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FORGET LAKE AREA, SAGUENAY COUNTY

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GEOLOGICAL REPORT 36

FORGET LAKE AREA

SAGUENAY COUNTY

by

W. W. Longley.

QUEBEC

RÉDEMPTI PARADIS

PRINTER TO HIS MAJESTY THE KING

1948

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FORGET LAKE AREA

SAGUENAY COUNTY

by W.W. Longley

INTRODUCTION

Location of Area

The writer spent the field season of 1942 making a geological survey of the Forget Lake area. The area mapped lies about fifty miles north-northeast of the village of Havre-St-Pierre, which is situated on the northern shore of the gulf of Saint-Lawrence, about four hundred miles below Quebec city (see index map on the geological map accompanying this report).

The area is a fifteen-minute square, extending from longitude 63°00' west to 63°15' west, a distance of approximately eleven miles, and from latitude 50°45' north to 51°00' north, a distance of approximately seventeen miles.

Havre-St-Pierre

Havre-St-Pierre is a small village, with a population of about fifteen hundred whose chief means of livelihood is fishing. Labrador Fisheries, Limited, maintains a cold storage plant in the village. Some trapping is carried on, and the majority of the villagers have small garden plots. The chief crops are potatoes, turnips, and cabbage, which appear to grow well.

The village is narrow, consisting chiefly of two parallel streets which extend along the shore of the gulf for about two miles (Plate I-A). One of its more important institutions is a hospital, which, at the time of the writer's visit, was being greatly enlarged by the construction of a large cement-block building. There are also a normal school, telegraph office, post office, and several general stores in the village.

Havre-St-Pierre is built on a sand bar, formed by wave action and along-shore currents and composed primarily of sands transported by Romaine river. It is essentially a barrier beach, built on the outer edge of the delta of Romaine river. At the present time, the main river lies about five miles north of the village, and empties into the gulf of Saint-Lawrence about nine miles west of the village. The area between Havre-St-Pierre and Romaine river is a muskeg lagoon, filled with small, shallow lakes (Plate I-B). The majority of these lakes range from a few hundred feet to about half a mile in diameter, and the largest is probably not more than a mile wide.

Havre-St-Pierre is a regular port of call for boats of the Clark Steamship Company. In ordinary times these boats arrive from Montreal about once a week during the summer months. During the winter, Canadian Pacific Airlines maintains passenger and mail service along the North

Shore (the term by which all that section of the north shore of the Saint-Lawrence below Saguenay river is known). There is no means of reaching the village other than by boat or airplane.

Means of Access

Fully loaded seaplanes, of a type suitable to the northern regions of Canada, can land on any of four lakes within the area: Métivier, in the southeast corner; Forget, in the north-central part; and Buit (1) and Sanson (1) in the northwest. The writer strongly advises anyone going into the area to travel by aeroplane.

The area may also be reached by canoe. Two routes are available, but both entail much difficult water and portaging. One is up Romaine river from Havre-St-Pierre; the other, and less difficult, route is from the village of Johan Beetz, on the North Shore about thirty-five miles east of Havre-St-Pierre. This latter route leads through a series of lakes and entails thirty to forty portages, as described by Claveau (2). The majority of the portages are short, and there is not the strong current to contend with that is encountered on the Romaine River route. However, the latter is the more commonly used, as Havre-St-Pierre is the only supply base in the region.

About ten miles south of the map-area, the main Romaine river is joined by the parallel East Romaine river, and from that point northward there are two alternative routes. One may continue up the main river and pass from it into Sanson and Buit lakes in the northwestern part of the area, or one may ascend East Romaine river as far as Boucher lake, about a mile south of the map-area, and from there travel northeasterly by way of a series of small lakes and short portages to Métivier lake in the south-eastern corner of the area.

Access to the western part of the area is provided by Romaine river and Sanson and Buit lakes, and from both of the lakes, Forget lake in the north-central part of the area may be reached over routes — involving portages — which are indicated on the accompanying map.

It is true that East Romaine river extends in an almost north-south direction through the eastern part of the area and that, on the map accompanying this report, but few portages are indicated, from which it might be inferred that the river furnishes an excellent water-way. Actually,

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(1) Note-In the preliminary report on this area (Que. Dept. Mines, P.R. No.175, 1943) and in the preliminary report on the Lower Romaine River Area (J.A. Retty, Que. Bur. Mines, P.R. No.171, 1942), Buit lake was designated as "Pauline" lake and Sanson as "Alphonse" lake.

(2) Claveau, J.- Geological Reconnaissance from Forgues Lake to Johan Beetz, North Shore of the St-Lawrence; Que. Dept. Mines, P.R. 180, 1943.

however, stretches which are suitable for travel with well loaded canoes are short and far apart. In times of low water, portaging would be necessary over fully one-half of the length of this section of the river, and, in times of high water, the steep gradient and rocky nature of the river would make travel dangerous (Plate II-A).

Points in the north-central part of the area may be reached from Forget lake. Métivier lake and a series of small lakes to the south provide access to the southeastern section. Doubtless many of the smaller lakes could be utilized in reaching certain localities, but, due to lack of information regarding their extent and disposition, the writer was unable to make the best use of the majority of these.

Portaging within the area is difficult. The terrain is rugged, the footing often precarious, and most of the portages are new or at best rarely used, so that the trails are not 'packed'. In places they are so precipitous that loads must be passed from person to person rather than carried. However, the portages used by the writer's party are well cut.

Possible Land Route

Should it be found desirable at some future time to build a north-south road or railway through this region, the writer – speaking only for the map-area examined and without knowledge of conditions to the north and south – would recommend a route either along East Romaine river or along the series of depressions one to two miles east of the river which extend northward for about twelve miles from the south margin of the area. Thence, the route should proceed in a northwesterly direction, leaving the northern margin of the map-area about a quarter of a mile east of the channel of East Romaine river. It might be added that there may be little or no gravel available along this suggested route, the nearest known gravel deposits being along the meandering sections of East Romaine river, above and below the mouth of Métivier river.

Field Work

The investigation of this area had two main purposes: to examine more fully certain occurrences of copper mineralization which had been noted by J.A. Retty in the course of his work in the area for the Quebec Department of Mines in 1941 (1), and to make a topographic and geological map of the area as an aid to further prospecting.

A few days more than two months were spent in the area, but many working days were lost due to inclement weather. Also, the field work was much impeded through lack of an adequate base-map.

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(1) Retty, J.A., Lower Romaine River Area, Saguenay County; Que. Dept. Mines, Geol. Rept. No.19, 1944.

Land traverses by pace-and-compass were run systematically at intervals of approximately half a mile. The numerous small lakes, whose positions and extent were then unknown, caused considerable difficulty in carrying out this systematic traversing. The traverses were generally run in an east-west direction in order to cut across the rock structures and topographic trends, which are in general north-south.

The geology along and adjacent to the major rivers and lakes was mapped by Retty in 1941 (1). Except locally, where additional information was desired, the shores of these waterways were not further examined by the writer.

During the field season, the only map available was a Department of Lands and Forests map, which, while very good insofar as the information contained on it was concerned, showed only surveys of the two main rivers and four larger lakes, with their outlet streams. If a complete base-map had been available at the time, some of the portage-routes surveyed and used during the course of the present work, and shown on the accompanying map, undoubtedly would have been at locations other than those actually selected.

