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PRELIMINARY REPORT

(EAST HALF) OPEMISCA MAP-AREA, QUEBEC

BY

G. W. H. Norman

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INTRODUCTION

This report, accompanying Map No. 401a, presents a brief account of the geology and gold occurrences of the east half of Opémisca map-area, Quebec, based on field work in 1936. The area examined includes the greater part of Barlow and Scott, and the eastern parts of Cuvier and Lévy townships, and lies immediately west of Chibougamau map-area.[1] Opémisca area

[1] Geol. Surv., Canada, Sheet No. 304A.

resembles closely Chibougamau area, particularly as the regional structure and many of the rock groups extend eastward across both areas. Several small quartz veins in granite, diorite, and anorthosite at David and Simon lakes that have yielded some high assays in gold, and two low-grade gold-bearing zones in greenstone near Rush lake are the principal mineral discoveries to date in the area examined. Copper-gold deposits like those at the Opemiska copper mines in the west half of Opémisca map-area have not been found. However, rocks and structures similar to those at the Opemiska deposits occur between Barlow and Gwillim lakes and merit further prospecting for deposits of this type.

Opémisca map-area lies 120 miles north of Oskelaneo River, a village about 210 miles west of Quebec, on the old Canadian National Transcontinental railway line. Transportation by air to the area either at passenger, freight, or charter rates may be obtained from various companies operating from railway bases, at Oskelaneo River, Senneterre, Amos, Rouyn, or St. Félicien. Canoe routes to the area start from the railway between Oskelaneo River and Senneterre or from St. Félicien the best marked and most used of which is from Oskelaneo River.

Two winter roads each approximately 135 miles long, one recently completed northwestward from St. Félicien to Doré lake, the other northwards from Rouleau Siding, 30 miles west of Oskelaneo River, to Opemiska copper mines, provide routes for tractor transport to the area from railway points during winter months.

GENERAL GEOLOGY

The distribution, regional structure, and general succession of the rocks in the map-area are shown on the accompanying map, No. 401a.

Keewatin.

The oldest rocks are the Keewatin volcanics, in parts of the area divisible into three main groups. Although the boundaries are indefinable and the groups probably vary considerably in thickness they seem to be quite definitely superimposed one upon the other in a regular order. The three groups, in descending order, are as follows:

Upper group - finely banded, greyish white to black tuffs or tuffaceous sediments, bedded breccias, locally resembling conglomerate, rhyolite, feldspar porphyry, and other acid to intermediate lavas that in part are well pillowed.

Middle group - greenstone types of basic to intermediate lavas, commonly pillowed, interbedded in places with much coarse-grained igneous material of gabbroic appearance that is in part lava and in part intrusive, some rhyolite, and related types.

Lower group - altered acid, intermediate, and basic volcanics.

The upper group forms narrow bands in the central part of the area between and on either side of the sills in the syncline between Barlow and Gwillim lakes, and in the southern part a belt 9,000 feet wide along the north side of the Timiskaming sediments south of Scott lake. Rhyolite, tuffs, and tuffaceous

sediments tentatively assigned to the upper group outcrop on Rush lake, in the northern part of the area, in a belt at least 2,500 feet wide that strikes slightly north of west. The structure of the Rush Lake belt is imperfectly known, but as the stratigraphic tops of the lavas immediately south of the belt seem to face northwards it is considered provisionally to be synclinal.

The middle group lies on either side of the upper group in the Barlow-Gwillim Lakes syncline, and is particularly well exposed on the south limb of this structure in a belt 8,000 to 9,000 feet wide that crosses Scott lake immediately north of the Barlow-Scott township line. The rocks between Gwillim and Rush lakes are with some exceptions basic to intermediate lavas and may represent a broad zone of the middle group repeated in an anticlinal fold. Basic to intermediate pillowed lavas possibly 3,000 feet thick occur at the southwest end of Scott lake and in the lake-like bay at its southwestern extremity. They lie immediately north of the upper group south of Scott lake, and on account of a few rather poor determinations of flow tops are considered to face south, and, therefore, to underlie this group. Apart from rhyolite interbeds, they resemble the middle group at the northern part of Scott lake. Their extension eastward is drift covered; if continuous and unfaulted westward they should extend across the rocky area north of the creek draining Laura lake. The volcanic rocks north of this creek, however, although containing some intermediate to basic lavas consist of feldspar porphyry lavas and tuffs, rhyolites, and agglomerates, and do not seem to fit in to the classified groups. The volcanic rocks in the southwest corner of the map-area south of Laura lake are pillowed greenstone types with gabbro like those of the middle group at the northern part of Scott lake. They face northwards towards the Timiskaming

sediments, from which they are separated by a drift-covered zone 3,000 to 4,000 feet wide except for one outcrop of acid lava and tuff, which is pale mauve, and liberally sprinkled with unusually elongate feldspar phenocrysts.

