approximately the same age, i.e., Algoman.

It should be pointed out, however, that the granites in the present map-area differ somewhat from the Algoman soda-rich granites of other areas in Quebec and Ontario. The following points of difference are mentioned because it is possible they may have some bearing, as yet unknown, to the economic possibilities of the area. First, the granites of the Barry Lake area are much foliated; and second, although potash feldspar is practically absent, the predominant feldspar is oligoclase and not albite. Moreover, there is little albitization of the country rock, and oligoclase is the stable feldspar in the metamorphic rocks.

Pleistocene and Recent

Practically all the unconsolidated deposits of the area are of glacial or fluvio-glacial origin. Ground moraine, consisting of silt-grade material with intermixed boulders, covers most

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(1) Cooke, H.C., James, W.F., and Mawdsley, J.B., Geology and Ore Deposits of the Rouyn-Harricanaw Region, Que.; Geol. Surv. Can., Memoir 166, 1931.
Hawley, J.E., Gold and Copper Deposits of Dubuisson and Bourlamaque Townships, Abitibi County; Que. Bur. Mines, Ann. Rept., Pt. C, 1930.
Gussow, W.C., Petrogeny of the Major Acid Intrusions of the Rouyn-Bell River Area, Northwestern Quebec; Trans. Roy. Soc. Can., Sec. IV, 1937, pp.120-161.

(2) MacKenzie, G.S., Pusticamica Lake Map-Area, Abitibi District; Que. Bur. Mines, Ann. Rept., Pt. C, 1934.

of the bed-rock, although in the northern parts of the area, particularly north of the Fortier lakes and close to the series of small lakes north of Croft lake, fine sand, free from boulders, is very common and forms several large hills and numerous extensive plains. Eskers and elongated boulder ridges are a common feature in Lacroix and Coursol townships, and one prominent esker, about 50 feet high, can be followed from the southern end of Lac aux Loutres to the centre of township No.118.

This covering of glacial deposits has so disarranged the pre-glacial drainage pattern that few of the lakes and streams occupy their old positions. Exceptions to this general rule are Aux-Loutres lake and the upper stretch of Macho river, which appear to occupy pre-glacial channels, probably established along fault lines. The northwestern shore of Barry lake follows closely the contact between the granite and the greenstones, and the Fortier lakes occupy a similar position on the northern side of the greenstone belt. All the other lakes are 'drift bound' and owe their shape to the configuration of the surrounding moraine. The two major rocky hills in the area are elongated parallel to the structure of the underlying rock and are inclined to the trend of the topographic features of most of the area.

With the exceptions noted above, the lakes and streams are elongated in a general direction N.20°E., roughly parallel to the direction of ice movement as determined from observations of glacial striae. This elongation is probably a result of the ice movement, but it may possibly be related to some fracture system developed in the underlying rock. In Coursol township, the structural trends are nearly parallel to the direction of ice movement, and, as a result, a marked linear character features the topography. It is probable that the pre-glacial topography consisted of ridges and valleys elongated parallel to the foliation of the bed-rock.

Post-glacial erosion in the area has been very slight, and the rivers have cut down to bed-rock in very few places. Atmospheric weathering of the bed-rock has been negligible, sufficient only to etch out certain less resistant structures in the greenstones, and to cause a certain amount of surface alteration in some of the carbonatized and mineralized zones that occur in the area.

STRUCTURE

The rocks of Keewatin type have been closely folded. The strike of the axial planes of the folds changes gradually from N.50°E. in the western end of the belt to S.80°E. in the eastern part, and then swings abruptly southward at the extreme southeastern end. The dips are steep throughout most of the area, but along Macho and Penache rivers, dips from 40° to 60° both north and south indicate an 'open' anticlinal fold, the axis of which crosses Macho river near its northern end. Elsewhere, the structure if known only from scattered observations of the directions of flow tops, few of which observations can be considered very reliable. There is a synclinal axis in the vicinity of Fortier river, and indirect evidence, i.e., the arching of the flow lines in the Barry Lake gneiss, suggests that there is a synclinal fold between the Macho River anticline and the gneiss. If this interpretation is correct, then the greenstone belt is a synclinorium, flanked by gneiss.

