DP 481

VERMETTE LAKE AREA - SAGUENAY COUNTY, FINAL REPORT

Documents complémentaires

Additional Files

Licence

License

Énergie et Ressources naturelles
Québec

MINISTÈRE
DES RICHESSES
NATURELLES

DIRECTION GÉNÉRALE
DES MINES

VERMETTE LAKE AREA

- SAGUENAY COUNTY -

P. T. Moyer, Jr.

Final report

1977

DP-481

GOUVERNEMENT DU QUEBEC
MINISTERE DES RICHESSES NATURELLES
EXPLORATION GEOLOGIQUE

GEOLOGICAL REPORT
VERMETTE LAKE AREA _ EAST HALF
SAGUENAY COUNTY

BY
P. T. MOYER, JR.
1958

Déposé au ficher ouvert en avril 1977. DP- 481

Table of Contents

INTRODUCTION

General Statement

The rocks of Vermette Lake Area, East Half, were mapped by the writer during the summer of 1958. The area lies within the Laurentian upland. The Champlain plain borders the area to the southeast. The region consists of paragneisses, assigned to the Grenville series, and syenitic and more basic rocks, intruded by gneissic granite and granite gneiss. Structural elements strike and trend northeasterly to east-west. Nothing of economic value was found.

Location

The southeast corner of the area is 5 miles west by south of Shelter Bay, a rapidly-growing village on the north shore of the St. Lawrence river, about 300 miles down-river from Quebec City. The map-area covers 192 square miles, and it is bounded by latitudes 50°00' and 50°15' north, and by longitudes 67°00' and 67°15' west. It occupies approximately the west one-third of Babel township and a small, north-northwest part of Grenier township, electoral district of Saguenay.

Access

Most parts of the map-area are readily accessible by one means or another. A gravel road passes in a northwesterly direction from Shelter Bay, through the central part of the area. This road crosses a bridge at the south end of Walker lake, 20 miles by road from Shelter Bay. It continues northwest beyond the area, connecting Shelter Bay and Port-Cartier with the holdings of the Quebec Cartier Mining Company at Jeannine lake. This road provides accessibility

to the east-central and northeastern parts of the map-area, as well as the west-central and northwestern parts. An abandoned, northerly road leads from the main road just west of the west boundary of the area. A trail connects the abandoned road with the northwest corner of the area. The far northeastern part can be reached by float-plane, landing on Square lake or North Square lake. The far southwestern part is not reached so easily. The writer reached it by way of Pentecôte, a village along the shore of the St. Lawrence river, about 23 miles up-river from Shelter Bay. From here, Canoe lake, just outside the southwest corner of the area, can be reached by canoe and portage by way of Pentecôte lake. Canoe lake is accessible also by float-plane. The southeastern part of the area can be reached by a winter road leading to the lake connected to the south by Dagneau lake.

Continuous canoe travel is possible through the entire north-south extent of the area, on Walker, Vermette, and Quatre Lieue lakes. Narrow portions of Vermette and Quatre Lieue lakes require extra care in navigation.

About as much as one-half of Rivière aux Roches, within the area, is unnavigable due to rapids.

Field Work

Traverses were spaced one-half mile apart wherever possible. Locations were determined usually by the pace and compass method, although the aerial photographs were sometimes helpful. Outcrops are generally abundant on the slopes of hills, along shores, and along the main road.

The photographs used are those of the Royal Canadian Airforce. These are at a scale of approximately 5,000 feet to the inch. The base map was prepared by Photo-Air Laurentides Company, Quebec, with a scale of one-half mile to the inch.

In addition to the writer, there was 1 senior assistant, 3 junior assistants, a cook, and 1 canoeman. Two, and sometimes three traverses were run on days when weather permitted. The party was in camp from June 14th to October 23rd.

Acknowledgements

The writer is grateful for the able assistance of K. Warren Geiger, graduate student at Cornell University; Allan A. Jared, student at McGill University; Roger Sirois, student at the University of Montreal; and René Letarte, student at Laval University. Gilles Caron, of Cap St-Ignace, served ably as cook, and Albini Boudreault, of Hâvre-St-Pierre, as canoeman.

The map-area is within the concessionary limits of the Quebec North Shore Paper Company. Mr. C. J. Borcoman, manager of Shelter Bay operation of the company, was most cooperative in making available camping facilities, storage space for equipment, and information regarding accessibility. Warmest thanks to him.

The Canadian Aero Service Ltd., Ottawa, made available maps showing the route of the proposed railroad through the area.

Previous Work

There is only one relatively recent published report which includes work done in the present area. This is a reconnaissance by Faessler (1942) of the North Shore between Godbout and Sept-Iles, Saguenay County. He takes in the southeastern part of the map-area in a highly generalized way. However, it does provide a study of the regional geology. Several references to much earlier reconnaissance work are given by Faessler.

DESCRIPTION OF THE AREA

Settlement and Current Construction

The nearest settlement to the map-area is Shelter Bay. There is one tiny settlement, or camp, within the area. This is at the south end of Walker lake, called "Cache 2" by the Quebec North Shore Paper Company. Here, there are several frame buildings, including a kitchen, all belonging to the company. They are occupied much of the time, either by company employees or by others who rent them. Canadian Aero Service Ltd., Ottawa, occupied most of these buildings during the summer of 1958.