The lower group is not so clearly definable nor so well established as a unit as are the other groups. The best evidence available from the regional structure and the attitude of flow tops in the adjacent middle group, unless invalidated by undetected faults, indicates that the rocks of the lower group are the oldest volcanic rocks in the map-area. However, corroboratory evidence that they are the oldest, by determination of flow tops in the lower group, is lacking. The lower group is poorly exposed in a belt about 4,500 feet wide between the anorthosite at Williams lake and the Barlow-Scott township line, and is well exposed in the rocky area in the northeast corner of Lévy township. At the former locality the rocks are schistose, in places carbonated, and, particularly in a zone along the south side of Williams lake, intensely sheared. The schistose state of the granite immediately south of Williams lake, coupled with the lack of granite dykes in the volcanics north of this lake in contrast to their characteristic presence at other granite contacts in the area, suggest that the shear zone at Williams lake is part of a fault striking slightly north of east. Intensely sheared anorthosite at the small lake west of Williams lake, and the peculiar occurrence of anorthositic gabbro at Scott lake on the strike of the Williams Lake shear zone, are further evidences that the zone is part of a fault that may extend for a considerable distance. The rocks of the lower group in the northeast corner of Lévy township are metamorphosed to dark, hornblende-bearing, and light grey, chorty types by the Opémisca granite mass, and are cut by granite and other dykes.

They include green, porphyritic rocks with occasional well-developed pillow structures and white feldspar phenocrysts (in part metacrysts) one-eighth to one-half inch in size.

Timiskaming

Timiskaming sediments form a wide belt which extends west-northwestward from Goudreau to Laura lakes in the southern part of the map-area. From the south side of this belt northwards to Scott lake the Timiskaming sediments and Keewatin volcanics, unless faulted, are a conformable succession facing south. The base of the sediments in contact with banded sediments, tuffs, and acid lavas of the upper group of the Keewatin to the north is arbitrarily drawn immediately below the lowest observed pebble or boulder conglomerate beds. These beds are characteristic of the sediments and contain very perfectly rounded pebbles in contrast to the angular character of fragments in the older fragmental rocks of the Keewatin. The well-exposed sediments between Trenholme brook and Goudreau lake consist of crossbedded to massive arkose with lenses and, in places, massive interbeds of pebble conglomerate. Many of the pebbles have been squeezed out to several times their original length. The axis of elongation seems to dip fairly consistently 75 to 80 degrees west in the various outcrops. The pebbles range in length from 1 inch or less to about 6 inches, and consist of various types of light-coloured, acid, volcanic material, such as rhyolite, chert, feldspar, or (and) quartz porphyry, and sparingly of greenstone and of grey, much altered, medium-grained granite. The granite pebbles occur particularly in the southeastern part of the sediments. Finely banded greywacke or argillite occurs in small interbeds in the arkose. The poorly exposed sediments between Trenholme brook and Laura lake include rusty black slate and finely banded grey to black cherts and grits, possibly of tuffaceous origin.

Volcanic rocks, both acid and basic, are interbanded with the sediments in the southern part of the sedimentary belt. Some of the volcanic rocks along the south side of the belt, however, may be narrow slices of Keewatin rocks faulted complexly in with the sediments.

The exposed Timiskaming sediments between Goudreau and Laura lakes are inferred by means of crossbedding to face south and to form the north limb of a syncline. The south limb of the syncline is either much attenuated in the concealed interval that separates the sediments from the northward-facing volcanics to the southwest or is cut out by a strike fault extending west-northwestward.

Serpentine (Peridotite), Pyroxenite, Gabbro, Quartz-Diorite Sills

The sills herein grouped together are probably genetically related and occur in the Barlow-Gwillim Lake syncline in the northern part of the map-area. The continuity of the syncline is broken by the Gwillim Lake fault which offsets the broken parts about 4 miles to the left from one another. The successive sills range, with certain repetitions, from ultrabasic to siliceous in passing from either side inwards to the axis of the syncline. The progressive increase of ferromagnesium minerals towards the base and of feldspar and quartz toward the top that occurs in the various sills except the ultrabasic ones, exemplifies in individual sills the arrangement of the different types of sills taken as a group. The arrangement of the sills as a group, and of the mineral constituents in the various sills, is too perfect to be attributed to chance or coincidence, and is considered indisputable proof that the sills were injected into nearly flat-lying Keewatin rocks, and were later folded into their present nearly vertical attitude. That they are sills and not large flows is indicated by slightly discordant relationships to flows by

inclusions tailing off laterally from wedge-shaped projections of the volcanics along their strike into the sills, and by metamorphism of the volcanics both above and below some of the sills.

The decrease in number of sills northward, particularly of the ultrabasic types, which is apparent in a comparison of the two limbs of the Barlow-Gwillim Lake syncline and its continuation to the east across Chibougamau area, suggests that the source of the sills lies to the south of the syncline. The source, of which no obvious trace now remains, would seem to lie on the axis along which the Opémisca granite, Chibougamau granite, and anorthosite masses occur, as a similar succession of ultrabasic to intermediate sills which occur south of Opémisca lake and die out southward from this same axis.

