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GEOLOGICAL REPORT 47

BACHELOR LAKE AREA

ABITIBI-EAST COUNTY

by

W. W. Longley

QUEBEC

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BACHELOR LAKE AREA

Abitibi-East County

by W. W. Longley

INTRODUCTION

Location of Area

The Bachelor Lake map-area lies northeast of Senneterre, a town on the Canadian National Railways' line from Quebec and Montreal to Cochrane. The distance from Senneterre to the southwestern corner of the area is about 85 miles, and to Bachelor lake about 95 miles. The area comprises approximately 250 square miles, extending from about four miles south of latitude 49°30' to latitude 49°45', between longitudes 76°00' and 76°15'. Lesueur and Boyvinet townships, the eastern parts of Nelligan and Bellin, the southern margin of Montalambert, and the southeast corner of Larouvillière, are included in the map-area.

Means of Access

The recommended means of access to the area is by hydroplane from Senneterre. Bachelor lake provides excellent landing for 'planes, and several stretches of Waswanipi river are suitable also. None of the other lakes is large enough for the take-off of a loaded 'plane, but small 'planes may land and take off on Auger lake. With completion of the railway line from Barraute, eighteen miles westward from Senneterre, to Kiask falls on Bell river, and improvement and extension of the Madeleine (Rose) Lake road, it is expected that there will be easy access to the area by ground routes in the near future.

The area may be reached by water routes that lead to Waswanipi lake and thence up either Bachelor or Waswanipi river. Of the two canoe routes from Senneterre to Waswanipi lake, the one generally used, and the one recommended for loaded canoes, is down Bell river to Mattagami lake, then eastward along the lower part of Waswanipi river and through Olga and Gull (Goéland) lakes. The second, a much shorter route but one that involves more portaging, follows down Bell river to Wedding river, up this river to its headwaters, then northward along a portage to Duplessis creek, which flows eastward into O'Sullivan river. This river, in turn, flows into the southern part of Waswanipi lake. These canoe routes are not recommended as they are long and difficult, and are dangerous in local stretches.

The northern part of the area may be reached from Waswanipi river, whereas the southern part is most readily accessible from Bachelor lake and river. In normal summer weather, Bachelor river carries little water. This condition, together with a sharply-winding channel and several long rapids, makes canoe travel along the river rather difficult, unless one is travelling light. An outboard motor can be used only along some of the lower stretches of the river. Travel along Waswanipi river, above Waswanipi lake, is difficult also because of long stretches of treacherous, swift water. The shortest canoe route from Bachelor lake to Waswanipi river is via Billy and Opawica lakes. This route entails a portage of about a mile between Bachelor and Billy lakes, a second portage of half a mile between Billy and Opawica lakes, and several portages along Waswanipi river. A considerable part of the area between Waswanipi river and Bachelor lake and river is difficult to reach as the streams are not large enough for canoe travel, and the east-west surveyed line forming the boundary between Lesueur and Poyvinet townships is not sufficiently cleared to be used as a trail.

An east-west line, cut and compass-surveyed by the writer's party, traverses the area about 3 1/2 miles south of Waswanipi river, with a branch running north to within one mile of Waswanipi river, about two miles from the eastern boundary of the area. These cut lines can be presently used to reach part of the area. Access to the extreme south-central section is provided by Auger lake and Auger creek, which flows southwestward into the northeastern bay of Pusticamica lake.

Field Work

The writer spent the field season of 1946 making a geological examination of the area described in this report. Traverses were made systematically at intervals of approximately half a mile, and additional work was done in several localities of interest. The east-west surveyed township line, the rivers and lakes of the area, and the line cut by the field party, served as controls for the traverses. In order to cross rock structures, as well as for convenience, the traverses, with few exceptions, were run in a north-south direction.

The base-map, on which the geology was plotted, was compiled by the writer from aerial photographs taken for the federal government. Unfortunately, these photos were not available until after the close of the field season, and consequently could not be used in conjunction with the field work. However, through subsequent detailed study with a magnifying stereoscope, it was possible to locate on the

photographs all major features observed in the field, and much interpolation from these features was possible. In addition, many features not observed in the field, or the significance of which was not noted at the time, were examined in the detailed stereoscopic study of the photos, and have been incorporated in the map.

Acknowledgments

J.E. Gilbert, Pierre Côté, and Cyrille Dufresne — all post-graduate students at McGill University — rendered outstanding assistance in carrying out the field work. Mr. Gilbert contributed much additional help through detailed petrographic descriptions of many of the thin sections of rock specimens collected.

Mr. W.J. Davis, in charge of the Canadian Pacific Air Lines' base at Senneterre, and the several pilots operating under him, rendered valuable service, which is greatly appreciated.

Description of Area

Topography

The surface of the area is relatively flat, with a gentle westward slope toward Waswanipi lake. Locally, the general flatness is relieved by small hills and ridges which have an east to northeast trend. The highest of these ridges, just northwest of Barbie lake, rises approximately 400 feet above Bachelor lake.

Much of the flat country is occupied by glacial sediments. Kames and eskers are conspicuous local topographic features in the southern part of the area. Numerous small, sharp, ridges of glacial débris, trending northwest, transversely to the direction in which the ice sheet moved, were observed.

Drainage

The drainage pattern has a pronounced northeast-southwest trend, with a secondary trend that is north to northwest. Waswanipi river, however, which crosses the northern part of the area in a general east-west direction, does not follow either of these structural trends to any marked degree. For the greater part, the area is well drained, but small muskegs and swamps cover a considerable percentage of the surface.

Bachelor lake, which drains westward into Waswanipi lake by way of Bachelor river, is the largest lake within the area, having an overall length of about four miles. There are four other much smaller lakes and several ponds. Of the smaller lakes, Auger, Billy, and Barbie lie in the southeastern part of the area, and Margie is near its western margin, about a mile and a half south of Waswanipi river.

Agriculture

Many localities appear to have good soil, and crops, such as those grown in other sections of the north, should grow well in these places.

Timber

A large part of the area was burned over by forest-fires some years ago, and the new growth is not yet large enough to be of commercial value. Many excellent stands of spruce and jack-pine that escaped past fires were seen. There are a number of unusually large spruce trees along Bachelor river. White birch is common in most of the better-drained spruce areas, and in a few places there are small stands of these trees. Both new- and old-growth aspens are common.

Fish and Game

Trout are abundant in many of the small streams and in some of the lakes. Larger fish, such as pike, pickerel, and sturgeon, are found in Waswanipi river and in some of the larger lakes and streams.

There are a few moose, but game and fur-bearing animals are scarce.

Previous Work

The area described in this report lies within the 4-mile-to-inch Puskitamika Lake map-sheet (No. 570A), and adjoins, on the west, the 1-mile-to-1-inch Opawica Lake map-sheet (No. 556A), both published by the Geological Survey of Canada, Ottawa. The southern part overlaps the area examined by MacKenzie[1] for the Quebec Bureau of

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[1]MacKENZIE, G.S., Pusticamica Lake Map-Area, Abitibi District; Que. Bur. Mines, Ann. Rept. for 1934, Part C, Map No.307.

Mines in 1934. All previous work within the area has been of a general reconnaissance character.

For the past several years there has been much prospecting activity around Opawica lake, which lies about eight miles east of Bachelor lake. Prior to the 1946 season, little prospecting had been done within the present map-area, but a few claims, chiefly westward extensions of the Opawica Lake activity, had been staked in the vicinity of Auger lake and north of Billy lake.

As a result of gold discoveries by Mr. J. Armstrong, prospecting for O'Brien Gold Mines, Limited, in a favourable-appearing section that had been pointed out to him by the writer, a major 'rush' to the area was started in the fall of 1946.

GENERAL GEOLOGY

General Statement

The bed-rock is covered by glacial deposits throughout the greater part of the area. In places, these deposits are silts, and it is probable that locally they extend to a depth of many feet. Exposures of bed-rock are confined largely to the higher ground, with some scattered along the banks of rivers and streams and the shores of lakes. A few of the hills and ridges have bare rock crests but, in general, exposures are confined to the steeper slopes.

The consolidated rocks of the area are all of Precambrian age. Approximately two-thirds of the area is underlain by metamorphosed interbedded volcanic and sedimentary rocks. These occur in a wide belt that crosses the area in a northeast-southwest direction, with two relatively narrow finger-like projections extending westward in the northern part. This belt is part of the large body of 'greenstone' that trends northeastward through the Madeleine (Rose) Lake-Pusticamica Lake region to the Opémisca section of the Chibougamau district.

One lobe of a body of intrusive rock projects into the west-central part of the map-area, and a second lobe occupies much of the northwestern part. These are parts of a large body of granite and quartz diorite that extends north, west, and east from Waswanipi lake. The southeastern corner of the map-area is underlain by a portion of another large intrusive body that extends from Pusticamica lake northeastward through Lichen lake and the southern part of Opawica lake.

A relatively small body of granite underlies Billy lake and continues to the north and west. A small granitic stock, of which only a few exposures were observed, is thought to underlie the greater

part of Bachelor lake. More basic rock, believed to be a contact facies of this intrusive, is exposed on the north and east shores of the lake.