The schistosity of the greenstones is parallel to the

bedding planes, wherever the latter could be determined, and schistosity parallel to the axial planes of the folds is not a characteristic of this area. In numerous places, a short distance north of Aux-Loutres lake and Barry lake, the greenstones are locally strongly sheared. This shearing is parallel to the regional schistosity and is most marked along, or adjacent to, contacts between formations of contrasting character, such as andesite and rhyolite. Some of these shear-zones are as much as fifty feet thick.

No large fault was seen in the area, but the apparent displacement of the granite-greenstone contact at the south end of Aux Loutres lake suggests that there is a north-striking fault of considerable displacement in this region. Faessler (1) already has indicated the possible existence of this fault, and has indicated that it possibly continues for at least five miles south of the Barry Lake map-area. The volcanics along Macho river, south of the county-line, are displaced by a small fault which strikes approximately north, paralleling the course of the river.

Little is known of the internal structure of the Northern gneiss, because very little of this formation is exposed within the map-area. The Barry Lake gneiss, however, has a well-defined planar structure, due to the sub-parallel orientation of the inequidimensional constituents of the rock. The foliation is rudely parallel to the border of the intrusive mass, and, because of this, it is probable that the foliation is a flow structure, developed in the consolidating rock. Near the border of the gneiss, the foliation is vertical and parallel to the schistosity in the greenstones, but away from the greenstone the foliation becomes less regular in strike and less steep in dip, until, in the southwestern corner of the area, the foliation is horizontal. Although the foliation is thought to be essentially a primary structure of the granite, there is evidence to show that, at least locally, the rock has been sheared and crushed after consolidation. In some thin sections of the rock, the quartz and feldspar grains are crushed, and the quartz commonly shows undulatory extinction. It is therefore probable that the foliation has been modified somewhat by later stresses, but that these have merely accentuated the earlier structures, rather than destroyed them.

The parallelism between the structure of the gneiss and that of the greenstones, and the arching shown by the flow planes in the intrusive, suggest that the intrusion was concordant, and that the roof of the intrusive was not far above the present surface. Moreover, the striking absence of any inclusions of country-rock in the gneiss is interpreted to indicate that the intrusion took place with little disruption of the country rock. These facts may be best explained by assuming that the granite was intruded concordantly along an anticlinal fold.

ECONOMIC GEOLOGY

General Statement

Up to the present, gold is the only metal that has been found in the area in deposits which give any promise of commercial size and grade. The occurrences may be divided into two groups, (1) quartz veins and (2) mineralized shear-zones.

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(1) Que. Bur. Mines, Ann. Rept., Pt. C, 1935.

Numerous quartz veins occur in the greenstones, but few are large enough to merit prospecting. They consist of white or bluish quartz, with some calcite and brownish ankerite. Tourmaline was noted as a minor constituent of a few veins. The metallic mineralization consists of small amounts of pyrite and chalcopyrite, and low gold assays have been reported from two occurrences. In general, prospecting in the region has shown that such veins are apt to be small and discontinuous.

Mineralized shear-zones occur chiefly along the southern margin of the greenstone belt, from Aux-Loutres lake to the northern end of Barry lake, where adjustments between the intercalated acidic and basic rocks have caused the development of local shear-zones. Several such zones of considerable width have been found, and from some of them low gold assays have been reported. The characteristic feature of these zones is the intensive carbonatization and silicification to which the rock has been subjected. Quartz, calcite, and ankerite are abundant, either as veinlets, or, more often, partially replacing the rock. Both the quartz and the carbonate are of more than one age, and in general the carbonate alteration has preceded the silicification. Tourmaline occurs in some of these zones, and is a major constituent in the one seen at the north end of Aux-Loutres lake. Pyrite, with lesser amounts of pyrrhotite, chalcopyrite, and other sulphides, is disseminated through the rock. Prospectors have reported seeing small specks of gold in some of these zones. Small amounts of sulphides occur in most of the shear-zones examined, but considerable amounts were seen only in those that had been fractured and the fractures filled by quartz. The gold, as far as is known, is associated with this late quartz.