The various rock types represented in the sills are for the most part readily distinguished from one another. The peridotite-pyroxenite sills are composite types made up of interbanded and sharply distinct layers, a few feet to 200 feet thick, of grey to green pyroxenite, in general unaltered, and of peridotite almost completely altered to serpentine. They weather reddish brown, and on fracture are grey or dark green to nearly black. The diabasic gabbro to gabbro pyroxenite sills may be in part composite, but the changes from one type to another of the rocks forming these sills are gradual and occur in a definite order. In any one of these sills, the base, that is the side away from the synclinal axis, is composed of green pyroxenite, in thin sections of which a trace of interstitial feldspar is visible. Feldspar is noticeably present in the upper part of the pyroxenite phase and increases in amount upward to the top, which is characteristically coarse grained, diabasic in texture, and contains irregular segregations of feldspar and femic minerals.

The characteristic phases of the gabbro and quartz-diorite sills are quite distinct unless altered. The gabbro sills display a general sequence in many places beginning with coarse grained, green to brown amphibolite at the base and grading upwards through normal gabbro to gabbro containing 5 per cent or more interstitial quartz at the top. The amphibolite, however, is not a persistent basal phase. The most typical rock of the gabbro sills is pale grey, medium to coarse grained, and is composed of dark and light, squat-shaped minerals in about equal proportions. The quartz-diorite sills also show a general but less obvious increase of feldspar and quartz towards the top, and of ferromagnesian minerals towards the base, although the greatest concentration of femic material and the coarsest grain do not occur at the base. The typical phase of the quartz-diorite consists of about 50 per cent long, platy, green hornblende crystals in a criss-cross pattern, intermingled with greenish grey, altered feldspar and glassy blebs of interstitial quartz. In quartz-feldspar rich phases dark-coloured constituents are barely visible in grey to greyish green, granular, quartz-rich aggregates, some of which show vague outlines of long, lath-shaped feldspars.

The only direct evidence bearing on the relative ages of various members of the sill group are a few small pegmatite dykes that closely resemble the quartz diorite mineralogically, and cut the lower of the two gabbro sills. Crosscutting of one sill by another was not observed.

Anorthosite and Gabbro

Anorthosite and associated gabbro at David lake form the western part of the Chibougamau anorthosite mass. The two phases, anorthosite and gabbro, are too poorly exposed to be mapped separately. They seem to be arranged in alternate broad bands striking west-northwest, and in places are slightly sheared

parallel to the west-northwest banding. The anorthosite is a white to light grey, mottled rock composed almost entirely of secondary minerals. The gabbro where not excessively altered is medium to very coarse grained and consists of interbanded phases differing from one another in feldspar content. The intensely altered phases are dark green and massive. Small, barren quartz veins a few inches to 2 feet wide strike north-northeast to northeast in the anorthosite and gabbro at David lake, more or less at right angles to the strike of the banding and shearing.

A zone, several hundred feet wide in places, of anorthosite intimately injected by granite and diorite dykes takes the place of a definable contact between the anorthosite and the diorite and granite to the west. The rock in part of this zone is an intrusive breccia with numerous angular blocks of anorthosite and altered diorite or gabbro set in granite.

Diorite-Granite Complex

The diorite at Simon and Scott lakes and in the district bordering these lakes is cut by numerous small bodies and irregular dykes of granite. In part, as south of Simon lake, diorite is the prevailing rock, in other places, particularly near the granite mass north of Simon lake, granite dykes form a network enclosing small blocks of diorite. The diorite if comparatively fresh consists of dark-coloured hornblende and light-coloured feldspar in about equal proportions, and is medium to medium coarse grained. Many phases of the diorite contain quartz. Where altered or sheared the diorite becomes massive, fine grained, and green, and may resemble greenstone. The granite is typically grey and medium grained, and contains, besides feldspar, about 20 per cent quartz and

about 10 to 15 per cent chlorite secondary after biotite. Basic chloritic dykes, in part containing feldspar phenocrysts, cut the diorite granite complex in many places, and range from 1 foot or less to about 12 feet thick.

Granite

Granite occurs in the map-area in the northern part of Scott township and in the northeastern part of Lévy township. The granite in Scott township may pass insensibly southward into the diorite-granite complex, as the boundary between these two masses seems to be merely a zone in which enclosed diorite blocks increase until they form an appreciable part of the rock mass. The granite in Scott township is pink or grey, coarse grained, and contains 10 per cent or less chlorite, probably secondary after biotite, and in general a high quartz content. Small, glassy quartz veins occur in the granite at the Ramsay prospect at the northwest corner of David lake. The granite near these veins contains considerable coarse pyrite and is altered to a coarse grained rock containing 50 per cent or more quartz embedded in a bright yellowish green aggregate of sericite. Numerous altered biotite lamprophyre dykes, 12 feet or more thick, occur in the granite, particularly near its margins, and at any particular locality are roughly parallel to one another.

The granite in the northeast part of Lévy township forms the eastern part of the Opémisca granite mass. The marginal phases of this mass contain much hornblende and range from syenite or quartz-poor granite to diorite.

GLACIATION

During the Glacial period the rocks of the area were strongly scoured and grooved by ice, and three types of unconsolidated deposits were formed.

The oldest of the unconsolidated deposits are drumlin-shaped hills that form a system trending north-northeast, as shown on the accompanying map, No. 401a. These hills are cigar-shaped to oval in plan, and range from inconspicuous low features to moderately prominent ridges 50 to 100 feet or more in elevation. They are clearly visible with the aid of a stereoscope in aerial photographs of the map-area, even though their boundaries are not sharp and their slopes merge gradually with the general surface. Outcrops if present on these ridges occur particularly at their northern ends, and in very few cases elsewhere except possibly on either side. In the southeast corner of the map-area where ridges of this type are most numerous few rock outcrops occur.