Table of Formations

CENOZOIC	Pleistocene and Recent	Till, glacial lake sediments, eskers, and kames
	Great unconformity	
PRECAMBRIAN	Keweenawan (?)	Gabbro dykes
	Algoman (?)	Granite dykes Bachelor Lake granite Billy Lake quartz porphyry Waswanipi granite Lichen Lake granite
	Intrusive contact	
	Temiscamian (?)	Conglomerate, greywacke
	Keewatin (?)	Gabbroic and dioritic rocks Interbedded sedimentary rocks Massive silicic 'greenstone' Fragmental lava with some sedimentary rock Ellipsoidal lava Amygdaloidal lava Massive andesitic and basaltic lavas

Keewatin (?) Volcanic and Sedimentary Rocks

The rocks described in this section are assumed to be of Keewatin age since they resemble rocks that, elsewhere in the Canadian Shield, have been classified as Keewatin.

They form part of a large belt of 'greenstone' that extends from west of Bell river northeastward through the Madeleine (Rose) Lake-Wedding Lake district, the Pusticamica Lake district, and across the Bachelor Lake area toward the Chibougamau district. This belt crosses the map-area in a general northeasterly direction, although in the northern part of the area there are two, narrow, westward-trending finger-like projections.

Many exposures of lavas — including massive, amygdaloidal, fragmental, and ellipsoidal types — were observed. The characteristic features of these are well developed and preserved in many places. Much of the clastic material is pyroclastic, but some of it is definitely of sedimentary origin. The work done was not sufficiently detailed to permit the separation of fragmental rocks of sedimentary origin from those of volcanic origin with sufficient accuracy to show the interbedded sedimentary rocks as a separate unit on the map. The Auger Lake conglomerate (Temiscamian ?) described below is a notable exception.

Where clastic material is interbedded with the Keewatin volcanics it is, almost invariably, similar in composition to the pyroclastics. In places, however, beds of quartzite and highly feldspathic fragmental rock were observed. These quartzose and feldspar-rich sedimentary rocks have been mapped with the volcanics, but, undoubtedly, more detailed mapping would permit showing them separately and, indeed, it is possible that they are more closely related to the Auger Lake conglomerate than to the volcanic rocks.

The sequence in which the following groups of 'greenstone' are described, and their order in the map legend, does not necessarily indicate the relative ages of the several groups.

Massive Basaltic and Andesitic Flows and Related Intrusives

Widely-scattered exposures of massive 'greenstone' were observed. The absence of amygdaloidal or other structures suggests that these represent the central parts of thick flows, or small lenses or sills injected into accumulated lava flows.

In general, the granularity of the massive 'greenstone' is coarser than that of the amygdaloidal lavas. Alteration has been so extreme that in many cases it is not possible to state the mineral composition or classification of the original rock. In some of the thin sections examined, the typical felted pattern of plagioclase laths common in andesites and basalts is evident. On the basis of the present composition of the plagioclase, the rock would be classed as an andesite, but it is quite possible that the original feldspar was more calcic and that the rock was a basalt.

Amygdaloidal and Ellipsoidal Lava

All the ellipsoidal lava observed is amygdaloidal and, because of its significance in determining structure, it has been

indicated separately on the map. Massive amygdaloidal lava was seen at a number of localities, particularly in the southern part of the area, and especially southwestward from Bachelor lake. Much of it is strongly sheared and altered, but, locally, relatively unaltered amygdaloidal lava was observed. One thin section of a particularly fresh-appearing specimen contains scattered, rounded aggregates of plagioclase that, in the hand specimen, have the appearance of phenocrysts, and amygdules of radiating, fibrous amphibole (for the greater part altered to chlorite), in a matrix of minute plagioclase laths distributed in a felted pattern in a feathery, felted mass of uralite and chlorite. Some amygdules in the section are filled with calcite and others with quartz. The plagioclase aggregates are oligoclase, but probably the original unaltered grains were much more calcic. Some magnetite or ilmenite in fine, dusty grains is present. In general, however, the amygdaloidal lava has been so much altered that the only identifiable minerals are chlorite, epidote, and magnetite, which occur together in a felted mass.

Some ellipsoidal lava was seen in the northeastern and east-central parts of the map-area, but outcrops are most numerous, and the ellipsoids best preserved, in the southern part. Three localities in which there are exceptionally good exposures are: some two miles southwest of Bachelor lake; in the belt of ridges and knolls between Billy and Bachelor lakes; and near the eastern margin of the map-area, about five miles north of Billy lake. In all three localities, the 'pillows' are sufficiently abundant and well preserved to permit determinations of the attitude of the flows. There are several horizons of ellipsoidal lavas. The ellipsoids observed are relatively small compared to many of those in the Keewatin rocks of other regions. They are commonly between four inches and four feet long, with a maximum thickness of about a foot, but a few up to six feet in length were seen. In general, those that have not been elongated by shearing are about four times as long as they are wide. At a few places, the ellipsoids observed may be 'bombs' rather than 'pillows'. In composition, the ellipsoidal lava is similar to the amygdaloidal lava described above.

Fragmental Lava with Some Sedimentary Rock

Exposures of fragmental lavas with a little interbedded sedimentary rock are widely scattered, chiefly in the southern part of the area. In general, the fragments are dark greyish in colour and cherty in texture, and are assumed to be rhyolite. Most of them are irregular and sharply angular in shape. In one exposure about two miles southwest of Bachelor lake and two and one-third miles east of the western boundary of Lesueur township, the rock is about 75 per cent fragments (Plate III-A). The greater number of the fragments in

this exposure range from half an inch to an inch and a half in diameter, although some up to eight inches across were observed. Scattered outcrops of similar rock extend northward from this exposure for a distance of approximately 1,000 feet to a contact with amygdaloidal lava. The contact zone trends northeast and is strongly sheared. Near its northern margin and about 35 feet south of where unusually well-preserved amygdaloidal lava is exposed, the fragmental rock contains angular to rounded fragments, up to a foot across, of feldspar porphyry and pink rhyolite, but none of granite.

Other exposures of fragmental lava were seen west, north, and northeast of Bachelor lake. Not quite one mile west of the lake, there is an exposure, about 200 feet wide across the strike of the banding, that trends east-west and dips vertically. The northeastern margin of this outcrop is marked by a shear zone that trends northwest and contains quartz veins. This rock contains somewhat rectangular-shaped fragments of fine-grained, sugary quartz that were probably derived from a fine-grained, thinly-banded sandstone. The fragments are from a quarter of an inch to an inch wide, and up to six inches long. The majority of the fragments have parallel sides and slightly-rounded corners. Locally, these fragments form up to 25 per cent of the rock. The matrix is a fine-grained, chlorite-amphibole schist.

The angular shape and general uniform rhyolitic composition of one group of fragments definitely suggest a volcanic origin, whereas the rounded fragments and those of quartzite suggest a sedimentary origin. It is possible,however, that scattered sedimentary material incorporated in lava flows may account for some of the rock observed.

Massive Silicic Greenstone

Some of the exposed rock in the southern part of the area, particularly southwest of Bachelor lake, is massive silicic 'greenstone'. A few exposures were observed also in the northern half of the area, particularly near its eastern margin. This massive silicic rock is very fine-grained, light greenish to dark grey in colour, and is characterized by a cherty, conchoidal fracture. The author believes that the greater part of the rock classified here as massive silicic greenstone is probably of sedimentary origin. Actually, however, assignment of rock to this group was based on the absence of any textures or structures that would serve to identify it definitely as, on the one hand, igneous or, on the other hand, sedimentary, in origin.

Although megascopically the various characteristics, except colour, are very similar for all the specimens examined, micro-

scopic examination of thin sections shows there is a wide range in composition. In thin section, a very fine-grained texture is seen to be a uniform feature. In some sections, a very strong alignment of the mineral grains is apparent.

In the knoll half a mile northwest of Barbie lake, the rock is composed of scattered, large grains of quartz in a matrix of extremely fine-grained quartz, albite, and biotite, along with chlorite, epidote, calcite, and a small amount of magnetite. The large quartz grains show bubble-inclusions along their margins, suggesting secondary growth around the original grains. The mineral composition of the rock suggests a relationship to the quartz-biotite rocks described below. Considering the overall size of the body exposed, the texture is too uniformly fine-grained for the rock to be of igneous origin; a mass of igneous rock of such dimension would be coarse-grained a short distance from its margins. Both texture and mineral composition indicate sedimentary origin.

Much of the rock exposed along the crests of the series of barren, north-northeast-trending knolls about two and a half miles southwest of Bachelor lake is very fine-grained, dark-coloured, and cherty, resembling that described above. This rock is composed chiefly of plagioclase, quartz, orthoclase, biotite, and chlorite, with minor amounts of epidote, sericite, leucoxene, and magnetite. In the thin sections examined, the maximum grain size observed was about a tenth of a millimeter. The rock is assumed to be a recrystallized sediment.

A section of a similar specimen, from an exposure just south of Bachelor river and about a mile from the western margin of the map-area, is composed of minute grains of feldspar and quartz, a tenth of a millimeter or less in size, the two making up about 50 per cent of the section, with much chlorite, sericite, and incipient biotite, and some epidote and magnetite.

Interbedded Sedimentary Rocks

Numerous exposures of rock were identified definitely as sedimentary, either on the basis of well-developed compositional banding, or because of fine texture, combined with high quartz content. The distribution of these exposures in relation to definitely recognized lavas is such as to indicate that the two are interbedded. Such exposures are most numerous in the following places: along the two westward prolongations of 'greenstone' in the northern part of the area; in the northwestern corner of Lesueur township close to the granite contact; west and southwest of Bachelor lake; and in the northeastern part of the area near Waswanipi river. Exposures were seen,

also, along the south side of Bachelor river at the western margin of the area and near the eastern margin of the map-area about two miles south of Waswanipi river.