Late in the summer, vertical aerial photographs of the area were taken by Canadian Airways, Limited, for the Quebec Departments of Mines and of Lands and Forests, and an excellent base-map was compiled from these photographs by the latter Department. The writer made a detailed stereoscopic study of the aerial photographs during December, 1942, and January, 1943, to aid the mapping of the various formations and the making of a contoured map he prepared at that time. Approximate elevations of the larger lakes and at several points along the main rivers were provided by the Department of Lands and Forests. The elevation of Métivier lake, as determined by the sensitive altimeter of the Canadian Airways 'plane, checked within thirty feet of that given by the Department of Lands and Forests. Other elevations were determined by the writer at critical points on practically all traverses, using an aneroid barometer, the readings of which were checked with those of a second barometer kept at camp.

Acknowledgments

The writer wishes to express his appreciation of the advice and information regarding the area which Dr. J.A. Retty kindly provided, and which proved most helpful. On the accompanying map, the majority of the outcrops along Romaine river, East Romaine river, and the four larger lakes with their outlet streams, were taken directly from a copy of Dr. Retty's manuscript map (2).

Particular thanks are due to Mr. Gérald Barrette, of the Quebec Department of Lands and Forests, for his co-

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(1) Retty, J.A., op. cit.

(2) Retty, J.A., op. cit.

operation by compiling the base-map as soon as possible after receipt of the aerial photographs and thus making it available to the writer in time for him to prepare, in the office, an adequate topographic and geological map of the area.

The writer also wishes to express his appreciation of the help received from his field assistant, Jacques Claveau, whose knowledge of the area, gained during his previous summer's work, proved very useful. Other members of the party were: Albert Lebrun, cook; Paul Blondin, canoe-man; and Adélard and Georges Vigneault, bushmen. All discharged their duties in a satisfactory manner.

DESCRIPTION OF THE AREA

Topography and Drainage

Topographically, the area is a rolling plateau, sloping gently to the south (Plate II-B). The general elevation is about 1,500 feet and the maximum relief more than 1,300 feet. The average relief, however, is not great, being only 200 to 300 feet in most sections of the area. Dissection of the plateau has been most pronounced along Romaine and East Romaine rivers. Along one stretch of the Romaine, cliffs rise precipitously to a height of more than 700 feet (Plate III-A), and there are cliffs almost as high but less precipitous along the East Romaine (Plate IV).

It is evident that glacial erosion was an important factor in the development of the present rugged configuration of the land surface, with its rolling hills and lack of level terrain. In its southward advance, the ice followed a direction parallel to the general trend of the bedding and foliation of the rocks over which it passed and greatly accentuated whatever irregularities there were in the pre-glacial, plateau-like surface.

There are four relatively large lakes in the area: Buit, four miles long; Sanson, in reality two lakes, with a total length of two and a half miles; and Forget and Métivier, each about three miles long. Buit lake is up to a mile and a half wide; the others do not exceed one mile in width.

Small lakes and ponds are numerous throughout the area, and are to be found at all elevations, from the lowest valleys to the crests of the highest hills. They are of all sizes, from mere pools fifty feet wide to lakes more than half a mile long, and, although of various shapes, they have a general north-south trend. These closed depressions are undoubtedly the result of glacial erosion. Annual precipitation is sufficient to keep them filled with water but the lapse of time since their formation has been so short that few of them have become silted up or drained through the cutting down of outlets — although several of the lakes do show evidence of changes in outlet streams, as may be seen by inspection of the accompanying contour map.

Some of the lakes, perched on the sides of hills, occupy basin-like depressions that have many of the

characteristic features of cirques, which the writer believes they were.

The basins of the smaller lakes may have precipitous sides or be gently sloping to almost flat, and the same is true of the larger lakes. Métivier, Sanson, and in particular Forget, lie in broad, flat basins (Plate III-B). Buit, on the other hand, appears to be a much deeper lake and its shores are hilly and rugged (Plate V-A).

Practically all of the map-area is drained directly by Romaine river or its tributary, East Romaine river. These form two drainage basins which extend almost due north-south — Romaine river, with Buit and Sanson lakes, in the western part of the area, East Romaine river in the eastern part. The hills and valleys show a strong north-south trend.

Hydro-electric Power

Romaine river and its principal tributaries within and outside the present map-area offer possibilities for the development of hydro-electric power. Some possible sites within the area are:

(1) Romaine river, about four miles north of the southern boundary of the area, where a series of chutes for a length of about half a mile give a head of about 15 feet, and where a greater head might be developed by the construction of a dam.

(2) East Romaine river, at the series of rapids of which the centre is about two miles north of the southern boundary of the area, or twelve miles from the mouth of the river.

(3) East Romaine river, at the series of rapids about eight miles from the southern boundary of the map-area or about eighteen miles from the mouth of the river.

(4) Outlet of Cimon lake.

For the last three of these localities, a published report (1) gives the following figures:

Site (numbered as above)	Head (feet)	Drainage Area (Square miles)	Estimated Capacity in H.P. at 80% Efficiency	
			At Ordinary Medium Flow	At Ordinary Six Months' Flow
2	80	165	422	780
3	366	116	1,330	2,495
4	150	61	286	545

(1) List of Water Powers in the Province of Quebec, co-operatively prepared by the Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa, the Quebec Streams Commission, and the Hydraulic Service, Department of Lands and Forests, Quebec, 1928.

Timber and Agriculture

The timber in the area is predominantly spruce, with minor amounts of fir and white birch. Timber of a size suitable for pulp wood occurs only in restricted areas. In some places the spruce are eighteen inches to two feet at the butt and would make good lumber.

The best stands of timber in the area are in the southeast corner, especially south of Métivier lake, and in the valley of Romaine river.

Much of the upland is barren of timber (Plate V-B). The stunted growth, or absence, of timber in these parts is due to the scarcity of soil, which was scoured away by the advance of the ice sheet, and little glacial débris was deposited in its place. Very little humus or soil has accumulated since the recession of the glacier.

No section within the area examined by the writer is suitable for agriculture.

Fish and Game

Many of the streams and lakes (including the large lakes, Forget, Buit, and Sanson) are devoid of fish. In the case of Forget, Buit, and Sanson lakes, this is due to the precipitous nature of their outlet streams, which prevents ascent by the fish. In East Romaine river, Romaine river, and some of their tributaries there are brook trout, but no other fish were caught by members of the writer's party.

Moose and deer are unknown in the region, and caribou are scarce. Only two caribou were seen during the summer, and few tracks were observed.

Partridge, duck, and rabbits are present, but not in great numbers.

There are few lakes that do not show evidence of the presence of beaver in the recent past. Today, however, as the result of trapping, there are practically no beaver in the area. Some muskrat, mink, and other small fur-bearing animals, were seen.

Previous Work

The only previous geological exploration in the area was that carried out in 1941 by Retty (1), who made a reconnaissance survey along Romaine river, East Romaine river, and the four large lakes, together with their connecting streams.

No previous prospecting had been done in the area, but, at the time of the writer's visit, two groups of prospectors were active and one group staked a few claims along the southern shore of Sanson lake.

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(1) Retty, J.A., op. cit.

GENERAL GEOLOGY

General Statement

Bed-rock is well exposed in most parts of the area, particularly on the crests and flanks of the numerous hills. Overburden is light or absent except in the south-east, south of Métivier lake, where there is a heavy deposit of glacial till, and even here there are numerous exposures of bed-rock.