Small, morainic ridges about 50 feet wide and 10 feet high, extending in general northwest, occur in various parts of the map-area. The ridges are discontinuous along parallel lines a few hundred to 1,000 feet apart and form a "washboard"[1] pattern.

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[1] Mawdsley, J.B.: Roy. Soc., Canada, vol. XXX, sec. IV, pp. 9-12 (1936).

In some cases they extend across the drumlin-shaped hills, but are not present in the linear belts of sand plain that extend northeast across the area. The morainic ridges occur in rocky as well as in drift-covered areas, and consist of unsorted, fine to coarse material. Ridges of this type in the more rocky areas contain angular blocks which represent, presumably a general sample of the rocks from the nearest outcrops to the northeast. If such a general sample were to contain angular blocks of vein material also, the place to prospect carefully would be immediately northeast of the ridge containing the vein material.

Two prominent linear belts of sand that are either unusually large eskers or are composite esker and localized

outwash deposits extend northeastward across the area, as shown on the accompanying map, No. 401a, and contain few if any outcrops. Together with the northwesterly trending morainic ridges, they suggest that the ice retreated northeastwards. Ice grooves and the elongation of the drumlin-shaped hills indicate that directions of advance were southwest and south-southwest.

STRUCTURE

The main features of the regional structure are three, large, east to east-southeasterly folds and one large north-easterly fault (Gwillim Lake fault). The folds are, from north to south:

(1) The Barlow-Gwillim Lakes syncline.

(2) The Scott-David lakes anticline, along the axis of which granite, diorite, and anorthosite have been intruded.

(3) The syncline of Timiskaming sediments.

The Barlow-Gwillim Lakes syncline extends eastward across the southern part of the north half of the area, and at Gwillim lake is shifted 4 miles to the left along the Gwillim Lake fault. The synclinal structure is brought out clearly by the symmetrical arrangement of the various sills about the synclinal axis, and by the facing of flow tops toward one another from opposite sides of the syncline.

The general succession of sills in the south limb of the Barlow-Gwillim Lakes syncline is repeated immediately south of the Opémisca granite in the west half of Opémisca map-area. The two occurrences of sills, ranging in order from ultrabasic to less basic types, one north, the other south, of the Opémisca granite mass are arranged symmetrically to the granite as to an anticlinal axis. The position of the stratigraphic tops of the

sediments and of the lavas that occur with the sills on either side of the granite afford confirmatory evidence of the existence of this anticlinal structure, now occupied almost entirely by granite. The continuation of this structure across the east half of Opémisca area, as the Scott-David Lakes anticline, is not clearly indicated except for the facing of flow tops away from the diorite, granite, and anorthosite at Scott, Simon, and David lakes.

The Timiskaming sediments occur in the central part of a syncline immediately south of the Scott-David Lakes anticline, and are bordered on either side by underlying Keewatin rocks. Although the Keewatin rocks in the southwest corner of the map-area are clearly part of the south limb of this syncline, they may be thrust northwards against the Timiskaming rocks and part of the south limb may be cut out.

Besides the folds described there may be a broad anticline between Gwillim and Rush lakes, and a syncline at Rush lake. A subsidiary fold shown by the structure of the sills on the north side of the Barlow-Gwillim Lakes syncline occurs near the east side of Barlow lake, and others are probably present in the area.

The Gwillim Lake fault is probably a northeasterly continuation of the Campbell Lake fault which occurs a short distance southeast of the Opemiska copper deposits, 16 miles southeast of Gwillim lake. The section between Gwillim and Campbell lakes along which the fault should extend is, however, almost completely blanketed by sand. The presence of the fault at Gwillim lake is indicated topographically by the narrow, rectilinear character of the lake, by complete discontinuity of structure across the lake, and by pronounced shearing of the rocks at various places along the shore-line of the lake. The most intense shearing and the alteration of the greenstone occur

at the small point on the north side of the lake one-half mile west of the eastern border of the map-area. At the extreme tip of this point the rocks for a width of 50 feet are converted almost entirely to rusty weathering carbonates cut by small quartz stringers, and even over a width of 300 feet are carbonated to some extent. Pillowed, basic lavas on the south shore of Gwillim lake opposite Sioui bay are also intensely carbonated although very slightly sheared.

North-northeast faults are the most conspicuous of the more local structural features of the district, and are indicated by zones of shearing or brecciation, and in some places by small offsets. The best exposed north-northeast fault occurs on the township line southwest of Scott lake, and brings rhyolite in contact with pillowed basic flows. The rocks at this fault are strongly sheared for 100 feet, are cut by calcite veins, and are very sparingly mineralized with sulphides. This fault is in alinement with a zone of intensely mashed diorite and granite that lies on the west side of Scott lake east of the Scott-Lévy mile-post 4. The presence of other zones of intense shearing or mashing of the diorite and granite along the west side of Scott lake, and of small faults on the south side of Gwillim lake opposite the north end of Scott lake, may indicate that faulting has occurred along, and has controlled the shape of, Scott lake. Besides the faults indicated on Map No. 401a there are several other poorly exposed north-northeast to east-northeast zones of shearing or distortion south of Scott lake, particularly in Scott township. Some of these zones are alined in the same general direction as sheared zones in the diorite complex of Simon lake which contain sulphides, quartz, and, in some cases, gold.