In both composition and structure, these sedimentary rocks range between wide limits. In many exposures, they are massive in appearance; in others, they show a pronounced compositional layering. In composition, they range from impure mica quartzite, through biotite-quartz schist, to a rock whose principal components are hornblende and plagioclase. It is assumed that the present mineralogical composition is a reflection of that of the original sediment. In general, the rocks with laminated structure are the hornblende-plagioclase type. On the other hand, the quartz-biotite-rich rocks are generally massive in overall appearance, although they do have a strongly-developed schistosity. In some localities, however, the quartz-biotite-rich rocks also have a well-developed compositional layering.

Several thin sections of various facies of these rocks were examined. A section of the finely-laminated, hornblende-feldspar rock (Plate IV-A) from a westward-extending band of these rocks, three miles south of Waswanipi river, was selected for detailed examination. it contains approximately 50 per cent small hornblende blades that are strongly aligned parallel to the direction of the layering. Most of the blades are less than half a millimeter long. The hornblende is remarkably fresh in appearance, and is pleochroic from yellowish-green to blue-green. Plagioclase and quartz, in grains about a tenth of a millimeter in diameter and interstitial to the hornblende blades, make up about 40 per cent of the rock. Although not as fresh in appearance as the hornblende, the plagioclase shows little alteration. Some layers that are low in hornblende contain a considerable percentage of epidote. The rock contains 5 to 10 per cent of magnetite. The layering is due to variations in the relative abundance of the component minerals.

In outcrops examined, this conspicuously-layered hornblende-feldspar rock grades rather imperceptibly into a massive rock of essentially the same composition. The hornblende blades in the massive rock, however, are not strongly oriented and are more uniformly distributed. In many thin sections they are seen to have a plumose arrangement.

One of the better exposed outcrops of impure quartzite or biotite-quartz schist is on the northwest side of the point about half a mile southeast of the outlet of Bachelor lake. The rock is very fine-grained, dark grey, and silicic in appearance. Compositional layering with a north-northeast strike and vertical dip is conspicuous.

The rock is approximately 40 per cent biotite in strongly aligned flakes, with a maximum width of about two-tenths of a millimeter. The biotite shows strong pleochroism from pale straw colour to reddish-brown. The rock contains about 50 per cent quartz and feldspar in irregular grains with an average diameter of four one-hundredths of a millimeter which are interstitial to the biotite. Some, at least, of the feldspar grains are plagioclase. The relative amounts of quartz and feldspar were not determined, but it seems that quartz is much the more abundant. The small feldspar crystals show no alteration, but there are scattered larger grains of feldspar, about a tenth of a millimeter in diameter, that are altered. These are assumed to be original grains of the sediment. The section examined contains about 5 per cent magnetite rather uniformly scattered in small irregular aggregates, and about 5 per cent of a carbonate, probably calcite, in small irregular patches.

An exposure of similar rock, on a small island close to the north shore of Bachelor lake, about a mile east of its outlet, strikes east-northeast and dips steeply north. This rock is conspicuously layered, with individual layers showing a remarkable uniformity in width. The range is from a sixteenth of an inch to three inches, with the majority about an inch wide. Here, too, the layering is due to variations in the relative abundance of the component minerals. The rock is composed chiefly of quartz, with feldspar and biotite as abundant constituents. The biotite is pleochroic from light greenish-brown to dark reddish-brown. The rock is very fine-grained, with grains ranging in size from one one-hundredth to two one-hundredths of a millimeter. Epidote is abundant in local zones. Magnetite, chlorite, and sericite are accessory minerals.

A thin section of a specimen of similar rock from an exposure just south of Bachelor river, at the western margin of the map-area, is approximately 40 per cent biotite, 40 per cent quartz, and 20 per cent feldspar. Both the biotite and the feldspar are very fresh in appearance. The biotite is pleochroic from light straw to deep brown, exhibits a very strong parallel alignment, and appears as recrystallized subhedral grains, with the quartz and feldspar occurring interstitially. The maximum width of the biotite flakes is about two-tenths of a millimeter, whereas the average grain size of the quartz and feldspar is about five one-hundredths of a millimeter.

Thin sections of two specimens of rock of similar appearance, one exposed half a mile, and the other three and a half miles, from the eastern margin of the map-area, immediately south of Waswanipi river, differ somewhat from the rocks described above, but have many similar characteristics. The exposures show well-developed, fine, compositional layering. The rock contains about 60 per cent chlorite

and biotite, the former predominating, 10 per cent epidote, and 30 per cent quartz and feldspar in very small, irregular grains. Scattered, small, irregular aggregates of magnetite are present.

Exposures of a sedimentary rock that is considerably more silicic and less recrystallized than the rocks described above were observed at several places in the same general belts. A thin section of a specimen from an exposure half a mile southwest of the southwest bay of Bachelor lake revealed rounded aggregates of quartz up to two millimeters in length, composed of minute grains with sutured margins, in a matrix of very fine-grained chlorite, sericite, quartz, and feldspar. An appreciable amount of pyrite in small cubes and irregular grains, and iron oxide, are present, and probably represent secondary mineralization.

A thin section of a specimen from an exposure about half a mile west-southwest of the outlet of Bachelor lake is composed of rounded grains of feldspar and quartz in a matrix of chlorite, sericite, and epidote, along with fine grains of quartz and feldspar. The rounded grains of feldspar are much altered. There is some similarity between this rock and the Billy Lake quartz porphyry as described on page 17. Sections of specimens from south of Waswanipi river, near the eastern margin of the area, are similar in general composition. The maximum size of the rounded grains is about one millimeter.

A section of a specimen from an exposure south of Bachelor river and three-quarters of a mile from the western boundary of the map-area contains about 30 per cent calcite, 30 per cent chlorite, and 30 per cent quartz. Some of the quartz is in grains with a definite concentric oölitic character. In hand specimen, the rock is dark grey to black, with carbonaceous material and a high carbonate content. No other exposures of rock high in carbonate were observed.

Gabbroic and Dioritic Rocks

Associated with, and considered as being of about the same general age as, the rocks that so far have been described, there are, in various parts of the map-area, massive rocks composed essentially of hornblende and plagioclase. On the basis of texture and composition much of the rock could be called diorite or gabbro (Plate IV-B), and locally, where the rock is low in feldspar, it might be called amphibolite. On the other hand, some of the rock included in this group is of sedimentary origin, and, although general opinion would most probably favour an intrusive origin for the more typically gabbroic and dioritic phases, the author feels that all the rocks described in this section originally were sediments.

As shown on the accompanying map, exposures of these rocks occur mainly in the central and northeastern parts of the area, but there are also some in the southwestern part, near Bachelor river.

In general, these rocks trend in the same directions as the flow structures or bedding of the volcanic or sedimentary rocks of the area. A notable exception to this correspondence of trend is in the fringe of ridges around the eastern margin of the granite lobe that extends into the central western part of the area.

While the composition and texture of these hornblende- and plagioclase-rich rocks vary greatly from place to place, and although abrupt changes over distances of only a few feet are striking, the rocks have a generally uniform composition and their textures grade from those of fine, laminated to fine, massive varieties and from fine-grained massive to coarse-grained massive types.

A thin section of a particularly uniform, coarse-grained specimen of these rocks was found to contain about 50 per cent plagioclase (albite) in euhedral to subhedral grains, with the remainder chiefly hornblende, interstitial to the plagioclase. The plagioclase crystals contain abundant small grains of epidote, chlorite, and uralite, from which fact it may be inferred that they were much more calcic before the epidote developed. The hornblende is greatly altered to uralite and chlorite. The minerals in most varieties of these gabbroic or dioritic rocks, however, are generally relatively fresh.

Temiscamian (?)

Greywacke and conglomerate, exposed both north and west of the western end of Auger lake, exhibit characteristics of Precambrian rocks that elsewhere are considered to be of Temiscamian age. It was not possible to follow the continuation of this belt in either direction. The southern margin of the belt is assumed to be a fault. It is thought possible that some of the exposures of clastic rock observed elsewhere within the map-area are downfolded parts of this belt, but the relationship cannot be demonstrated with the evidence presently available. Consequently, in this report, the above-mentioned body is treated as a separate unit.

The observed exposures form a discontinuous ridge for about a mile and a half. The prominence of this ridge diminishes at both ends. The rock in all these exposures has a uniform strike of approximately northeast, and dips 70° to 75° northwest. The ridge has its greatest width — some 500 feet — immediately west of Auger lake. It is probable that this belt continues west of Barbie lake. Although

it was not positively identified in the latter locality, some of the rock exposed there is clastic.

The most characteristic feature of the belt is the conglomerate. Its maximum width is unknown, but in many places there are exposures over a width of 150 feet. In general, about half the surface area of the conglomerate consists of rounded boulders or pebbles of granitic rock (Plate III-B). The greater number are from one to three inches in diameter, a few are four to eight inches, and none were seen exceeding twelve inches. They show no open fractures, and little if any distortion. A typical outcrop of the rock was found to contain pebbles of the following sizes and types:

No. of Pebbles	Diameter	Type of Rock
2	2 inches	Coarse anorthosite
1	4 inches	Coarse aplite
2	2 inches	Feldspar porphyry
3	1 to 4 inches.	Medium- to coarse-grained hornblende syenite or hornblende granite
Several ..	up to 8 inches	Even-grained quartz-rich granite

Elongated fragments of schist are common in the matrix. In some localities they comprise as much as 25 per cent of the rock. In general, their maximum thickness is about a quarter of an inch and their maximum length six inches. The matrix contains much quartz, secondary hornblende, grains of feldspar that appear to be secondary, sericite, kaolinite, chlorite, and calcite.