Strong evidence of glaciation was observed in the area. The general north-south trend of both topography and rock structures parallels the direction of ice movement as indicated by observed striae. As a result, the relief of the pre-glacial topography has been accentuated, and many sharp ridges and valleys have been formed. Glacial erosion is also responsible for the majority of the innumerable lake basins in the area.

The consolidated rocks underlying the area are all of Precambrian age. They consist of three general groups: a sedimentary series, probably of Grenville age, intruded by rocks of the two other groups, gabbro and granites. Bodies of granite extend into the map-area from the northwest, southwest, and southeast, the one from the northwest occupying approximately one-quarter, and the others much smaller portions, of the total area of the map-sheet. The remainder of the area is underlain chiefly by impure, massive, grey quartzite, with some mica and hornblende schist. Gabbro occurs in the eastern part of the area, as dykes cutting the quartzite. The largest of these dykes is more than fifteen miles long and has a maximum width of about a mile.

The topography reflects the type of the underlying rock. Granite areas have little relief and are in sharp contrast to the more rugged areas underlain by quartzite and gabbro (see accompanying contour map). The basins of the four large lakes are in granite, two of them being completely within, and the others at the margins of, granite bodies. The gabbro dykes form conspicuous ridges. Schist areas are marked usually by deep depressions, a notable exception being the high ridge of schist immediately east of Forget lake. Areas underlain by quartzite are rugged, with considerable relief.

Table of Formations

Quaternary	Pleistocene and Recent	Till, river gravels
	Great Unconformity	
Precambrian	Post-Grenville Intrusives	Coarse porphyritic biotite granite
		Buit Lake Granite: pink biotite granite, pegmatitic granite, porphyritic granite, and hybrid types
		Gabbro dykes
	Intrusive Contact	
	Grenville(?)	Quartzite
		Hornblende and biotite-quartz schists, graphitic schist

Sedimentary Series (Grenville?)

Slightly less than one-half of the map-area is underlain by metamorphosed sedimentary rocks. These are assigned by the writer to the Grenville series on the basis of their similarity to rocks of that series occurring elsewhere in the Canadian shield. In the present area, the types represented are impure, grey, rather massive, quartzite, biotite-quartz schist, hornblende schist, and graphitic schist, the schists being present in minor amount. The series occupies the eastern third of the area north of Métivier lake, with arms extending westward and southwestward through the central part and continuing beyond the margins of the map-area.

Hornblende, Biotite, and Graphitic Schists

The rock described here as schist is not a separate lithological unit. It occurs interbedded with, and is thus contemporaneous with, the quartzite, to be described later. These schists are, in some instances, the more highly metamorphosed of the original sediments, in others, the metamorphic equivalents of basic sediments, and possibly, in some cases, metamorphosed basic intrusives. It is not always possible to map them precisely and separately from the quartzite. In such cases, the rock has been indicated on the accompanying map as schist or quartzite,

depending on which of the two predominates.

The principal occurrences of schist are: a band, a quarter of a mile to two miles wide surrounding the large granite body in the northwest quarter of the area; an inclusion, half a mile to a mile wide and a mile and a half long, in the granite at the southern part of Sanson lake; and an inclusion, a quarter of a mile wide and half a mile long, in the granite two and a half miles north and half a mile east of the southwest corner of the map-area. In addition innumerable small inclusions, not shown on the accompanying map, are scattered through all the granite bodies. The general alignment of these inclusions indicates that many of them are the remnants of roof pendants of the rock which the granite intruded.

It can be safely assumed that the schists associated with granite resulted from contact metamorphism of the original sedimentary rocks by the granite. The igneous activity not only supplied the heat necessary to bring about the changes, but also supplied magmatic solutions which carried new materials into the sediments to aid in the formation of new minerals.

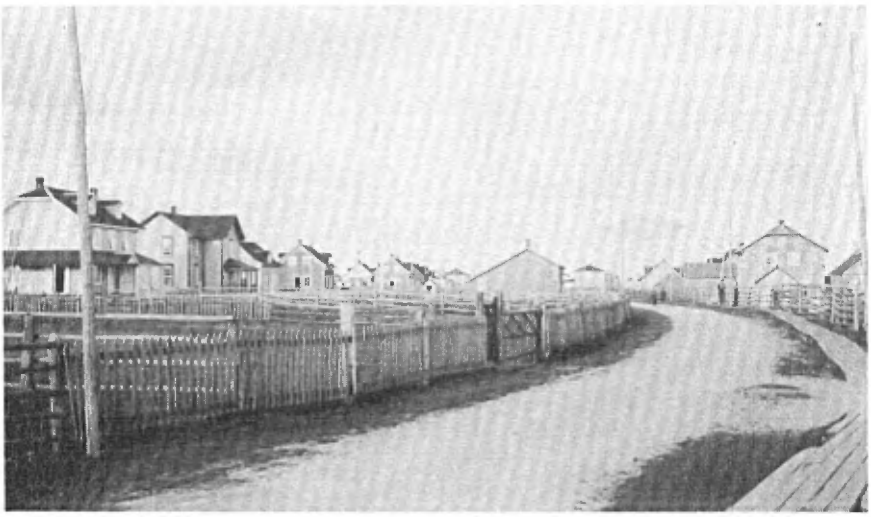
The schists are of three types: hornblende-quartz, biotite-quartz, and graphitic. They occur most commonly in depressions, although there are exceptions to this. The deep trench in the western part of the map-area, where Romaine river flows southeastward, and the eastward extension of this depression, are cut through schist. Biotite-quartz schist, in particular, usually occurs in such depressions, because of its low resistance to erosion.

The best exposures of hornblende schist are north of Romaine river, at the western margin of the area, and in the inclusion about the southern part of Sanson lake; there are also narrow horizons in the area east of Forget lake. The rock is medium to coarse grained and contains 50 to 80 per cent of hornblende. Much of the remainder is plagioclase of intermediate composition. Usually a small amount of magnetite is present, and garnet was observed in some of the thin sections examined, one section containing as much as 30 per cent garnet.

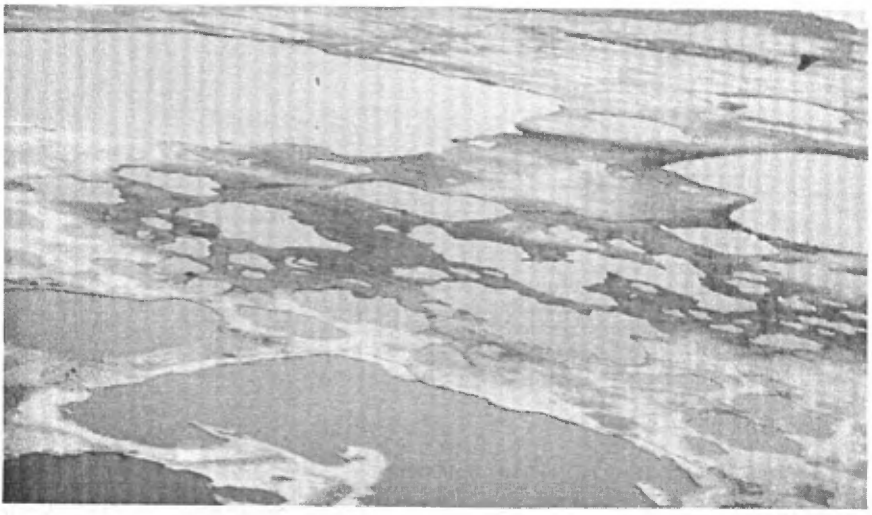
The mineral composition of these hornblende schists suggests an igneous origin. In the field, however, the rock almost invariably shows well developed bedding planes. In occurrences in the western part of the area, the beds observed range in thickness from one-eighth of an inch to an inch, while south of Sanson lake they are up to a foot and a half thick. The hornblende schists east of Forget lake are more massive than this and for that reason have all the appearance of altered igneous intrusives.