North-northeast fractures, shears, and, in places, faults, are clearly indicated by the topography of the belt of

sills between Barlow and Gwillim lakes. Only one fault, however, 1½ miles west of Sioui bay, Gwillim lake, on the north side of the belt is known to have a definite offset. The lack of direct continuity of the sills across Barlow lake, which is apparent on the map, and the presence of numerous quartz veins, particularly near and north of the central, constricted part of the lake, may indicate north-northeasterly faulting along the lake. The occurrence of a little arsenopyrite in one of the veins suggests that the section along Barlow lake should be carefully prospected, as the structure and the rocks at this locality have much in common with those at Bourbeau lake, 16 miles to the east, where gold occurs in veins carrying arsenopyrite.

GOLD OCCURRENCES AND PROSPECTING

General Statement

The map-area has probably been prospected to some extent during the last ten years or so, but much the greater part of the exploratory trenching on various mineral occurrences containing gold has been done in the last two years. In 1935 and 1936 two quartz carbonate zones, mineralized with pyrite, were discovered in greenstone between Little Rush lake and Rush lake (Croteau showings), and several quartz veins with associated sulphides and carbonates were found in diorite, anorthosite, and granite at David and Simon lakes. Work on these showings to date has not demonstrated that any of the discoveries contain commercial ore-bodies, but does indicate the occurrence of gold in parts of the area.

Work was also done in 1935 by McKay (Quebec) Exploration Company on several small shear zones containing quartz and pyrite in diorite, granite, and volcanics at the south end of Scott lake, and on the zone of shearing in greenstone along the south

side of Williams lake. Very low gold assays or traces are reported from samples from the Scott Lake zones. The Williams Lake zone was explored by the company during the winter of 1935-36 by drilling eight holes, totalling 1,000 feet, through the ice. The rocks encountered by drilling resemble closely those exposed on the shore of Williams lake, and consist of fine-grained, chloritic, and grey, sericite, carbonate-rich schist, some with quartz blebs or phenocrysts. The schist contains a little pyrite and is cut by a few stringers and small veins of quartz and carbonate, some of which contain 50 per cent or more massive chalcopyrite and pyrite.

Two iron sulphide zones in sediments that were trenched, apparently without encouraging results, prior to 1935 occur in the map-area, one[1] (LeRoy showing) 2,000 feet east of

[1]Geol. Surv., Canada, Sum. Rept. 1930, pt. D, p. 48.

the north end of Laura lake, the other at the south contact of the southern gabbro sill 1¾ miles west of the Gwillim Lake fire ranger's tower. The LeRoy zone was re-sampled in 1935 and reported to carry only a trace of gold. Sulphide zones occur at many places along the south contact of the gabbro sill west of the fire ranger's tower and are indicated by rusty cappings. The zone, trenched 1¾ miles west of the tower, is in banded sediments and rhyolite and contains disseminated pyrite, pyrrhotite, and a small proportion of chalcopyrite.

Late in the season of 1936 Mr. Kilpatrick, in charge of prospecting claims of W.J. Marshall south and west of Laura lake, uncovered several, small, parallel quartz veins, a few inches wide, containing much chalcopyrite and pyrrhotite in volcanics and associated gabbro a few hundred feet northwest of Laura lake. Samples from these veins are reported to have assayed $3 to $6.40 in gold a ton. A significant fact is the proximity of the veins

to a strong zone of shearing, at Laura lake, interpreted to be a fault of considerable magnitude. It is apparently another of the many instances in the district of the proximity of mineralized zones to faults.

It is important to realize in the selection of the more favourable parts of the map-area for prospecting that even those sections in which no deposits have been found may contain undetected or concealed gold-bearing zones or veins that are difficult of discovery. It would seem, however, that the more favourable parts are those in which structure and rock associations compare closely with those present in parts of the district where potentially commercial deposits have been found, and parts where some progress has already been made in discovering deposits equivalent in grade, if not in size, to commercial ore-bodies.

Accordingly, the region between Barlow and Gwillim lakes in which a series of ultrabasic to fairly siliceous sills are folded synclinally may be considered a favourable section for prospecting, on account of its similarity in structure and rock association to the district south of Opémisca lake in which the Opemiska copper deposits occur. Moreover, the sills both at Gwillim lake and at the Opemiska deposits terminate eastward against a large east-northeast fault, and in both localities north-northeast zones of minor faulting occur. There is also some similarity between the structure at Barlow lake and that at Bourbeau lake, although at the latter locality a stock of quartz-poor granite or syenite occurs and may have exercised an indirect structural control in the localization of the gold veins there. Rock outcrops are numerous in the region between Gwillim and Barlow lakes and must have already attracted many prospectors who would have located any easily accessible deposits. Discoveries if made, therefore, will probably require careful prospecting, much exploratory stripping, and possibly, trenching.