The scarcity of outcrops, as well as the heavy cover of green timber, is a serious handicap to prospecting or geological exploration, and prospecting must of necessity be confined to those parts of the area in which exposures are relatively abundant; that is, the section north of Aux-Loutres lake and Barry lake, which also appears to be the most favourable ground for the occurrence of metallic mineralization. The central part of the greenstone belt is practically devoid of outcrop, and the northern margin is composed largely of hornblende schists that do not appear to be favourable for prospecting. The areas underlain by gneiss are likewise unfavourable, although occurrences of gold have been reported in the granite in Buteux township (1), about ten miles east of this map-area.

Description of Properties

Rouleau Mines, Limited (Barry and No.118 townships)

This property comprises sixty unsurveyed claims extending northward from Barry lake in Barry and No.118 townships. They are numbered as follows: A-58282-84, 82572-86, 82590-92, 82602-14, 82619-25, 82628-31, and 82883-97. The Company originally held a block of eighty claims, staked in 1935 for S.M. Rouleau and associates, but in 1939 twenty of these were transferred to the newly formed Mégiscane Mining Corporation, whose property is described on a later page.

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(1) Freeman, B.C., Buteux Area, Abitibi County and Abitibi Territory; Que. Bur. Mines, P.R. No.142, 1939; also Geol. Rept. 15, 1943.