Biotite-quartz schists are by far the most common type occurring in the area. In this connection it should be stated that all the quartzite of the area is micaceous and might well be termed quartz-biotite schist or gneiss. However, the term schist as used here applies only to the coarser grained, biotite-rich rock, which has a definite schistose structure. The rock usually shows well developed bedding, with beds several inches thick, although in places bedding layers less than an inch thick were observed (Plate VI).

PLATE I



A. Havre-St-Pierre. Section of Main street, looking east.



B. Terrain north of Havre-St-Pierre. Note numerous small lakes and muskeg.

PLATE II

A. View to show character of sections of East Romaine river.

B. View to show hilly nature and general concordance of topography; one mile east of Buit lake, looking west.

PLATE III

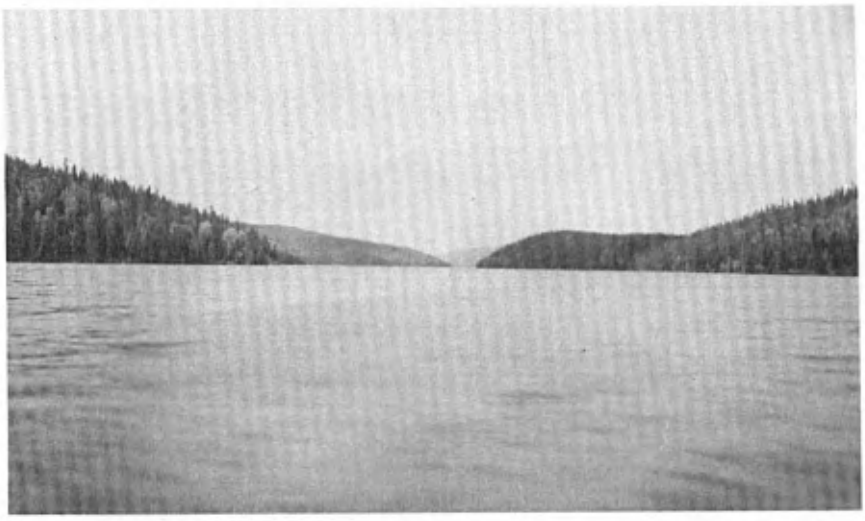
A. View, looking south, of the steep slopes of Romaine river, where it cuts porphyritic biotite granite in the southwestern corner of the map-area; height of cliffs about 700 feet.

B. View to the north across the basin of Forget lake.

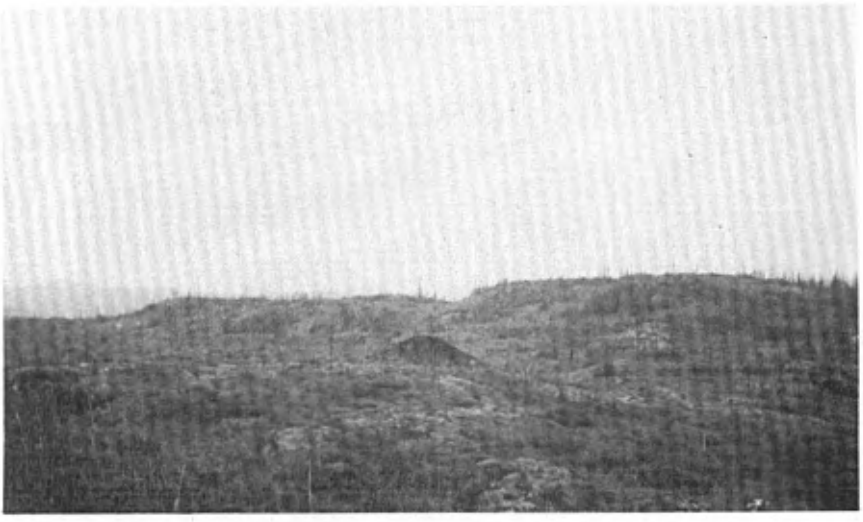
PLATE IV

Talus slope of gabbro dyke on west side of East Romaine river, two and a half miles upstream from the mouth of Métivier river. The slope is about 500 feet high.