In the area underlain by diorite, granite, and anorthosite at Simon and David lakes, deposits have been discovered containing good, if erratic, concentrations of gold. The scope of prospecting in this section of the area is limited by drift which mantles all but a small part of the surface. As many of the outcrops occur on lake shores, careful prospecting of the lakes when the water is at its lowest level should be considered prior to other expensive methods of exploration.

Occurrences in Greenstone

Croteau Showings. Two showings, referred to here as the Croteau showings, were staked by the Croteau brothers in 1935. They occur in greenstone on the south side of Chibougamau river between Little Rush lake and Rush lake, as shown on the accompanying map, No. 401a.

The eastern showing, $1\frac{1}{3}$ miles southwest of Rush lake, lies in a restricted area of comparatively numerous outcrops. Three trenches, at about 140-foot intervals, at this locality expose intensely schistose and carbonated volcanics, on either side of a quartz vein that strikes about east 5 degrees south and dips steeply south. The vein in the central trench is 7.2 feet wide and consists of massive white quartz with some small streaks of carbonate, and with a few veinlets, $\frac{1}{8}$ to $\frac{1}{4}$ inch wide, of fine-grained pyrite, particularly near its sides. Pyrite occurs also in the schistose wall-rocks along the margins of the vein. The vein and wall-rocks in the eastern trench are similar to those in the central trench, but no quartz was observed in the western one. The reported results of sampling suggest that the zone has a low, possibly erratic, gold content.

The western showing lies about $1\frac{3}{4}$ miles east of Little Rush lake, on the south side of Chibougamau river. The rocks exposed at this showing are carbonated greenstone types, and

form a few low and small hummocks above the level of the surrounding muskeg and water. About 280 feet of trenching was done on this showing in 1935, but most of the trenches were filled with water when examined by the writer in September 1936. The zone indicated by trenching extends slightly north of west for about 170 feet and may extend farther, as it is not fully exposed. It consists of heavily carbonated rock cut by irregular stringers and veins of quartz. Pyrite occurs in small amounts in the carbonated rock and in the quartz. The zone as exposed in the trench 20 feet west of the most eastern one consists, from north to south, of the following parts:

	Feet
(a) Intensely carbonated rock, green on fracture, containing about 5 per cent of coarse pyrite and cut by flat, irregular quartz stringers streaked with carbonates, 2 to 6 inches wide. A small amount of pyrite and a trace of chalcopyrite occur in the quartz	14.6
(b) Mostly quartz mixed with a little carbonated rock, and containing a small amount of sulphides as in (a). Dip uncertain.....	3
(c) Similar to (a) except for a slightly greater content of quartz and pyrite	5
(d) Rusty weathering, carbonated rock cut by a few quartz stringers and mineralized in places with a little pyrite	21

The character of the zone in the other trenches as indicated by loose blocks is probably similar to the section described, although the widths may be quite variable. The quartz in the easternmost trench contains a little specular hematite, and in one of the most western trenches is veined by very narrow seams of fine-grained pyrite, and by tourmaline, and includes small amounts of a micaceous, dark green mineral, probably a chlorite. Reported assays from this zone suggest that the gold values although erratic are slightly better than those in the eastern showing.

Occurrences in Diorite, Anorthosite, and Granite

Outlet Rapids, Simon Lake. A narrow quartz vein, trenched by McKay (Quebec) Exploration Company, in 1935, occurs in granite on the northwest side of the foot of the Outlet rapids of Simon lake. The vein strikes south 46 degrees east, and dips about 40 degrees south along its exposed length of about 45 feet. It varies from 2 to 6 inches wide, is milky to greyish white, and contains about 30 per cent sulphides, which are chiefly pyrite with pale yellowish green sphalerite and some chalcopyrite. The granite in the foot-wall is altered for 4 feet, and is cut by small stringers of quartz and of carbonate. A drill hole put down 100 feet south of the vein passed through quartz diorite cut by granite dykes from 25 feet to 58 feet before entering granite. The 6-inch vein was not intersected in the drill hole, although the granite at the depth it was estimated to occur showed the same type of alteration as at the foot-wall of the vein on the surface and contained a few narrow veinlets one-quarter inch wide of quartz and carbonate with a little pyrite. One sample from the 6-inch quartz vein at the surface is reported to have assayed about 1.0 ounce gold a ton.

Noranda Showing. A shear zone stripped by prospectors for Noranda Mines, Limited, in 1935, occurs in diorite cut by granite dykes on a very small rock islet in the southwest arm of Simon lake. The zone is apparently 8 feet wide, strikes about north 53 degrees east, and dips 70 degrees south. The diorite in the shear zone is moderately to strongly sheared to a green, chloritic rock, and is cut by stringers of quartz, 1 to 3 inches wide, mineralized with pyrite, sphalerite, and small amounts of chalcopyrite. Small amounts of carbonate are present in the zone, and pale, radiating bunches of pale greyish yellow actinolite or tremolite occur in some of the quartz stringers. An assay by the Mines Branch, Ottawa, of a sample of one of the 3-inch stringers,

consisting of 50 per cent sphalerite, with much pyrite and some quartz and carbonate, gave silver 0.22 ounce troy a ton and no gold. Assays of other parts of this zone are reported to have yielded low values in gold.