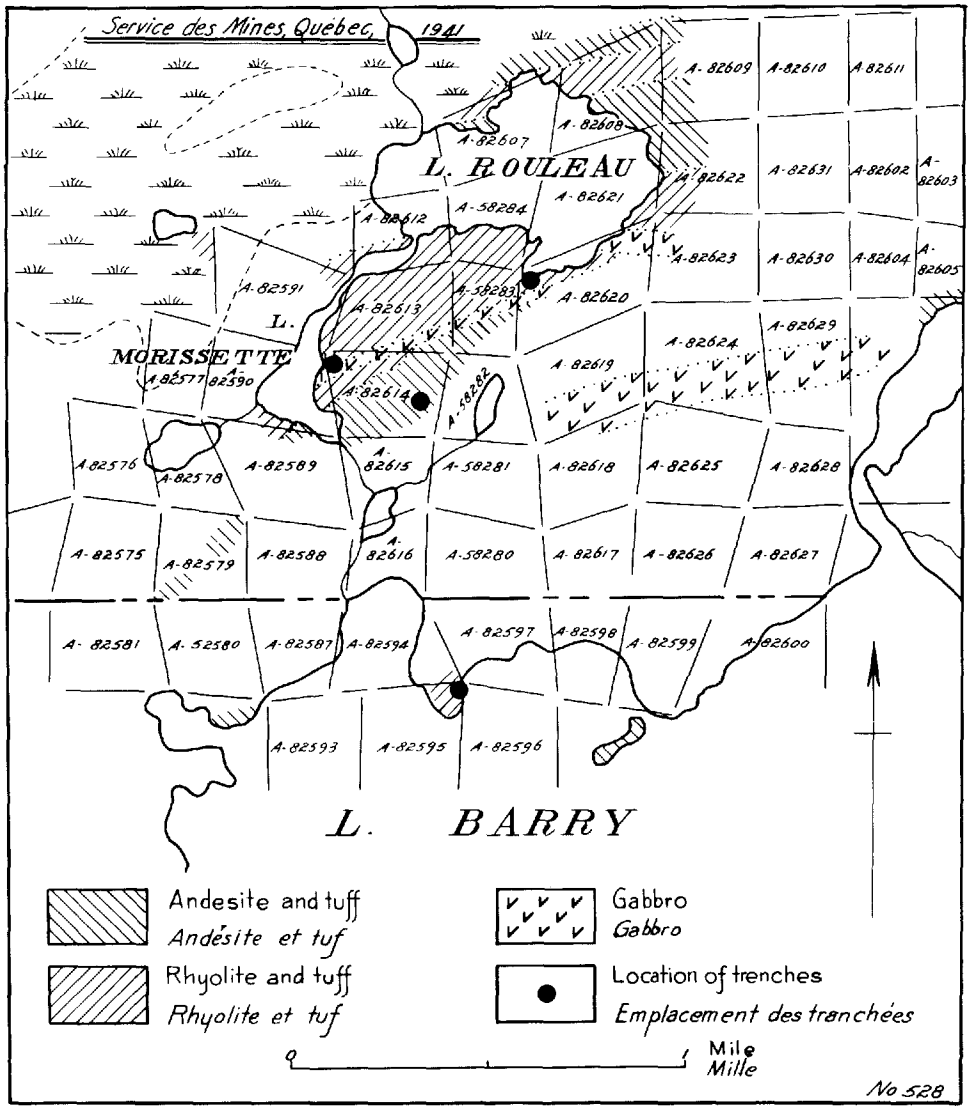

Figure 1.-Sketch of geology around Rouleau lake

The claims have been explored by means of trenches, and during the winter and spring of 1939 a magnetometer survey was made of part of the property.

The general geological features of the property and the location of the various discoveries are shown in Figure 1. Alternating bands of acidic schists (rhyolite and tuff) and basic volcanics cross the property in a general direction N.70°E., dipping steeply north.

The first gold discovery was made near the northwest corner of claim 82620, on the shore of Rouleau lake. Here, a mineralized zone occurs at the southern margin of a wide band of highly sheared siliceous tuff. The zone has been exposed in three cross-trenches (N.30°W.) over a length of 350 feet, and it has a maximum width of 50 feet (Figure 2). The rock of the zone itself is but weakly sheared. It weathers rusty-brown, but on the fresh surface it is greyish and resembles rhyolite. It consists chiefly of quartz and ferruginous carbonate, with considerable disseminated sulphides. The contacts with the adjoining