PLATE V

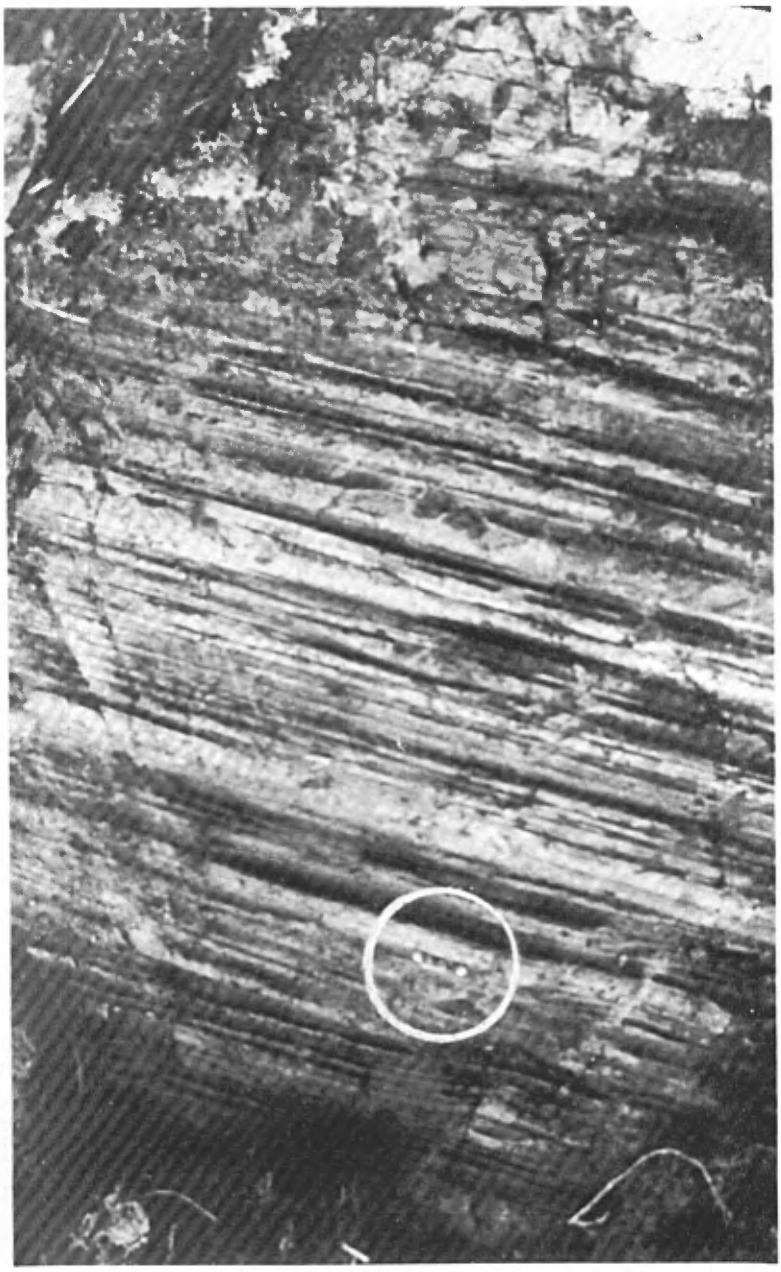


A. Buit lake, looking north, showing narrow, deep character of lake.



B. View to show barren character of some of the upland parts of the area, south of Forget lake.

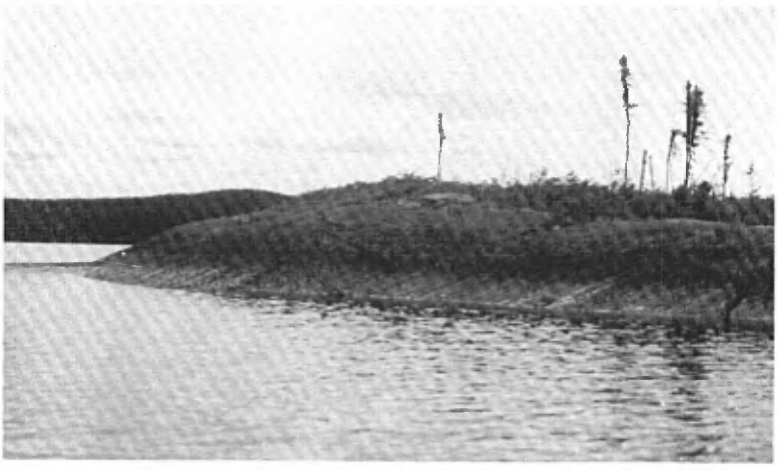
PLATE VI



Thin bedding of biotite-quartz schist, south of Forget lake. See knife for scale.

PLATE VII

A. Massive bedding in quartzite, south of Forget lake.



B. Glaciated island with glacial striae, Buit lake.

C. Hanging glacial valley entering Romaine river, a mile and a half southwest of Sanson Lake; truncated spurs to left.

PLATE VIII

Erratic of schist on glaciated surface of granite at the crest of a ridge, two and a half miles south-southeast of Sanson lake.

The biotite-quartz schist contains 40 to 60 per cent quartz in recrystallized, interlocking grains, and about 25 per cent biotite and muscovite, the flakes of which have been stretched out from their original shape and made friable by the strong shearing stresses to which the schists have been subjected. Garnet is usually present, up to a maximum of about 30 per cent. Plagioclase, in small grains, is a minor but persistent constituent. In some occurrences east and southeast of Sanson lake, where metamorphism apparently has been extreme, andalusite, sillimanite, and kyanite were observed.

Many of the small schist inclusions in the granite of the northwest part of the area have undergone extensive recrystallization, accompanied by the addition of much silicic mineral matter. This has given rise to a rock which, in hand specimen, is difficult to distinguish from granite.

The graphitic schists, observed only along parts of East Romaine river east of Forget lake, appear to be all in one narrow horizon, about ten feet thick. They are dark greyish, rather than black, and they do not have the greasy feel of typical graphite schists. The content of graphite is small and nowhere sufficient to be considered as an economic source of this mineral.

Quartzite

The rocks included in this group are impure, grey quartzites, the chief impurities of which are biotite and magnetite. Some types may well be termed biotite-quartz schists or gneisses. Occupying somewhat less than half of the total area covered by this investigation, they underlie the eastern and southern parts of the map-area, except where they are intruded by the prominent gabbro dykes north of Métivier lake and by the granite masses in the southeastern and southwestern corners of the map-area.

The topography of sections of the map-area underlain by quartzite is irregular. This is probably due to several factors, chief of which are the folding of the rock and the varying degrees of resistance to erosion of the different horizons of the formation. Some of the higher hills are composed of massive quartzite.

The quartzite is medium to fine grained, and light grey in colour. The colour is due to the presence of biotite and magnetite. These minerals are usually visible, and in some specimens biotite is abundant. The grey colour prevails, however, in the many cases where these minerals are present in such small grains that they cannot be seen in the hand specimen.

In some places the rock is massive, but often a definite banding is evident. Most commonly, the quartzite is in massive beds, from one to five or more feet thick (Plate-VII-A). These contain only a small amount of biotite, while the thin dividing planes between them are relatively rich in biotite.

The following description of the massive quartzite is based on the examination of six thin sections. Quartz

forms up to 90 per cent of the rock. The grains, for the most part less than one millimeter in diameter, are irregular in outline and form an interlocking texture, showing that the original sandstone has been completely recrystallized. The biotite content of the rock ranges from 5 to 15 per cent. The flakes are rarely more than one millimeter, and usually are less than half a millimeter, in diameter. They have parallel alignment, marking a well developed foliation. In two of the sections, the biotite is partly altered to chlorite. Magnetite, in small, irregular grains, is present in all the sections examined, making up from one to five per cent of the rock. Minor constituents are plagioclase, in small, clear grains, and zircon and garnet. Sillimanite was observed in one section only, of which it forms about 5 per cent.

Post-Grenville Intrusives

Altered gabbro dykes

Several basic dykes were seen in the quartzites east of East Romaine river and one minor projection of the largest dyke extends a short distance west of the river. Topographically, they form ridges which are quite conspicuous. The largest dyke, from a quarter of a mile to more than a mile wide, has a length of over fifteen miles within the map-area and extends to the north and southeast beyond it; another is more than six miles long and from 500 feet to nearly half a mile wide; there are four or more others which could not be followed for any appreciable distance.

The dykes are generally concordant with the quartzites but occasionally cut across them. At two places, narrow granitic dykes were seen cutting the basic dykes. One small mass of basic rock similar in composition to the dykes lies within the granite, half a mile southwest of Métivier lake.

Claveau (1) observed many similar and prominent basic dykes in the area between Forgues lake, which is six miles east of Métivier lake, and Johan Beetz, which is on the St-Lawrence coast and forty miles south of Forgues lake. These dykes are generally concordant with the intruded sedimentary rocks, trend south-southeasterly and persist over great distances. The rock of the dykes, which commonly displays ophitic texture and carries uralite pseudomorphs and highly altered plagioclase of the composition of intermediate andesite, is described as an altered gabbro-diabase. Claveau found the gabbro-diabase to be older than the granites of the region. He also suggested that the basic dykes east of East Romaine river were part of the system of gabbro-diabase dykes which he found between Forgues lake and Johan Beetz.

Some of the basic dykes of the Forget Lake area have an ophitic texture and some of their thin sections contain uralite, so that, quite probably, they also are altered gabbro and are older than the granite.

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(1) Claveau, Jacques, op. cit.

The dykes dip steeply east except just north of Métivier lake, where the large dyke dips southward at an angle of about 40 degrees.

The largest gabbro dyke enters the map-area from the north at a point a short distance east of East Romaine river. With southerly strike it parallels the river for a distance of nine miles and below that appears on both sides of the river for a further two and a half miles, to a point half a mile north of the mouth of Métivier river. There it swings abruptly to the east, passing north of Métivier lake and continuing beyond the map-area. It is probable that this easterly trending part of the dyke follows a fault zone.