Ceres Showings. Two small showings of quartz in sheared parts of the diorite and granite at Simon lake were explored by Ceres Exploration, Limited, in 1935. They occur in the southwest part of the lake, one on an island, the other on the southeast shore half-way between Deschênes island and the southwest end of the lake.

The discovery on the island is a sheared, quartz-bearing zone 8 feet wide in granite, containing numerous blocks of diorite. The zone exposed for 40 feet by stripping on the west side of the island strikes about north 60 degrees east and dips about 40 degrees north. The rocks in this zone are considerably altered to carbonate and sericite, and in places are intensely sheared. One quartz vein 6 inches wide at the shore and diminishing to 3 inches 20 feet inland, with parallel narrow veinlets, some containing a little black tourmaline, extends along the zone. Pyrite and some chalcopyrite occur here and there in bunches a few inches long in the main vein, and pyrite is sparingly disseminated in the sheared rocks along the zone. A shear 6 inches wide on the east side of the island, about 175 feet distant, possibly represents a continuation of the zone exposed on the west side of the island. Assays for gold of the various parts of the zone are reported to indicate that the carbonated and sheared granite and diorite carry a trace of gold only and that gold occurs in important amounts in the 6-inch quartz vein. Two assays of the vein from points 5 feet apart are reported to have yielded 3.58 and 0.88 ounces of gold a ton.

The Ceres showing on the southeast shore of Simon lake is a quartz-bearing, sheared zone in granite and diorite that

strikes north 56 to 60 degrees east and dips steeply north. It is very similar to the Ceres Island showing except for its larger size and greater included width of quartz vein material, which contains carbonates, tourmaline, and pyrite. Assays from this zone, however, are reported to have yielded a trace of gold only.

Deschênes Island Showing. The Deschênes island showing occurs in a complex of diorite, quartz diorite, and granite cut by fine-grained to porphyritic, basic dykes on the northern tip of Deschênes island, Simon lake, and was discovered and staked by McKay (Quebec) Exploration Company in 1935. During 1935 a series of trenches totalling about 1,400 feet in length were dug to explore the continuity of the vein southward from the shore outcrop where the initial discovery was made. The trenches disclose two irregular and branching bodies or veins of quartz, alined in a general northerly direction, which range from a few inches to about 3 feet wide. The southern body is about 250 feet long and swings from north 40 degrees east to north a few degrees west from its south to north end. The northern section is about 100 feet long and lies about 170 feet north of the southern, 250-foot section. It is flexed anticlinally and synclinally and, accordingly, has a very sinuous outcrop, which strikes from north a few degrees west to east a few degrees north. The dip of the quartz veins, as indicated by about 1,000 feet of drilling in 1936, is 25 to 30 degrees west. The quartz veins contain bunches of coarse-grained pyrite from a few inches to a few feet long and an inch to a few inches wide, a considerable amount of pale yellow carbonate, and, more particularly along their walls, tourmaline, chlorite, and sericite. The wall-rocks along the vein are not sheared, although in places they are moderately carbonated or converted to a pale green colour due to

the presence of abundant sericite. Assays of (a) a general sample, (b) sulphide-rich sample, (c) carbonate-rich sample, (d) quartz, tourmaline carbonate vein material from the deposit are reported to have assayed in gold a ton $14.35, $7.70, $1.75, and $1.05, respectively. The gold would seem to occur at Deschênes island and at similar deposits of the vicinity in a fairly coarse state, particularly in association with sulphides. This inference is suggested by the erratic occurrence of values in these types of deposits, by the presence of very coarse gold at the Smith showing 2 miles southeast of Deschênes island, and by the occurrence of gold in important amounts in quartz veins well mineralized with sulphides, as at the Ceres Island showing and at the Outlet rapids of Simon lake.

Smith Showing. A small but spectacular gold discovery was made in 1936 on the Smith group of claims at the northeast corner of Buckell lake. The claims were carefully explored after the discovery by McKay (Quebec) Exploration Company, and now with the Deschênes Island group are controlled by Scott Chibougamau Mines, Limited. The Smith claims straddle the contact zone between the anorthosite mass of David lake and the diorite and granite complex of Simon lake. In this zone, and particularly where the discovery occurs on the northwest side of Chibougamau river one mile south of the David Lake outlet, the anorthosite is cut by numerous irregular diorite and granite dykes.

The spectacular part of the Smith discovery is a 20-foot section of a vein a few inches to 15 inches wide which lies in a narrow shear zone striking about north 18 degrees west and dipping about 50 degrees west. The vein material consists of quartz well mineralized with pyrite, and with carbonate, particularly along the foot-wall. At one point abundant coarse gold could be seen in the vein for 2 inches near the hanging-wall. Assays from the

gold-rich part of the vein have yielded extraordinarily high returns. The veins on either side of the 20-foot gold-rich section, as well as numerous other nearby shears with narrow fillings of quartz mineralized typically with coarse-grained pyrite, are reported to contain little if any gold. The work to date at the discovery consists of about 1,000 feet of trenching and surface stripping, and about 588 feet of diamond drilling.