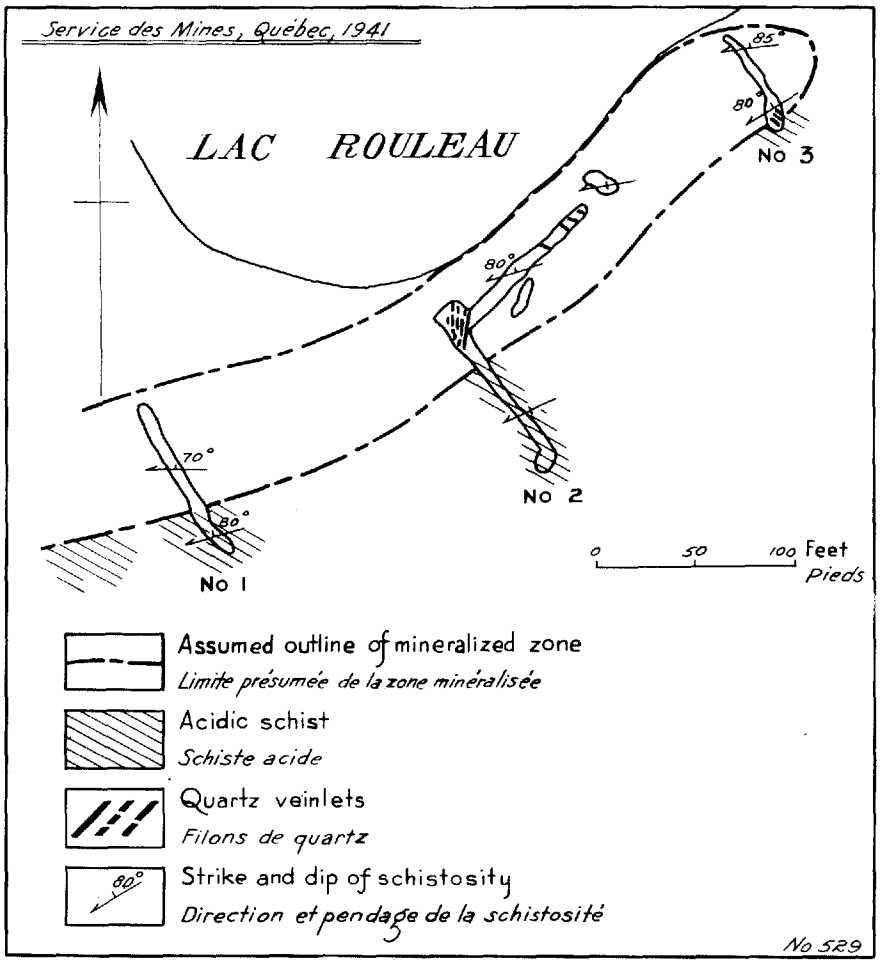

Figure 2.-Sketch of trenches at Rouleau lake

schist are gradational and the relationship between the two rock-types is not evident. Additional trenches made too late in the season to be mapped by the writer confirm the tentative outline of the mineralized zone indicated on the sketch.

The 'zone' is cut by numerous, small quartz stringers, striking in a general north-south direction. These veinlets, most abundant in the central or No.2 trench, contain much fine-grained tourmaline, which is visible only under a microscope. The metallic minerals, which also are most prominent in the No.2 trench, comprise mainly pyrite, with lesser amounts of pyrrhotite, chalcopyrite, arsenopyrite, and magnetite. Visible gold has been noted in some of the veinlets, The metallic mineralization appears to have been associated with the later quartz (the N.-S. stringers) and to have followed the initial alteration of the rock by the quartz- and carbonate-bearing solutions.

The following assay results of channel sampling have been taken from a Company report:

Trench No.1 ..... $2.85 in gold per ton, over 34.0 feet
Trench No.2 ..... $2.24 in gold per ton, over 32.6 feet
Trench No.3 ..... Not sampled

A number of higher assays have been reported from individual samples. A two-pound grab sample, taken by the writer from the No.2 trench and assayed in the laboratories of the Bu-

reau of Mines, gave $2.03 in gold per ton. Further exploration of the zone has been planned by the Company.

A magnetometer survey of the property showed high magnetic anomalies in the vicinity of this zone, due probably to the content of magnetite in the rock. A second area of high anomalies was found some distance to the east, but trenching here revealed only a carbonatized basic flow or dyke. Since such rocks are fairly common in the region, care must be taken in the interpretation of magnetic surveys.

The westward extension of the siliceous tuff band is exposed on the eastern side of Lac Morissette, on claim 82614. Shearing and carbonate alteration are pronounced on the southern border of the tuffs, and numerous white to dark-blue quartz veins cut the schist, most of them parallel to the schistosity, but a few obliquely. Several trenches have exposed highly sheared tuffs with sparsely disseminated pyrite, but sampling of these indicated only traces of gold.

Near the centre of claim 82614, a heavily carbonatized zone has been exposed by stripping. The rock is dark-green to greyish-green andesite, partially replaced by a network of quartz and ankerite stringers, giving the rock a brecciated appearance. There is a little pyrite and chalcopyrite in the rock and in the veins, and low gold assays have been reported. Where exposed, the zone is 15 feet wide, but it dies out rapidly along the strike.

Other sheared and carbonatized zones were seen on the property, one at the northeast corner of Rouleau lake, and another on the shore of Barry lake, west of the largest of the islands in the northern part of this lake, but no work has been done at either of these localities.

Mégiscane Mining Corporation (Barry, Bailly, and No.118 townships)

This Company holds twenty claims, formerly part of the Rouleau Mines property, at the northwest end of Barry lake. The claims are numbered as follows: A-58280-81, 82587-89, 82593-601, 82615-18, and 82626-27.

Little work has been done on the property. Trenching at the northeast corner of claim 82595, on the shore of Barry lake, has exposed a narrow quartz vein in acidic schist. Low gold assays have been reported from here, but the workings had fallen in at the time of the writer's visit, so that little could be seen.

Barry Lake Mining Company, Limited (Barry township)

As originally staked in 1935, this property consisted of fifty claims in Barry township, at the west end of Barry lake. At present, the Company holds fifteen of these claims, numbered as follows: A-60631-32, 60638-44, and 60647-52.

During the summers of 1936 and 1937, the property was intensively prospected by means of trenching and stripping. Three gold discoveries were made, none of which, however, proved to be of commercial grade. Since 1937, the property has been idle.