The field appearance of the gabbro varies considerably from place to place, but, in general, the rock is greenish-grey to greyish-black in colour and of coarse grain. In places it has undergone much shearing and resembles a chlorite schist or amphibolite. In places along and east of East Romaine river, north of the mouth of Métivier river, the surface has a 'knobby' appearance caused by hornblende aggregates or crystals, one to two inches in length, weathering in relief.

In hand specimen, hornblende and plagioclase can be recognized, with much magnetite evident in some instances. In places where the rock is very coarse grained, plagioclase laths up to two inches long are to be observed.

Seven thin sections of this rock were examined. Although in hand specimen hornblende appeared to make up about 80 per cent of the rock, in section it was estimated as not more than 50 per cent. In some sections it is fresh in appearance and strongly pleochroic, while in others it is uralitic, with considerable chlorite. The uralite indicates that the original ferromagnesian mineral was pyroxene and the fresh hornblende is doubtless the result of complete recrystallization.

In places the texture of the rock is diabasic. In only one section examined is the plagioclase considerably altered to zoisite and epidote. It must be stated that only the freshest rock obtainable was selected for thin section specimens. Determination of the composition of the plagioclase indicates that it is not more basic than $Ab_{55}An_{45}$ (Andesine). Magnetite is present in all sections, the amount ranging from one to fifteen per cent in the different sections.

A section of a specimen taken from the coarse grained central part of the large dyke where it is about three-quarters of a mile wide, east of Forget lake, contains large, fresh grains of plagioclase whose refractive index is less than that of balsam, indicating a sodic plagioclase (oligoclase). The hornblende content is about the same as in the other sections examined.

Granite

Six separate bodies of granite are shown on the accompanying map. Petrographic studies of thin sections of specimens from these bodies show only two distinct

varieties of rock. The mass in the southwestern corner of the area is a porphyritic biotite granite. The other five bodies differ from this, but resemble one another, in composition. This suggests that they are parts of one intrusive mass or at least had a common magmatic source. They will be referred to in this report as Buit Lake granite. It is quite possible that the porphyritic biotite granite, also, is a differentiate of the same parent magma. The granites have a well developed gneissoid structure which is not original but was imposed on them by regional stresses. In general, the gneissoid banding parallels the trend of the margins of the granite bodies.

All the granites are obviously younger than the quartzites and their metamorphic products as evidenced by innumerable schist inclusions in the granite, and by several granite dykes extending into the schists and quartzites. There is no evidence to indicate the relative ages of the porphyritic biotite granite and the Buit Lake granite, but the more massive character of the former suggests that it is the younger.

Buit Lake Granite

Five bodies of granite are included in this group. Two of these are small and lie entirely within the area while the other three extend beyond its boundaries.

The mass of granite which projects into the northwestern corner of the map-area, around Buit and Sanson lakes, and from which this group of rocks takes its name, occupies about one-quarter of the map-area. The portion within the present area is rudely triangular in outline, with the apex near the centre of the map. Adjacent to this mass and probably representing outlying lobes are two small bodies of similar granite, one just east of the apex, the other east of Forget lake. Both have a north-south trend, paralleling that of the margin of the main mass nearby. The other two bodies of Buit Lake granite extend from beyond the limits of the map-area into its southern part; the larger one is south of Métivier lake, and the other, probably joining the one just mentioned south of the map-area, crosses the central part of the southern boundary between Romaine and East Romaine rivers.

In hand specimen, the predominant rock type is a medium to coarse grained, pink, biotite granite, which usually has a definite gneissoid structure. In places, it is porphyritic, with scattered, pink feldspar phenocrysts. The quartz is crushed and glassy in appearance. Biotite and muscovite are minor constituents of the rock.

There are many variations from this type. These are probably hybrids, produced by contamination of the intrusive with the sedimentary schists it invaded. These hybrid granites vary widely in colour and composition. Light coloured types rich in quartz and feldspar are common. These are usually coarse grained. In the immediate vicinity of schist inclusions, the rock tends to be dark coloured, with a high content of hornblende and biotite.

Although, from a petrographic point of view, the granite south of Métivier lake is similar to that in the

northwestern corner of the area, in general field appearance the similarity is not so evident. It may be noted, also, that pegmatite dykes and schist inclusions, which are common in the northwestern granite mass, are rare in the granite south of Métivier lake.

Examination of thin sections of typical specimens showed that the granites of all the Buit Lake bodies are closely similar. The rock has undergone much granulation, so that the characteristic appearance in thin section is of fractured, larger grains in a 'mortar' of fine, crushed grains. The quartz grains, forming between 20 and 30 per cent of the rock, all show many lines marked by microscopic openings, which are undoubtedly 'healed fractures'. Microcline is the most abundant constituent, making up about 50 per cent of the rock in some of the sections examined. It is usually fresh in appearance and replaces the other feldspars. In some facies of the rock, microcline occurs as phenocrysts. Orthoclase and plagioclase, together, usually form up to 25 per cent of the rock and, in general, they increase in amount with decrease in microcline. Biotite makes up one to two per cent of most of the sections examined, with a maximum of five per cent.

Closely associated with the Buit Lake granite bodies are numerous dykes and irregular masses of pegmatite. They are particularly abundant in the northwestern part of the area, where they are chiefly irregular masses. The pegmatite ranges in mineral composition from an orthoclase-rich type containing little mica, common in the northwestern part of the area, to a type containing as much as 25 per cent muscovite, in flakes up to two inches in diameter. This high-muscovite pegmatite is rare and the dykes observed are less than two feet wide. Neither the quality of the mica nor the purity of the feldspar is such as to be of commercial interest.

Porphyritic Biotite Granite

The intrusive mass which extends into the southwestern corner of the map-area is porphyritic biotite granite. It stands considerably above the surrounding quartzite and schists and its contacts with these are well marked topographic features. Romaine river has cut a deep, narrow gorge through this granite body (Plate III-A). In the section east of Romaine river, strong banding in the granite, parallel to the contact, is quite conspicuous on the aerial photographs.

The rock is a coarse grained, pink, porphyritic granite, with an abundance of biotite and of pink feldspar phenocrysts, about an inch long, that are a striking feature of exposures of the rock. The composition of the rock, as observed in four thin sections, is as follows: microcline, 25 to 30 per cent; orthoclase, 20 to 25 per cent; plagioclase, 10 per cent; quartz, 20 to 25 per cent; and biotite, 10 to 15 per cent. The biotite is strongly pleochroic and contains inclusions of zircon. There are some scattered, small grains of apatite. The orthoclase and plagioclase are considerably altered to sericite.

In addition to its generally pronounced porphyritic character, this biotite granite differs from the Buit Lake

granites in containing considerably more biotite. Thus, from a petrographic standpoint, two distinct types of granite are represented in the map-area. It is quite possible, however, that both types derive from the same parent magma.

Pleistocene and Recent

The area has been subjected to glacial erosion of both continental and valley types. The movement of the continental ice sheet was in a general southerly direction, as evidenced by scattered glacial striae and by numerous north-south hills whose shape, with gently sloping north ends and abrupt south ends, undoubtedly is the result of glacial erosion (Plate VII-B). This is also the general trend of the bedding and schistosity of the rocks of the area. Consequently, zones of softer rock were deeply cut, and the relief of the pre-glacial topography was accentuated.