Ramsay Group of Claims. The Ramsay group of twelve claims, at the northwest corner of David lake, on which mineralized zones occur in granite, was optioned and explored by O'Leary-Malartic Mines, Limited, in 1935-36. The northern and greater part of the claims is underlain by granite which outcrops extensively in a low, round hill 1,000 feet north of the lake, and near the northern boundary of the group in a high ridge which is separated from the round hill by a drift-filled valley one-quarter mile wide. Two small anorthosite outcrops, one on the lake, the other 2,000 feet west, occur in the southern part of the claims, and are separated from the granite at the round hill by a 1,000-foot, drift-covered interval. Gabbro which is exposed in one trench outcrops 1,000 feet east of the round hill near the east boundary of the group.

The mineralized zones on the property, only one of which has important length and width, are well exposed by trenching on the southeast side of the round granite hill. Trenches have been dug on the granite ridge in the northern part of the group without encouraging results.

The most northern and largest zone strikes about 18 degrees south of east and dips about 65 degrees north. It consists of closely spaced, irregular stringers of fine-grained pyrite with some chalcopyrite and, in places, a very little sphalerite in fractured, massive granite. A few small stringers of chalcopyrite

and lenses of quartz, with either chalcopyrite or carbonate, occur also along the zone. The sulphide stringers range from a fraction of an inch to an inch or so wide, and in places form 25 to 50 per cent of the material of the zone. The granite where very heavily mineralized is massive, green, and chloritic, but elsewhere is comparatively fresh, coarse-grained, and consists of quartz, about 50 per cent, and feldspar, altered in part to sericite. In the eastern part of this zone the granite is porphyritic.

The northern zone has been almost completely stripped for a distance of 375 feet, and varies within rather ill-defined walls from 3 feet or less to 4 feet wide. It is not present or is represented by a trace of sulphides only in a trench 25 feet west of the 375-foot section. A trench 35 feet east of this section exposes porphyritic granite of brecciated appearance traversed by irregular veinlets of brown-weathering carbonate accompanied by chalcopyrite and a little pyrrhotite and pyrite. Dykes of altered biotite lamprophyre 8 to 12 feet wide that occur on either side, roughly parallel with and close to this zone, extend beyond either end of the 375-foot section, and suggest that it is not cut off by cross faults. The reported results of sampling indicate that a 180-foot interval about 4 feet wide of this zone has a fairly consistent gold content, ranging between 0.1 and 1.0 ounce a ton. Similar assays have been obtained over an additional length of 90 feet, but there the width is less.

Another zone lies 100 to 150 feet south of and roughly parallel to, the northern zone. It is ill defined, consists of granite cut by small vein-like lenses of unmineralized quartz, and contains segments of a much sheared and faulted lamprophyre dyke. The granite for irregular distances of a few feet from the quartz lenses is altered to a vivid yellowish green and grey and is mineralized with cubical pyrite, much of which is in large

crystals. The feldspars in the green granite are altered completely to soricite and the quartz content seems to be much increased by the alteration. The gold content of this zone is reported to be erratic and low, except for one assay ($21 a ton) of an 18-inch section across a carbonated dyke mineralized with pyrite, which lies 150 feet south of the western end of the north zone.

A third zone lies 485 feet south-southwest of, and parallel to, the northern zone. It has an exposed length of 65 feet, a steep north to vertical dip, and a width of about 2 feet. The granite in this zone is fractured, moderately altered, and cut by a small quartz vein 3 to 6 inches wide and a lamprophyre dyke 6 to 18 inches wide on the south side of the vein. Pyrite occurs in the quartz vein, in the dyke with carbonates, and with chalcopyrite either as small stringers or sparsely distributed in the granite. Moderate to low values in gold are reported across widths of 27 inches in the western part and a trace only in the eastern part of this zone.

The most important local structures in the granite which seem to have controlled the development of the mineral zones are the lamprophyre dykes. They form a closely spaced, parallel series, particularly along the main mineral zone, and strike in general slightly south of east, except some that may be branches and strike east. There are also zones of jointing and minor shearing that strike north about 40 degrees east, and others at north 14 degrees west. These zones, however, along some of which small movements have occurred, are seemingly later than the gold mineralization.

If an attempt is made to trace the possible eastward extension of the mineralized zones into the area covered by drift east of the round granite hill two possible interpretations of the more general structure in which the deposits occur should be

considered. The distribution of the rocks in the southern part of the Ramsay group of claims shows that the south boundary of the granite, which probably lies near the south margin of the round hill, swings sharply northward past the east side of the round hill before continuing eastward. The northward bend of the contact can either be interpreted as an offset to the left of about 1,700 feet by faulting or the natural boundary of a blunt nose of granite. The evidence in favour of interpreting the apparent displacement of the contact as due to a north-northeast fault is a similar apparent offset to the left of about 2,000 feet of the north contact of the granite 1 mile north-northeast. Evidence in favour of attributing the irregularity of the contact to the presence of a blunt nose and embayment in the south margin of the granite is the porphyritic character of the granite in the easternmost part of the round hill. The porphyritic character would more likely indicate the proximity of the normal margin of the granite than a fault.