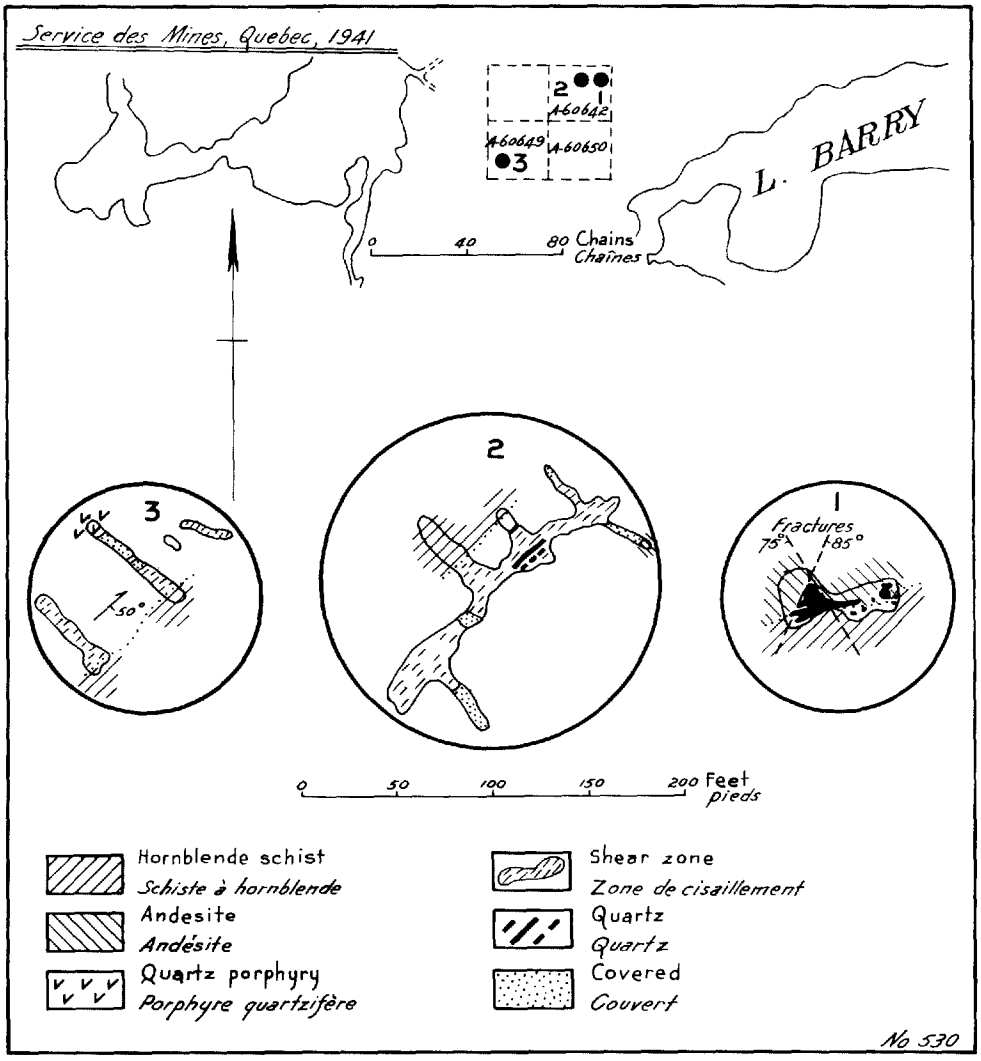

Figure 3.-Sketch of trenches, Barry Lake Mining Company's property

The first discovery, No.1 of Figure 3, known as zone No.1, is at the northeast corner of claim 60642. Here between fine-grained andesite (on the north) and medium-grained gabbro, now hornblende schist (on the south), a quartz body of irregular shape, from a few inches to 15 feet wide, has been exposed for a length of 50 feet, with general strike N.70°-80°E. The main part of this body is rudely triangular in outcrop, being bounded on the west and east by prominent fractures that cut across the andesite-gabbro contact at, respectively, N.30°E. and N.30°W. The quartz is traversed by numerous fractures and through it are distributed pyrite and chalcopyrite, in general sparsely but locally in fair concentration. It is reported that free gold has been seen in the chalcopyrite, but, according to information furnished by the Company, sampling has indicated that the vein material is not of commercial grade.