In addition to the evidence offered by the shape of the hills, the fact that even the highest of them was glaciated is shown also by the presence of numerous erratic boulders on their summits (Plate VIII).

In general, the result of the continental phase of the glaciation was to carve several large, broad basins, such as the basin of Forget lake (Plate III-B). On these basins and their margins, innumerable small basins and valleys were superimposed, due to variations in the resistance of the rock to glacial erosion. At the close of this phase of glaciation, the country probably presented a plateau, with a gently undulating surface and with few precipitous slopes.

There is abundant evidence that, in the waning stages of the continental sheet, valley type of glacial erosion was active in the area. Evidence of this is found in such features as the precipitous slopes and deeply entrenched valley of Romaine river, with its numerous hanging valleys and truncated spurs (Plate VII-C). On this river, the rapids, about $4\frac{1}{2}$ miles in a straight line below the mouth of Lebrun river, are over a boulder ridge. The river has cut through the western margin of this ridge, whereas the débris of the eastern part of the dam is undisturbed. The dam quite definitely appears to be an end moraine of a valley glacier, as it is composed of boulders of many kinds, including a considerable percentage of anorthosite containing 'precious' labradorite, and its material varies in size from boulders six to ten feet in diameter to fine glacial clay. There are also many perched lakes along Romaine river, one of the best examples of these being at a point about two miles east of the mouth of Lebrun river.

In many places, amphitheatre-shaped depressions are nested on the sides of hills. The back walls of these are precipitous and the bottoms are usually occupied by lakes. In the case of one of these, west of Buit lake in the northwest corner of the map-area, the depression opens to the northwest. This would eliminate the possibility of the quarrying having been the work of the continental ice sheet. It thus appears definite that these are basins of

small cirques that existed during the waning stages of the continental glaciation.

In addition to its effect on the topography, the glaciation denuded the uplands of soil. This has had a profound effect on the growth of timber — where the soil is thin or absent the timber is scarce and stunted (Plate V-B), and where it is deep the timber is of normal growth.

Post-glacial gravel deposits occur along Romaine river and East Romaine river. Along the latter, the deposits occur as basin fillings on the valley bottom. The most extensive is just below the mouth of Métivier river. The gravel basins are marked by meanders of the river in a flat valley. Inspection of the accompanying map will show the locations of such basins. Gravel deposits are of less frequent occurrence on Romaine river, but they appear as narrow terraces, about twenty feet high, along some parts of the river where the valley bottom is flat. The positions of such narrow terraces are also quite evident on the accompanying contour map, being at the places where the nearest contour line is at an appreciable distance from the river's edge. Although gravel deposits along Romaine river are not numerous, the river transports large amounts of gravel which could be trapped, if the need for gravel warranted this.

STRUCTURAL GEOLOGY

The general trend of the structural features in the area is north-south. There is also a strong topographic trend in this direction, which is marked by sharp ridges and deep valleys that have been accentuated by glacial erosion. Both the bedding of the sediments and the foliation of the intrusive bodies strike in a general northward direction except along and near the margins of the intrusive bodies, where there is a strong tendency for the strike to parallel the contact. It is, however, no more than a tendency, for much of the contact between granite intrusives and sediments is discordant. The gabbro intrusives are, in general, concordant dykes, but locally they cut across bedding for short distances.

North of Métivier lake, the trend of the bedding of the quartzite bends sharply from southwestward to southward, which suggests dragging of these rocks westward along the north side of an east-west fault. The large gabbro dyke appears to have followed such a fault channel, for here it, also, strikes east-west and dips southward at an angle of about 40 degrees, in contrast to its general north-south direction and steep dip to the east. The dips and strikes of the strata in the area are generally observable. It is assumed that the tops of the beds face the direction in which they dip, but only in three places were such features as cross-bedding and, in one place, ripple marks, seen, to indicate which side of a bed is the top. On the assumption just made, it appears that the strata of the area have been folded into gentle anticlines and synclines, the general axial trend of the folds being north-south. In places the folds are plunging, as in the area directly south of Forget lake, where the dips and strikes indicate a gentle northward plunge of the axis of a north-

south trending anticline. The granite intrusives have to a considerable degree distorted and obscured the folded structures of the adjacent metamorphosed sedimentary rocks, but some of the original folds may be recognized over short distances.

East of East Romaine river, the strata dip to the east, dips ranging from between 30 and 45 degrees near the river to between 60 and 80 degrees near the eastern margin of the area. Locally there are wide variations from this general attitude. The above observations indicate that the eastern part of the area is occupied by the somewhat uniform eastern flank of an anticline. The axis of this anticline, at the northern end of the map-area, appears to be about half a mile east of the north end of Forget lake, for, near this part of the lake, the strata dip westerly. To the south, it appears probable that the anticline continues just west of East Romaine river to a point about six miles from the northern boundary of the map-area. South of this the location of the axis is more indefinite, but the eastward trending and northward dipping strata about a mile west of the river at this point suggest the possibility of the axis of the same gently northward plunging anticline having been offset westward along a fault. There is a possibility, however, that these east-west trends of the bedding here are due to the intrusion of a granite body just south of them.

In the southern part of the map-area the intrusions of granite have disturbed the strata too greatly to permit any definite interpretation of structure. However, in the west-central part of the map-area, just north of the body of porphyritic biotite granite, the attitudes of the strata suggest a north-south anticlinal axis along Romaine river.

Along the central part of the western margin of the area, the strike changes abruptly from north to west. Immediately west of the boundary of the map-area, aerial photographs show a persistent north-south 'break', along which the westward striking strata end. The steep dip of the strata in this vicinity suggests that this is also drag folding along a north-south fault, in which the relative movement has been east side to the north.

There are many linear depressions in the area. Although few of these show definite evidence of faulting, such as offset or shearing, faulting is the most probable explanation of their origin. Shearing may be absent but is more probably present and obscured by débris. The depressions have either of two general trends, the more prominent being north-northeast, the other northwest. Examples of the former type are much of the course of East Romaine river, a series of lakes about a mile and a half to the east of the river, the western margin of the granite mass south of Métivier lake, and the large lakes in the northwestern corner of the area. Northwest depressions include the western margin of the main body of Buit Lake granite, and many depressions branching from the valley of East Romaine river. One of the more prominent of these latter passes from this river to Forget lake, along the steep southern end of the largest hill east of the lake.

Local shearing observed in several places along East Romaine river – particularly east of Forget lake, and

where the river cuts through the gabbro dyke — suggests the presence of a fault zone along the valley of this river.

These various depressions cut all rocks present in the area; therefore, if they represent rock fractures, such fractures are younger than any of the rocks. It is probable that any mineralization there may be in the area is related to one or other of the intrusives; thus it seems doubtful that mineralization would be found related to this system of probable faulting.

ECONOMIC GEOLOGY

Prior to 1941 no prospectors had worked in the area, and no occurrence of ore minerals had been reported. During the summer of 1941, J.A. Retty (1), while engaged in field work for the Quebec Department of Mines, observed several occurrences of chalcopyrite, and in 1942 two parties of prospectors were active in and near the area. J. Giasson, of one of the groups, staked five claims along the south-western part of Sanson lake, in the name of A.A. Hayman. Retty had reported copper mineralization at this locality in 1941. Several new occurrences of chalcopyrite were noted by the writer in the course of his field work in the area. Their locations are shown on the accompanying map. The majority are south of Forget lake, one as much as six miles distant from it. One of the better surface showings seen is about 4½ miles east of the south end of the lake.