Post-Keewatin Intrusives

(Algoman and Keweenawan ?)

Apart from the possibly intrusive gabbroic and dioritic rocks associated with the Keewatin volcanics and sedimentary rocks, the intrusive rocks of the area consist of two small bodies, parts of two large masses, and many dykes. No evidence was found as to the relative ages of these intrusives. It is assumed that the small bodies underlying Bachelor and Billy lakes are younger than the large masses, and also that all the granitic intrusives are post-Temiscamian or Algoman in age. Following the procedure usually adopted in mapping this section of the Canadian Shield, the assumption is made that large, northeast-trending, diabasic, gabbro dykes are of Keweenawan age.

In general, the granite areas have low relief and exposures are few and widely scattered. This has made it either difficult or impossible to delimit their boundaries. In many places, topography has been helpful in determining the approximate location of contacts with the surrounding rocks, but in other places the assumed contacts are rather arbitrary.

Lichen Lake Granite

The southeastern part of the map-area is underlain by granite that is part of an extensive body which extends eastward for some 35 miles to Doda lake, and south and west for a total of some 45 miles, ending about five miles northeast of Quévillon lake. Within the map-area, the northern boundary of the granite passes through the western part of Auger lake and extends northeastward, passing in the general vicinity of Barbie lake.

Immediately south of Auger lake, exposures of this rock are relatively abundant, but, in general, the area underlain by this granite has low relief and exposures of bed-rock are few. The rock of the various exposures examined is similar in general appearance and composition. In hand specimen, one of the most conspicuous features is the quartz which has a slightly opalescent, glassy appearance and is unusually abundant, making up as much as 35 per cent, and rarely less than 30 per cent, of the rock. The feldspar is light grey in colour, giving the rock an overall light grey appearance.

In thin section, the quartz exhibits wavy extinction and is seen to contain many 'healed fractures' marked by traces of minute bubble-holes. In many sections examined, the quartz has sutured margins, and in some there is a cataclastic mortar structure, with much quartz in fine grains in the matrix.

Feldspar and its alteration products make up 60 to 65 per cent of the rock. About half of it is albite and half orthoclase, with some microcline. The feldspar is much altered, chiefly to sericite, with some kaolinite. Some carbonate has developed. The original rock contained 5 to 10 per cent biotite, now almost completely altered to chlorite and epidote. Common accessory minerals are apatite, titanite, rutile, and zircon. The rock should be classified as an albite granite.

Waswanipi Granite

Two lobes of a large granite batholith extend into the west-central and northwestern parts of the map-area, respectively, and

are separated by a narrow band of steeply-dipping recrystallized sedimentary rock. This large granite body, having a length of about 40 miles and a northeast-southwest trend, extends west, north and east of the northern part of Waswanipi lake.

From place to place, the rock presents considerable variations in colour, mineral composition, and structure. In general, it is a massive, medium- to coarse-grained, pink granite. The biotite shows some degree of alignment, however, and in some facies of the rock it has a shredded appearance and a quite pronounced alignment. The quartz content ranges from 5 to 30 per cent and in thin section the grains show an undulatory extinction. They are rather clear, glassy in appearance, and considerably fractured. Albite, orthoclase, and a small amount of microcline are present. In thin section, a cataclastic mortar structure is a conspicuous feature of the rock. Most of the broken, interstitial material is quartz and feldspar. Small amounts of sericite, epidote, and chlorite are present. Common accessory minerals are apatite, titanite, and zircon.

Billy Lake Quartz Porphyry

Quartz porphyry is exposed along the north, south, and west shores of Billy lake, and on knolls immediately west of the lake. Exposures were observed, also, for two and a half miles north of the eastern part of the lake. The location of the contact of this body with the surrounding greenstone is not known, as there is a considerable distance between outcrops and the topography is relatively flat, with no diagnostic features to suggest the location of the contact zone. It could probably be located accurately by geomagnetic methods. As shown on the map it is arbitrary.

The quartz porphyry is greyish in colour. In some exposures it is massive, but in most places it is highly sheared. In hand specimen, one of the most conspicuous features is the quartz, which is opalescent and glassy in appearance and ranges in amount from scattered grains to about 15 per cent of the rock. Grains up to 5 millimeters in diameter were observed, but much smaller ones are more common.

Originally, feldspar was the most abundant constituent, probably making up about 75 per cent of the rock. Alteration of the rock has been so extreme, however, that only small relics of the original feldspar grains are now present. In general, 'shadow-outlines' of the former grains can be discerned. For the most part these are rounded, but some are euhedral. Orthoclase was probably the most abundant feldspar, with some plagioclase, probably albite. Epidote and zoisite are abundant alteration constituents. Other secondary minerals include

kaolinite, sericite, calcite, leucoxene, and chlorite. The matrix of the rock is too fine-grained, and has undergone too much alteration, to be identified. The rock is very low in ferromagnesian constituents.

This rock is considered to be quartz porphyry, although there is a possibility that it is a recrystallized arkosic sediment. The low quartz and ferromagnesian content are the chief evidence against sedimentary origin. It is believed that the rounded and angular shapes of many of the feldspar grains were caused by corrosion and breaking during crystallization of the magma.

Bachelor Lake Granite

The Bachelor Lake intrusive is considered to be the source of the metalliferous deposits southwest of Bachelor lake, discussed later in this report in the section on economic geology. Exposures of this rock are too sparse to permit definite delineation of the margins of the body, but it is assumed to underlie practically all of Bachelor lake.

This granite is best exposed near the middle of the south shore of the lake. The rock here is fresh in appearance, medium- to coarse-grained, with subhedral feldspar phenocrysts up to a centimeter in length. Quartz, in clear, glassy grains, forms about 25 per cent of the rock. It is, for the most part, interstitial to the feldspar, and shows a wavy extinction. Microcline and orthoclase, with minor amounts of albite, make up about 70 per cent of the rock. A small amount of biotite, much of which has been altered to chlorite and epidote, is present. Accessory minerals include apatite and titanite. Some sericite has developed in the feldspar.

Exposures of the marginal zone of the intrusive were observed on the north and east shores of the lake. This marginal rock is more basic than that of the central part of the intrusive. One of the thin sections examined contains approximately 75 per cent altered ferromagnesian minerals, and much of the remainder is made up of metacrysts of feldspar. As the outer margin of the intrusive is approached, the percentage of feldspar decreases, and the metacrysts become smaller. The rock of the marginal zone is characterized by a low content or absence of quartz and by the presence of an appreciable amount of hornblende, largely altered to epidote and chlorite. In some of the thin sections, a typical mortar structure was noted. Pyrite is present as scattered grains in many of the sections examined.

PLATE I

A.—View upstream of a quiet stretch of Waswanipi river, at western margin of map-area.

B.—View to the north, from knoll southwest of Bachelor lake, showing general flat character of the area.

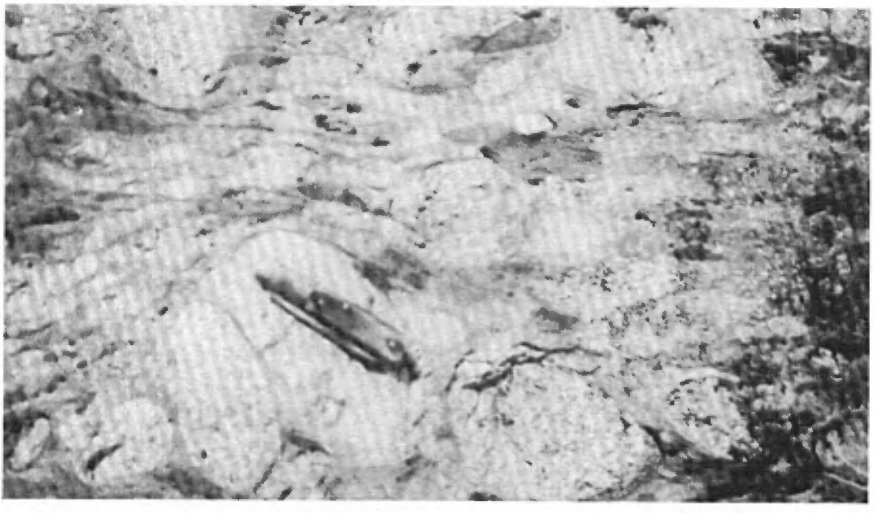
PLATE II

A.—Glacial ridge, west of Auger lake.

B.—Kettle lakes along glacial ridge, southwest of Bachelor lake.