Zone No.2 (Figure 3) is in the same claim as No.1, being west of it, near the middle of the northern boundary of the claim. It is a highly sheared and silicified zone in rock

that was originally dacite or andesite, and it has been uncovered for a length of 150 feet and a width of 50 feet. The schistosity strikes N.60°E. and dips 70° south. The rock is finely banded in alternating dark and light streaks, the former due to the segregation of small hornblende crystals, and it contains numerous poorly developed crystals of pink garnet. Although silicification is the chief alteration, some brownish ankerite may be seen. A few small, barren quartz veins cut the schist, through which, also, pyrite is disseminated, locally in considerable amount. It is reported that sampling of this zone showed it to contain only traces of gold.

Zone No.3 (Figure 3) is in the northwest corner of claim 60649. The northeast corner of this claim coincides with the southwest corner of claim 60642, in which zones No.1 and No.2 occur. Four trenches here have exposed a mineralized zone for a length of 100 feet and an average width of 40 feet. The rock, buff in colour, is strongly sheared and is bounded on one side by andesite and on the other by hornblende schist, probably an altered gabbro. The schist is too highly altered to permit determination of its original nature, but a short distance to the east there is exposed a small body of quartz porphyry, which is very similar to the schist seen in the trenches, and it is probable that this schist is the schisted and altered equivalent of the porphyry. Small quartz and carbonate stringers cut the schist, which contains also some disseminated pyrite. It is reported that sampling of the zone gave no results of interest.

Other Operations

A group of fifteen claims was staked in January, 1939, at the north end of Aux-Loutres lake. Stripping has exposed a band, 50 to 100 feet wide, of bluish, fine-grained schist, carrying scattered pyrite and chalcopyrite. The schistosity strikes N.60°E. and dips 60° south. This schist, which is an altered tuff-breccia bordered on the north by siliceous tuffs and on the south by highly sheared andesite, may be traced westward nearly to the boundary of the map-area. Locally, the rock is strongly sheared and carries much pyrite. A grab sample taken by the writer near the eastern end of the workings at Aux-Loutres lake, and assayed in the laboratories of the Bureau of Mines, gave only a trace of gold.

During June of 1939, a trench was opened across a small point that juts out from the northwest shore of Lac Chanceux, in the north-central part of Lacroix township. "The trench is slightly more than 100 feet long and cuts across the strike of the formations. Most of the rock exposed in it is well bedded tuff, striking N.65°W. and dipping vertically, but about midway along its length is a carbonatized zone, 10 feet wide, and near its south end the tuff is cut by a quartz vein, 3 feet wide. At the northern end of the trench, on the lake shore, there is a 20-foot-wide outcrop of white, crinkled, talcose schist, and similar rock is exposed at the south end. The rock outcropping on the lake shore about 30 feet south of the end of the trench is andesite containing a large amount of disseminated pyrite. Assays of samples from the showings on this property are reported to have yielded negligible values in gold" (1). Claims were staked at this point on June 16th, 1939, by A. Nault, but, apparently, they were not registered as there is no record of them at the Government offices at Quebec.

(1) Freeman, B.C., Buteux Area; Que. Bur. Mines. P.R.142, 1939, pp.9-10.

A few occurrences of disseminated pyrite were seen in silicified tuff and greywacke along the northern side of the greenstone belt, as for example at the first rapids in Fortier river and on the east shore of Croft lake. None of these appear to have been explored by prospectors. An irregular-shaped quartz vein near the northern end of Macho river has been uncovered by prospectors, but it contains only negligible amounts of sulphides.

Much of the ground along the north shore of Barry lake has been staked, but, beyond superficial prospecting, no work has been done on any of these claims. No metallic mineralization was noted in these claims during the course of the summer's work.

Although, up to the present, no commercial mineral deposits have been developed in the map-area, the occurrence of gold at Rouleau lake justifies further exploration, in particular along the southern edge of the greenstone belt near its contact with the Barry Lake gneiss.

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