The mineralization observed is of two general types: disseminated through the country rock, and distributed along minute fractures in the rock and in small quartz veins that traverse it. In the quartz veins, the chalcopyrite occupies irregular areas between quartz grains and, to a minor extent, replaces the quartz.

Some copper mineralization occurs in the belt of schist extending around the borders of the granite body which occupies the northwest quarter of the area, and in a body of similar schist at the southern end of Sanson lake. This belt of schist is only half a mile to two miles wide, and the rocks forming it have undergone considerable alteration, probably the result of contact metamorphism. Whereas, in general, the sediments in the area are quartzites, here they have been altered to quartz-mica schists, and in places to hornblende schists, the variation in rock-type probably resulting largely from differences in composition of the original sediment. The mineralization favours the hornblende-rich phases of schist.

Both types of mineralization occur in this belt of schist. In the hornblende schist, the chalcopyrite is present as disseminated flecks, and usually it shows a definite preference for certain stratigraphic horizons marked by an abundance of garnet. In the quartzites and quartz-mica schist, the tendency is for the chalcopyrite to occur along minute fractures or in narrow (up to one inch wide) quartz veins. Adjacent to these fractures and

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(1) Retty, J.A. op. cit.

veins the rock is considerably silicified. The quartz of the veins is usually glassy and granular in appearance, and the chalcopyrite is scattered between the grains in small pockets. At and near the surface, these pockets are conspicuous, as alteration of the chalcopyrite has produced considerable iron stain in their immediate vicinity.

The mineralization observed at the point four and a half miles east of the south end of Forget lake is at the contact between a gabbro dyke and quartzite, the chalcopyrite occurring in both quartzite and gabbro. The gabbro has been altered to such an extent that it might almost be considered a chlorite-hornblende schist. In the gabbro, the chalcopyrite occurs in a manner similar to that in the hornblende schist described above, that is, as disseminated specks or small pockets, with no evidence of continuity from one to another. In the quartzite at this locality the mineralization occurs along minute fractures that have undergone considerable silicification. An assay made in the laboratories of the Department of Mines, Quebec, of a specimen from the gabbro zone, gave the following result: 0.34 per cent copper, and 0.006 oz. gold and 0.045 oz. silver per ton.

Hayman Claims

These claims, staked by J. Giasson at the southern part of Sanson lake, are on a schist inclusion about half a mile wide and a mile and a half long, near the southwestern margin of the main body of Buit Lake granite. The rock is a banded recrystallized schist, chiefly biotite-quartz and hornblende-quartz, with some interbedded garnetiferous hornblende schist. The strata strike approximately N.10°W. and dip 80 degrees to the east.

The best exposure of copper mineralization is on the shore of the lake. A zone which parallels the trend of the bedding can be followed in a southerly direction, as a depression, for about a quarter of a mile. In several places along the walls of this depression, slight mineralization is exposed. It consists of a sparse dissemination of chalcopyrite along irregular pockets and zones in a bedding layer that is characterized by an abundance of reddish-brown garnet, which makes up 10 to 25 per cent of the volume of the rock. The garnet crystals, which average about a quarter of an inch in diameter, with range from one millimeter to half an inch, have been considerably crushed. This garnetiferous schist contains 60 to 80 per cent hornblende, some fine grained quartz and feldspar, and in places a small amount of biotite. The hornblende is much coarser grained than in adjacent bands.

The garnetiferous bands are interbedded with a massive, medium to coarse grained, hornblende-quartz-feldspar schist and are intruded by irregular pegmatite and granite dykes which comprise about 5 per cent of the rocks in this section of the area.

Some chalcopyrite mineralization was observed elsewhere on the claims in similar garnetiferous hornblende bands. Observations indicate that such bands are the most favourable for the occurrence of chalcopyrite. Although the rocks are foliated to some extent there are no well defined zones of shearing.

About a quarter of a mile south of the lake there is a small lens of quartz, five feet long and a quarter of an inch to one inch wide, which parallels the bedding of the schist and is spotted with chalcopyrite. The quartz has a granular, glassy appearance, and the schist in the immediate vicinity of the vein has been considerably silicified. An assay of a selected sample, made in the laboratories of the Department of Mines, Quebec, yielded: 1.47 per cent copper, and 0.002 oz. gold and 0.21 oz. silver per ton.

Pegmatite

There are many pegmatite dykes in the area, but the largest observed is not more than two feet wide. A few of them contain 'books' of muscovite from which flakes as much as two inches in diameter could be split off. Even apart from their small size, however, the flakes are not perfect enough to be of commercial value. However, their presence does suggest that commercial muscovite may occur in the area. The feldspar of the pegmatites is probably too poor in quality, and too far removed from means of transportation, to be of commercial interest. No beryl was observed in the pegmatites.

Ilmenite Sands

Gravels along the rivers and lakes throughout the area contain much black, magnetic sand. It is not possible to determine definitely whether this sand was derived from quartzite or gabbro, but it appears probable that the chief source, at least, was quartzite. A sample of the black, magnetic material panned from the gravel on the shore of Métivier lake was analysed in the laboratories of the Department of Mines, Quebec, with the following result:

FeO	29.03	per cent
Fe_2O_3	33.76	" "
TiO_2	22.9	" "
Cr_2O_3	0.08	" "
SnO_2	0.06	" "
WO_3	0.00	" "
V	0.08	" "

The presence of chromium, tin, and vanadium is interesting, and suggests the possibility of deposits of ores of these metals somewhere in the general region.

Summary

The rocks of the area contain few of the indications for which the prospector usually looks, such as sheared and brecciated rock, and zones of hydrothermal alteration. In the belt of schist described in this report, the metamorphism has been in the nature of a complete recrystallization, rather than hydrothermal alteration. In spite of the above conditions, which might be considered as negative indications, many local occurrences of chalcopyrite were observed.

The observed chalcopyrite mineralization is confined to the belt of schist which extends around the main body of Buit Lake granite, in the northwestern quarter of the map-area – and to schist inclusions in this body – and to the gabbro-dykes and adjacent rocks in the eastern part of the area. Although, in the case of the gabbro dykes, only one occurrence of mineralization was observed, it is quite probable that others may have been overlooked, due to the absence of customary iron stain. In the one occurrence observed, the chalcopyrite occurs chiefly as disseminated grains in the gabbro, in the immediate vicinity of its contact with quartzite. This contact would afford an excellent channel along which ore solutions could migrate, and chlorite and hornblende – present in large amount in the gabbro — are readily replaceable by ore solutions. Such solutions might well have had their origin in the gabbro magma. For these reasons, the margins of the gabbro bodies should be favourable prospecting ground.

Little is known of the general region surrounding the area described in this report. However, it is known that the belt in which the gabbro-dykes occur extends for some distance to the east and south and there, also, prospecting might reveal copper mineralization of interest.

The writer recommends that any programme of exploration in the region should include particularly the vicinity of the gabbro intrusives. The zone of schists about the northwestern quarter of the area, particularly a strip extending southward from Forget lake, should also be examined.

The analysis of the ilmenite sands, given above, suggests that the prospector would do well to watch the pegmatites for the presence of cassiterite and the basic rocks for possible chromium mineralization.

ALPHABETICAL INDEX