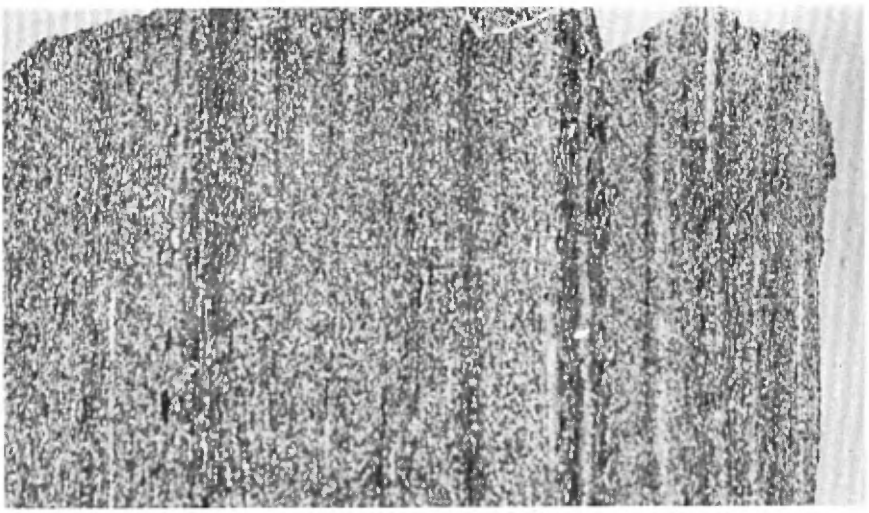
PLATE III

A —Fragmental lava, southwest of Bachelor lake.

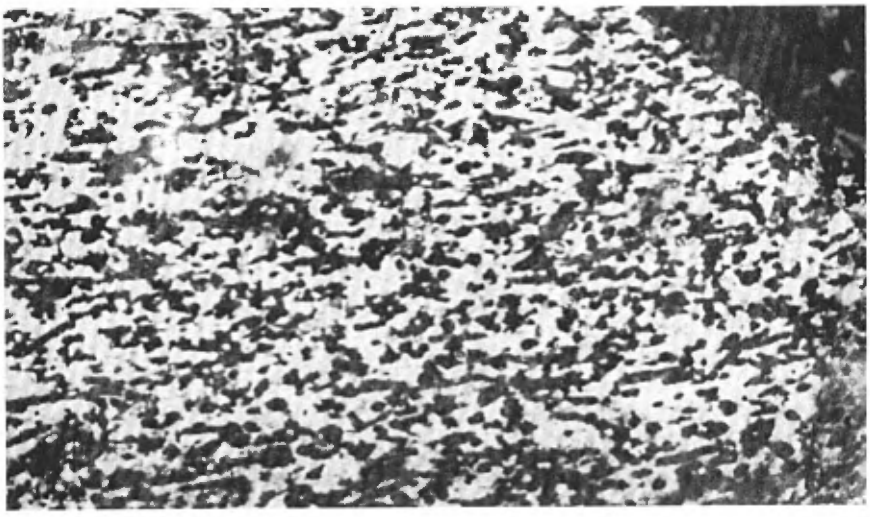


B.—Conglomerate, west of Auger lake. Dark areas are schist fragments.

PLATE IV



A.—Rock showing compositional layering, from sedimentary belt three miles south of Waswanipi river. X5



B.—Dioritic rock. X2

Granite Dykes

Many small granite, rhyolite, and related dykes were seen in the map-area. The majority of these are near the several intrusive bodies and are assumed to be genetically related to the intrusives in their immediate vicinity. In general, the feldspar and ferromagnesian minerals of the small dykes are altered to such an extent that no precise determination can be made of the original composition of the rocks. Some dykes in the vicinity of Bachelor lake contain an unusually high percentage of hornblende and are low in quartz, corresponding to the general character of the marginal zone rock of the Bachelor Lake stock.

Some of the rhyolite and quartz porphyry dykes may be related to silicic facies of the Keewatin rocks, rather than to the later granitic intrusives, but it is assumed that, of the dykes observed, the majority are related to the granite.

Gabbro Dykes (Keweenawan?)

In conformity with the usual age designations for this part of the Canadian Shield, northeast-trending gabbro dykes are assumed to be of Keweenawan age. Within the map-area, it is known only that they are younger than both the Waswanipi and Lichen Lake granites. Such dykes were seen in three widely-separated parts of the map-area. A series of exposures, assumed to be parts of the same dyke, extends east-northeastward from the south shore of Auger lake to beyond Barbie lake. At the exposure immediately south of Auger lake the dyke is 150 feet wide. A second dyke crops out a mile south of Waswanipi river, about two miles west of the eastern boundary of the map-area. A third is indicated by a series of three exposures along a northeasterly trend, in the northwestern corner of the map-area. These gabbro dykes have a diabasic texture.

In the exposure south of Auger lake, completely altered plagioclase laths, about a centimeter long, make up approximately 55 per cent of the rock, and augite, considerably altered to serpentine and chlorite, about 35 per cent. The rock contains, also, about 10 per cent magnetite, much of which appears to have developed from alteration of the augite. Apatite is an abundant accessory mineral.

A thin section of a specimen from east of Barbie lake shows the rock here is similar in many respects to the above but is finer grained. The original rock was about 65 per cent labradorite,

25 per cent augite, and 10 per cent magnetite. Apatite is present, and serpentine, chlorite, kaolinite, epidote, and paragonite are abundant alteration products.

The rock of the exposures in the northwestern part of the area is fresh in appearance and quite fine-grained. The feldspar is labradorite.

Pleistocene and Recent

The ridges and hills of the area have been abraded and rounded by glacial erosion, and the depressions and hills alike are largely covered by glacial débris, with the exception of a few barren rock knolls. The general direction of movement of the ice-sheet, as determined by glacial striae, was southwest. Rather extensive deposits of silt are found in many localities; they were probably deposited in glacial lakes.

In the southeastern part of Boyvinet township, a large crescent-shaped hill, some two miles long, has all the features of a glacial deposit and is probably a kame. Southwest of Bachelor lake, an esker-like ridge extends for some three miles in a northeast direction. Several kettle lakes occur along this ridge (Plate II-B). Its southern end is a kame-like bulb, surrounded by a gently sloping silt area nearly two miles across.

It is to be expected that gravels would be found extensively with these glacial deposits. Waswanipi river, however, is cutting chiefly through glacial clays, and gravel deposits along this river are small.

STRUCTURAL GEOLOGY

The drainage pattern of the area has a dominant northeast-southwest trend. This is also the general direction of a large percentage of the linear topographic features, and observed zones of shearing. The southwest movement of the Pleistocene ice-sheets would tend to accentuate this pattern and to obliterate, to some extent, trends in other directions. Other prominent directions of linear topographic features are northwest and north.

The general character of the underlying bed-rock is reflected to a considerable degree by the topography. The larger areas underlain by granitic rock have a gently rolling, subdued relief, whereas irregularity of surface relief is much more pronounced in the

areas of sedimentary and volcanic rocks. Areas of greatest relief, and those marked by greatest irregularities, are in the general vicinity of contacts of these latter with intrusive bodies. The writer believes that the position of contacts can be approximated in many places by the character of the topography. It was noted that the granitic rocks weather the most readily. The country rocks in the vicinity of the igneous bodies are more resistant than elsewhere, probably because of the greater degree of metamorphism to which they have been subjected.

In much of the sedimentary and volcanic belt, schistosity and layering trend in a general northeast direction. The rocks are tightly folded and dips of both layering and schistosity are almost vertical, ranging from about 80 degrees upward, both to north and south. Dips as low as 70 degrees are not common. In the vicinity of the margins of the larger intrusive bodies there is a parallelism between the schistosity and the trend of the contact.

Although much pillow lava was observed, only a few determinations of tops of flows could be made. In exposures along the ridges that extend between Bachelor and Billy lakes, several determinations were made, all of which indicated that tops of the flows are toward the north. On the other hand, determinations on exposures a little more than a mile southwest of Bachelor lake indicate that tops of the flows there are to the south. A belt of conglomerate approximately two and a half miles south of the latter locality probably marks the axis of a syncline, and an anticlinal axis is indicated as passing along the general location of Bachelor lake and probably, beyond that, slightly south of the upper part of Bachelor river. If this interpretation is correct, there are definite arkosic and fine-grained siliceous sedimentary rocks along the axial zone of the anticline. Pillows in lava exposed on a series of northeast-trending ridges four or five miles north of Billy lake show that the tops of the flows are to the south, indicating that there is a synclinal axis between here and Billy lake.

The rocks in the two westward-trending projections of greenstone are similar; they are characteristically finely layered and are assumed to be recrystallized sediments. These two fingers probably represent the same horizon, but no evidence as to the position of this horizon on the folded structure could be found. The southern of these two tongues, which is approximately three miles south of Waswanipi river, can be projected eastward by means of layering, schistosity, and topography. From the western margin of the map-area to the central part of Boyvinet township, these features trend directly eastward. There they turn northeastward, and they continue in this direction to the eastern boundary of the map-area at a point about a mile north of Waswanipi river.

Many of the ridges in the area have an east-west trend, particularly those along the two finger-like projections of greenstone, those immediately north and south of Bachelor lake, and those just south of Bachelor river near the western margin of the area. Many exposures of layered sedimentary rocks were observed in these ridges, with the trend of the layering and schistosity more or less east-west.

The most pronounced topographic feature in the area is the ridge that includes the knoll northwest of Barbie lake and extends westward with an abrupt north-facing slope and a gentle south-facing slope. This ridge is marked by several northeast-trending 'breaks', along some of which there are minor offsets. The north face of the ridge passes about half a mile south of the southwest end of Bachelor lake, and continues westward for about a mile. This section of the ridge contains much sedimentary material; the bedding strikes east-west and the dips are steep. Continuing, the ridge takes a sharp turn to the south-southwest, and extends for about three miles in this direction. Along this section it is marked by three prominent, barren, rocky knolls that are similar in many respects to the knoll northwest of Barbie lake. At its southwestern end, the ridge faces a sharp, straight, southwest-trending valley that is a quarter to half a mile wide. The presence of an esker and related glacial silts within this depression indicates that a glacial river once occupied this valley.

In each segment of the ridge, the strike of the bedding parallels, approximately, the trend of the ridge. These changes in direction of strike of bedding suggest truncation by faulting between the two segments, but they may also be due, in part, to folding. The structure is probably related in some way to the emplacement of the Bachelor Lake granite mass.

An arcuate fringe of ridges extends around the eastern margin of the large granitic body that protrudes into the west-central part of the map-area. From the structural point of view, this fringe marks the general contact zone between the granite and the rocks of volcanic and sedimentary origin. The ridges are all composed of similar rocks and their trend cuts across the general trend of bedding in the area. The conformity in position, together with the relationship to general structure, suggests that this topographic expression is due to the effects of differential erosion on a contact metamorphic zone, and is not related to the general Keewatin structures of the region.

Shear zones and escarpments were observed in many places. In some instances, a stereoscopic study of aerial photographs that became available after the close of the field season showed that escarpments or shear zones observed in the field at places some distance apart were parts of the same zone. Many other strong, linear,

topographic expressions that had not been suspected from ground observations were also seen in the photographs.

The configuration of the long, narrow, northeastern bay of Opawica lake (which lies immediately east of the southern half of the map-area) indicates a major zone of structural weakness. This zone can be followed for some distance east of the lake and also extends westward into Bachelor lake. It is believed that the configuration of Bachelor lake is related to this zone, and that much of the shearing extending southwest from the lake is a distributed 'horse-tail' type of structure, resulting from westward movements of the northern side of the 'break' relative to the southern side. It is believed, also, that the localization of the Bachelor Lake intrusive is related to this structure. Shearing along the south shore of Billy lake, together with escarpment immediately south of the lake and extending west-southwest, suggests that another branch of the major Opawica Lake shear zone may pass through this section of the area.

ECONOMIC GEOLOGY

Sporadic prospecting and exploration work has been carried on for many years in the general vicinity of Opawica lake, which is just east of the area described in this report. During the 1945 field season, the activity around Opawica lake increased considerably and extended westward, with some claims being staked in the vicinity of Billy and Auger lakes.

Early in the season of 1946, the writer located a particularly favourable-looking area southwest of Bachelor lake. The attention of prospectors working in the vicinity was drawn to this locality, and encouraging results were obtained by some of them within a few days of the time they started work in the designated districts. In the fall, discovery claims were recorded, and a major 'rush' to the area ensued almost immediately. Subsequently, practically the whole volcanic-sedimentary belt within the area, and beyond to the northeast and southwest, was staked. Exploration and development work has extended the original discovery and new deposits have been located elsewhere in the belt.

Near the northern boundary of the map-area, Mr. J. Armstrong, of O'Brien Gold Mines, Limited, discoverer of the Bachelor Lake deposit, found a narrow, gold-bearing vein in the greenstone just east of its contact with the granite. Several small quartz porphyry dykes, some small quartz veins, and mineralized shear zones were observed at this place. To the north, beyond the margin of the map-area, chalcopyrite was seen in a small shear zone.

There is much sedimentary rock interbedded with the volcanic rocks in the southern part of the area, especially southwest of Bachelor lake, and similar rock was seen in the northern part of the area. In many places the sedimentary rocks and interbedded volcanics have been considerably silicified and mineralized with pyrite. It is assumed that much of the alteration, silicification, and mineralization in the southern part of the area is genetically related to the Bachelor Lake intrusive. Similar silicification and mineralization was observed in the northern part of the area, particularly near the eastern boundary, south of Waswanipi river. This definitely indicates sources of mineralization other than the Bachelor Lake intrusive.

Several features of interest in regard to favourable conditions for mineralization were noted in that part of the area centring around the Bachelor Lake stock. Immediately to the northeast, the Billy Lake quartz porphyry extends for some distance north and west of Billy lake, and eastward, just beyond the margin of the map-area, there is another small granite stock. From the structural point of view, it appears that the strong structural break that extends westward through Opawica lake continues into the eastern end of Bachelor lake, then turns southwest and branches beyond the western part of the lake. The granite contact that extends northeast from the western part of Auger lake through Barbie lake can be considered as the southern limit of this favourable section.

Along Waswanipi river, just within the eastern boundary of the map-area, there are several zones of strong shearing that contain quartz stringers, much carbonate, and some pyrite, and have undergone much hydrothermal alteration. At one place, on the south bank of the river about half a mile from the eastern boundary of the map-area, a small amount of chalcopyrite was observed.

Near the western margin of the map-area, just south of Bachelor river, there is a series of small knolls with exposures of interbedded volcanic and sedimentary rocks, some rich in quartz and others rich in carbonate. There are numerous small quartz stringers along shear zones in these rocks. A quartz vein, at least four feet wide and trending north-northeast, was seen on the northeasternmost knoll of the series. Along the margins of this vein, the country rock is considerably sheared and contains abundant carbonate and some pyrite.

Much carbonate, pyrite, and scattered small grains of milky quartz are present in local, highly-schistose zones along the southern side of Billy lake. Several small quartz veins were found along the south side of the conglomerate ridge just west of Auger lake, and also south of the west end of that lake. At the latter

locality, a little chalcopyrite was seen in a narrow shear zone near the granite contact. Southwest of Bachelor lake, several silicified and mineralized shear zones and quartz veins were observed, in addition to much silicified and mineralized country rock.

The interbedded sedimentaries and volcanics appear to be favourable host-rocks for ore deposits. Innumerable zones of shearing and faulting within these rocks have provided adequate channelways for the passage of mineralizing solutions. It appears evident, also, that other conditions requisite for the formation of metalliferous deposits were favourable, namely, the presence of a source magma and the coincidence in time of the emanation of metallizing fluids and suitable conditions for the precipitation of metals.

The more important discoveries up to the present time have been to the west and southwest of the Bachelor Lake granite stock. The entire volcanic-sedimentary belt of the southern part of the area is favourable ground for prospecting.

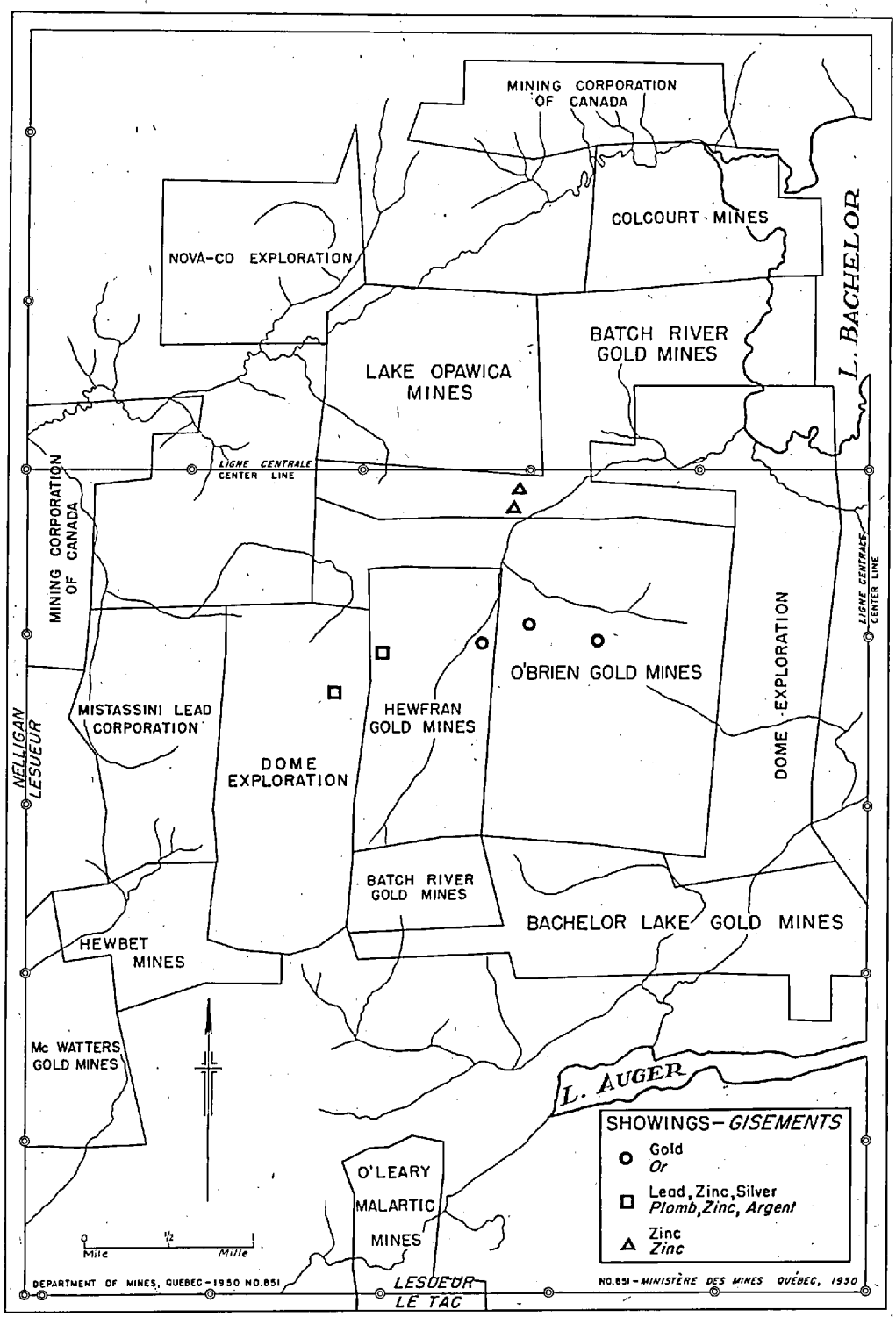
APPENDIX

Mineral Showings, Southwest Part of Lesueur Township (1949)

To make readily available to the reader a description of the mineral occurrences that have been exposed by prospecting activities subsequent to the writing of the above report, we append, almost in toto, pages 8 to 15 of P.R. No. 243, "Preliminary Report on the Southwest Part of Lesueur Township, Abitibi-East County", which was prepared in 1949 by R.B. Graham for the Mineral Deposits Branch of the Quebec Department of Mines. Figure 1 gives the location of the mining properties and mineral showings described.

"Gold, silver, zinc, and lead mineralization has been found within the map-area. In all occurrences examined by the writer (R.B. Graham), the host rock was agglomerate, compact "brittle" tuff and to a lesser extent fine grained basalt of rhyolitic appearance, ... The localization of mineralization in the favourable host rock is apparently consummated by a structure, or combination of structures, such as fracturing, shearing, and drag folding.

"Pyrite mineralization is widespread on the O'Brien, Hewfran, and Batch River properties. The pyrite occurs as stringers, blebs, and disseminations in the same type of host rocks as the gold, silver, zinc, and lead. Locally, this mineralization is sufficiently



PARTIE SUD-OUEST DE

SHOWING LOCATION OF MINING PROPERTIES AND MINERAL SHOWINGS

SOUTHWEST PART OF

LESUEUR

Fig. 1

MONTRANT LA LOCALISATION DES PROPRIÉTÉS MINIÈRES ET DES GISEMENTS MINÉRAUX

strong to result in a rusty weathering "burn". Such a "burn" may be observed 3,000 feet north of the main O'Brien workings where it is exposed for a length of 800 feet. A second "burn" occurs about 2,200 feet west of the main O'Brien workings. Other smaller ones were noted on the rocky ridge in the southeast part of the Hewfran property. Although the pyrite mineralization is conspicuous, assays of samples taken by the writer gave at best only traces of gold. It is possible that these mineralized zones might be indicators of other sulphide deposits of economic value.

Description of Properties

"The ground mapped was all staked at the time of writing. Fifteen mining companies have claim groups. The remainder of the ground is held by individuals. Property descriptions will be confined to those areas in which exploratory work such as diamond drilling or trenching has been carried out.

"O'Brien Gold Mines, Ltd.

"This group consists of 40 claims in the southwest-central part of Lesueur township. The claim numbers are as follows:

C.25718, claims 1-5 inclusive
C.25719, claims 1-5 inclusive
C.25720, claims 1-5 inclusive
C.25721, claims 1-5 inclusive
C.25722, claims 1-5 inclusive
C.25723, claims 1-5 inclusive
C.27794, claims 1-5 inclusive
C.27795, claims 1-5 inclusive

"The property is underlain by a sequence of interbedded tuff, agglomerate, basalt, and andesite. The strike of these formations is north-northeast to northeast. Dips range from 80°S.E. to 75°N.W. In the west-central part of the property, adjacent to the main workings, is [a] syenite stock....

"The main gold mineralization occurs along a narrow shear zone approximately 6,200 feet north and 1,000 feet east from the southwest corner of the property. This zone has been exposed by trenching for a length of 325 feet. It strikes approximately N.50°W. and dips 60°S.W., but information disclosed by diamond drilling suggests that the dip flattens with depth. The rock along the shear zone is

silicified and altered to a flesh-pink to salmon-pink colour over widths varying from a few feet to 15 feet. The pink alteration in some places appears feldspathic with an aplitic texture and in others cherty and jasperoidal. The degree of alteration also varies, giving a patchy effect. The altered zone is mineralized with fine pyrite which occurs as disseminations and minute stringers. The latter seldom exceed one inch in length or 1/8 inch in width. The zone is intruded by a narrow lenticular quartz vein, parallel to the shear, which seldom exceeds one foot in width. The core of the vein is milky and is mineralized with sparsely disseminated, fine-grained pyrite. Numerous stringers of quartz and areas containing inclusions of the pink altered rock characterize a gradational zone from the central portion of the vein outward into the altered zone. The quartz vein and related structure weaken and die out when they meet the syenite to the southeast.

"The altered zone is reported to carry good values in gold over its whole width, including the quartz vein. Three grab samples taken along the length of the exposure gave the following assays (1):

Sample No.	Oz. Per Ton	
	Au	Ag
1	0.666	0.088
2	0.484	0.052
3	0.682	0.060

"The country rock adjacent to the mineralized zone consists of interbedded agglomerate and tuff. The beds strike N.33°E. and dip 80°N.W.

"Two thousand feet east from the main workings, on the east side of the syenite stock, some trenching has been carried out in tuff and agglomerate. It is reported that low tenors in gold accompany pyrite mineralization at this locality. A small amount of chalcopyrite, specular hematite, and carbonate is also present. This mineralization occurs as patches and stockworks, the largest of which attains a diameter of 180 feet. Mineralization is sufficient to give the rock a rusty aspect on weathered surfaces.

(1) All samples taken for assay by the writer were analyzed in the laboratories of the Department of Mines, Province of Quebec.

"Dome Exploration (Quebec), Ltd.

"Dome Exploration holds two groups of claims. One adjoins the O'Brien property on the east and the other the Hewfran property on the west.

"The east group consists of 41 claims. One thousand feet of diamond drilling was done on the northwest part of this group in 1948. In the fall of 1949, further drilling had just commenced when the writer left the field. No discoveries have been reported from this group.

"The southwest corner of the west Dome group lies about 2 miles north and one mile east of the southwest corner of Lesueur township. The group comprises 25 claims, numbered as follows:

C.27091, claims 1-5 inclusive
C.27096, claim 1
C.27097, claims 1-5 inclusive
C.27098, claims 1-5 inclusive
C.27099, claims 1-5 inclusive
C.28503, claims 1-4 inclusive

"The northwest part of the property is underlain by a gabbro-diorite intrusive. This is succeeded to the southeast by a volcanic complex consisting of tuff, agglomerate, and basalt. A band of andesite, about 1,500 feet wide, crosses the southern part of the property. The regional strike of the formations is N.40°E. except in the extreme southern part, where it is slightly south of west. This change in strike represents the westerly trending flexure in the southern part of the regional S-shaped fold. The formations dip 70° to 80°S.E.

"The Dome zinc-lead-silver deposit is located in claim 4, C.27091. It lies approximately 2,800 feet south and 1,000 feet west of the northeast corner of the group. It occurs as two lenses in an agglomerate-tuff complex 600 to 800 feet east of the gabbro-diorite intrusive. The lenses consist of massive, light-brown sphalerite containing finely disseminated galena. One lens strikes N.55°E., is exposed for a length of 28 feet, and is 5 feet wide. The other strikes N.15°E., is exposed for a length of 30 feet, and has a maximum width of 10 feet. Both dip steeply to the northeast. The lens striking N.15°E. lies 60 feet northwest from the other on a line bearing S.65°E.

"Assays from the east lens are reported to average 58.26 oz. Ag per ton; 2.86 per cent Pb; 19.51 per cent Zn; those from the west lens 36.3 oz. Ag per ton; 4.48 per cent Pb; 20.16 per cent Zn. A grab sample from the west lens collected by the writer gave

11.6 oz. Ag per ton; 6.55 per cent Pb; and 42.54 per cent Zn. The silver is reported to occur mainly along the margins of the sulphide lenses and in a zone extending 2 or 3 feet into the country rock. It occurs as native silver and as a ruby silver.

"Drilling up to late August, 1949, had indicated a zone about 700 feet long and 5 to 50 feet wide, containing numerous lenses similar to those observed on surface. A study of the drill core in conjunction with surface geology indicates that the deposits have been emplaced in part along a northeasterly striking shear which lies along the axis of the most southeasterly flexure of [a] drag fold ... This drag fold has also influenced the mineral deposition, as sulphide lenses occur off the shear, on or near the nose of the drag fold. During 1948, a geophysical survey and 13,827 feet of diamond drilling were completed. The drilling programme was continued in 1949, but was not finished when the writer left the field.

"Hewfran Gold Mines, Ltd.

"This property lies between the Dome property on the west and the O'Brien property on the east. It consists of a group of 18 claims whose numbers are as follows:

C.23916, claims 1-3 inclusive
C.23920, claims 1-5 inclusive
C.23921, claims 1-5 inclusive
C.25239, claims 1-5 inclusive

"The property is underlain by interbedded tuff, agglomerate, basalt, and some rhyolite. Part of the andesite band in the south part of the west Dome group extends through the southeastern corner of the property. The drag fold which lies on the Dome group to the west extends into the west-central part of the property. A zinc-lead-silver occurrence and two gold occurrences were examined.

"The zinc-lead-silver occurrence is located 2,800 feet south and 600 feet east of the northwest corner of the property. It occurs along the south edge of an outcrop 80 feet long and 45 feet wide. The outcrop consists of tuff with some associated agglomerate. This pyroclastic formation lies in a dominantly basaltic horizon. The mineral deposit consists of three small lenses of sulphides which are exposed in a zone 45 feet long and 5 feet wide. They strike N.50°E. A narrow shear zone which dips 55°N.W. forms the hanging-wall. The lenses themselves do not exceed 4 feet in width. They consist of massive sphalerite containing some galena, chalcopyrite, and pyrite. Native silver was observed by the writer in the tuff at the hanging-

wall contact of one of the sulphide lenses. A grab sample collected from this locality assayed 0.40 oz. Ag per ton; 0.15 per cent Pb; 1.47 per cent Zn. Another sample from the country rock adjacent to one of the sulphide lenses contained 0.002 oz. Au per ton; 0.184 oz. Ag per ton; 0.10 per cent Pb; 0.25 per cent Zn. Assays reported from drilling along this zone gave returns in the order of 3 to 6 per cent zinc and up to 17 ounces of silver per ton.

"A mineral deposit containing gold, exposed by stripping, occurs in the eastern part of the Hewfran property, 140 feet west and 570 feet south of the southwest corner of O'Brien, claim 5, C.25719. The deposit occurs in a pink, altered zone similar to that on the O'Brien property, 3 to 10 feet wide, in a fine-grained basaltic rock. Both walls are marked by shear zones up to 4 inches wide. Several quartz stringers form a narrow stockwork near the hanging-wall of the altered zone. The quartz and the altered rock are mineralized with sparsely disseminated, fine-grained pyrite. The zone has been traced for a length of 60 feet; it strikes N.78°E. and dips 85°S.E. Favourable assays were reported from the early work on this zone. Subsequent sampling was disappointing. A sample from this deposit, selected for assay by the writer, contained 0.056 oz. Au per ton. Another deposit containing gold occurs in the southwest part of claim 2, C.23920, on the east side of a rocky ridge rising out of the large muskeg which occupies the central part of the Hewfran property. This zone occurs in agglomerate which has undergone alteration similar to that previously described. It is 10 to 30 feet wide and contains a quartz vein 3 to 6 inches wide which dips from vertical to 70°S. The mineralization consists of disseminated pyrite in the altered zone and in the quartz vein. The zone strikes slightly north of west and has been traced for a distance of about 200 feet. Three grab samples taken by the writer were submitted for assay. The best assays were 0.06 oz. Au per ton. In 1948, Dome Exploration had an option on the property and carried out 10,003 feet of exploratory diamond drilling.

"Batch River Gold Mines, Ltd.

"Batch River holds two groups of claims in the map-area. One consists of 6 claims immediately south of the Hewfran property and the other of 24 claims adjoining the O'Brien group on the north. This north group is made up of the following claims:

C.24591, claims 1-5 inclusive
C.26632, claims 1-5 inclusive
C.24633, claims 1-5 inclusive
C.26792, claims 1-4 inclusive
C.26793, claims 1-5 inclusive

"Geophysical work and prospecting have been carried out on the strip of claims along the north boundary of the O'Brien group. Diamond-drill holes with an aggregate length of 5,352 feet have been drilled on the central claims of this strip.

"The extreme northern part of the group is underlain by sediments. This formation is succeeded to the south by basaltic lava which in turn is followed by rocks consisting predominantly of tuff and agglomerate with some basaltic flows. The southwestern corner of the property is underlain by diorite and gabbro. These claims lie on the northern flexure of the regional S-fold where the formations change their strike from north-northeast to east.

"Two small deposits with zinc mineralization, which occur on claim No.3, C.26793, have been explored by means of trenching and diamond drilling.

"The north deposit lies 700 feet east and 300 feet south of the northwest corner of the claim. The mineralization occurs along a shear 10 feet wide which strikes N.85°E. and dips 75°N. It has been traced for approximately 40 feet. The north or hanging-wall side of the shear consists of gougy material 6 inches wide, beyond which the wall-rock is replaced over a width of 2 inches by white carbonate and some quartz containing a few "splashes" of sphalerite. The country rock is tuff and agglomerate.

"The south deposit, which occurs in fine grained tuff, lies 400 feet east and 300 feet north of the southwest corner of the claim. It has been traced for a length of 50 feet and consists of a zone of closely spaced parallel fractures striking north N.55°E. and dipping 75°N.W. The fracturing occurs over a width of 10 feet. The fractures contain a few irregularly distributed blebs of sphalerite up to 4 inches long and 3 inches wide. A sample of one of these sphalerite blebs submitted for assay contained 30.66 per cent zinc, 0.01 per cent lead, and 0.02 oz. silver per ton.

"Mistassini Lead Corporation, Ltd.

"This property lies immediately adjacent to the west boundary of the west Dome group. It consists of 15 claims numbered:

C.26365, claims 4-5 inclusive
C.26865, claims 1-3 inclusive
C.26951, claims 1-5 inclusive
C.26952, claims 1-5 inclusive

"All but the extreme southern part of the property is underlain by the diorite-gabbro mass which contains some syenitic phases. South of the gabbro, the rocks consist of an interbedded complex of tuff, agglomerate, and basalt. Diamond-drill holes having an aggregate length of 7,139 feet were drilled along the intrusive-volcanics contact and in the volcanic to the south. No mineralization of economic importance is reported from the work on the property, nor was any observed by the writer.

"O'Leary-Malartic Mines, Ltd.

"O'Leary-Malartic Mines, Ltd., controls two groups of claims which lie partly in Lesueur township and extend into Le Tac township to the south. Most of the exploratory work has been confined to the east group. This group consists of 37 claims and straddles the Le Tac-Lesueur township line from about 700 feet west of mile-post 2 to 3,400 feet west of the same point. The claim numbers are as follows:

C.25944, claims 1-5 inclusive
C.25945, claims 1-5 inclusive
C.28008, claims 1-2 inclusive
C.28180, claims 1-5 inclusive
C.28181, claims 1-5 inclusive
C.28182, claims 1-5 inclusive
C.28183, claims 1-5 inclusive
C.61926, claims 1-5 inclusive

"At the east edge of the property, in Le Tac township, just south of the township line, a series of nine trenches has exposed a strong shear zone of chlorite-sericite schist for a length of 500 feet and a width of approximately 230 feet. The shearing strikes from east-west to N.75°E. and dips from vertical to 73°N. The shear zone is locally silicified and contains some green mica. It also contains lenses of sheared quartz porphyry and is cut by quartz stringers and veinlets which tend to be parallel to the schistosity. The farthest trench to the southeast has exposed for a length of 45 feet an irregular, lenticular, milky quartz vein. The strike of the vein is N.60°E. At the east end it is 8 feet wide, but toward the west it narrows and horsetails to a width of 5 feet across the widest section. The quartz veins, the silicified zones, and the schist adjacent to these zones, are mineralized with pyrite, chalcopyrite, and, locally, sphalerite. The mineralization occurs as disseminations and narrow veinlets one or two inches wide.

"Grab samples, taken by the writer, of the most favourable-looking material gave the following results:

	Oz. Per Ton		%	%
	Au	Ag	Cu	Zn
Farthest west trench				
Flat, milky quartz vein containing some ankerite and mineralized with stringers and blebs of chalcopyrite and pyrite	0.004	0.226	0.47	nil
Silicified schist with milky quartz stringers mineralized with lenses, stringers, and disseminations of chalcopyrite and pyrite	Trace	0.244	??	
Second trench from west end				
Silicified zone in sheared quartz porphyry, containing finely disseminated pyrite and chalcopyrite ...	nil	nil	??	
Fourth trench from west end				
Milky quartz vein 4 inches wide cut by yellow carbonate. Contains stringers and irregular ramifications of chalcopyrite and pyrite and narrow veinlets of sphalerite ...	0.198	0.752	2.09	8.95
Farthest southeast trench				
East end of quartz vein	0.002	0.112		
West end of quartz vein	0.003	0.313		

"Hollinger Exploration Co., Ltd.

"During the summer of 1949, Hollinger optioned a group of 40 claims in Le Tac township, off the west end of Lichen lake. The claim numbers are:

C.37498, claims 1-5 inclusive
C.37499, claims 1-5 inclusive
C.37502, claims 1-5 inclusive
C.37503, claims 1-5 inclusive
C.38251, claims 1-5 inclusive
C.38252, claims 1-5 inclusive
C.38250, claims 1-5 inclusive
C.38256, claims 1-5 inclusive

"The area was prospected and several mineralized zones were found. These occurred in the northeast part of claim No.1, C.37503, along the north edge of claim No.4, C.37502, and along the south part of claim No.4, C.37503.

"The mineral occurs in rusty zones in sheared chlorite granite. The zones strike northwesterly and the shearing strikes east-west to northwest. The rusty zones are 5 to 10 feet long and 1 to 3 feet wide. The largest rust zone observed was traced for 50 feet and varied from 2 inches to 5 feet wide. In places, these rusty zones occur in amphibolite dykes. The mineralization consists mainly of pyrite with some chalcopyrite, arsenopyrite, and magnetite. The chief gangue minerals are chlorite, quartz, carbonate, and tourmaline. Quartz veins up to 2 feet wide in some of the rust zones can be traced for 10 feet. They contain pyrite crystals up to 1/5 inch in diameter. Material from the vein and rust zone was panned by the writer. A few colours were observed in one pan and a 1/8-inch tail of gold was observed in another".

ALPHABETICAL INDEX