Shelter Bay is 5 miles east by north of the southeast corner of the map area. According to Mrs. C. J. Borcoman, wife of the company manager, there were 1250 people in Shelter Bay before Quebec Cartier Mining Company arrived in 1958. Now, of course, there are many more, and it is impossible for the writer to estimate the current population. Port-Cartier, site of the proposed dock installation, is about 5 miles down-river from Shelter Bay. When

the writer left in October, 1958, an access road and a temporary wharf had been completed, but there were no permanent buildings at Port-Cartier,

The proposed railroad connecting Port-Cartier with the property of Quebec Cartier Mining Company at Jeannine lake, runs through the map-area. It crosses the east boundary of the area along the south shore of Rivière aux Roches, and west of Walker lake it runs north of, and more or less parallels, MacDonald river. It is shown on the accompanying map. At the end of October, 1958, a 100-feet-wide swath had been cut, straddling the line, but actual railroad construction had not begun. The contract for construction of the railroad was awarded to the Pitts-Foley Company, Toronto, Canadian and American interests, respectively.

A gravel access road was completed to Jeannine lake, near the end of the summer of 1958. The railroad line closely follows this road. Within the map-area, this road coincides with the road built years ago by the Quebec North Shore Paper Company. Construction of the new road was done by the Perini Company, Boston.

Pulpwood Industry

The pulpwood industry has been established along the North Shore for many years. Shelter Bay was founded by what is known now as the Quebec North Shore Paper Company, and the village remains largely company-owned. Except for a fishing club near the south end of Walker lake, all camps within the map-area are owned by this company. Most of these are abandoned and falling apart. "Old-timers" in the district seem to know the whereabouts of every

abandoned camp, road, and portage in the area, and these people were of great help in our work.

Trees are largely balsam fir. Black spruce are found here and there, and white birch are rather common, especially in the burned areas. Speckled alder are along streams, around lakes, and in swamps. Black ash, mountain beech, jack pine, tamarack, and poplar are known to occur, but are uncommon.

The entire area has been cut over at least once, and various stages of subsequent growth are seen. Fires in 1939 and 1941 have marred portions of the central and south-central parts of the area.

Fish and Wildlife

Lake trout are caught most commonly within the area. Halibut, bass, perch, and salmon are said to be present, but none of our party saw any of these.

Four moose and three black bears were seen by the writer, as well as one lynx and numerous beavers. Caribou, otters, mink, rabbits, and porcupines are known to occur.

Physiography

The map-area lies entirely within the Laurentian upland. The Champlain plain borders the area to the southeast.

The main drainage channels are cut deeply into the underlying rock. Local relief ranges generally from about 200 feet to 1,000 feet. Maximum local relief reaches about 1,200 feet at the fire tower, 2½ miles north-northwest of the bridge at the south end

of Walker lake. Elevations range from less than 300 feet above sea-level, where Rivière aux Roches crosses the east boundary of the map-area, to more than 1,800 feet above sea-level near the northwest corner of the area.

The half of the area west of Walker, Vermette, and Quatre Lieue lakes is persistently higher and shows more dissection than the east half. This suggests the possibility of a north-south fault along a line through these lakes.

Surface water drains toward the St.Lawrence river by way of several major streams. The most important one is Rivière aux Roches which flows through the central part of the map-area, joining the St. Lawrence river at Shelter Bay. Ronald river, which flows south by west across the northwest corner of the area, joins Rivière aux Roches west of the area. Boulée river flows east from the northeastern part of the area, draining into Pasteur lake, which in turn flows southward into Rivière aux Roches, just east of the map-area. The Riverin river flows southward of the area, joining the St. Lawrence river at the village of Pentecôte, about 23 miles southwest of Shelter Bay.

Vermette and Quatre Lieue lakes do not drain directly southward, but flow northward into Rivière aux Roches. Walker lake drains southward into Rivière aux Roches.

The course of Rivière aux Roches in the area shows striking variations from meanders in broad valleys to relatively narrow, swift rapids. The elevation of this river at the west boundary of the map-area is about 400 feet above sea-level. Its elevation at the east boundary is between 250 feet and 300 feet.

The area is generally well-drained, for, although the plateau tends to be relatively flat, swamps are uncommon. A place notably swampy lies west of Vermette lake. Foliation and joints are reflected in the linear arrangement of streams and lakes. This is apparent throughout the map-area. It is noticeable particularly in the southwest corner.

Interfluvial areas along Walker lake are commonly truncated parallel to the shore, and the valley of Walker lake, as a whole, can be considered "U"-shaped. This form has been accentuated apparently through glaciation. Glacial grooves and striae are present throughout the area, but uncommon. Polished rock surfaces were noted here and there; ground moraine is practically everywhere. Terraced fluvial deposits were noted at the south end of Walker lake and along Vermette and Quatre Lieue lakes.

DESCRIPTION OF THE ROCKS

Regional Outline

The consolidated rocks of the region are Precambrian. Pink granitic rocks make up at least 80 per cent of the map-area. Metasedimentary gneisses are considered of Grenville age, and they are engulfed in the granitic rocks. Syenitic rocks, here called pyroxene-hornblende-feldspar gneiss, are considered by F. F. Osborne (personal communication) to be older than the granitic rocks. Like the metasedimentary gneisses, the syenitic rocks occur mostly as discontinuous lenses and layers striking parallel to gneissosity in the granitic rocks. Mixed gneisses (migmatite) are common. This entire complex is cut sparsely by pegmatite and diabase dykes. Glacial till is practically everywhere.

Age relationships among the various rock types are obscure. However, from the field work, and a discussion with F. F. Osborne, the writer proposes a table of formations which, in the post-"Grenville" part, is based tentatively on age relationships.

Table of Formations

Cenozoic: Pleistocene and Recent		Clay, sand, gravel, erratic boulders
Precambrian	Intrusive and metasomatic rocks	Pegmatite and diabase dykes Augen gneiss Gneissic granite and granite gneiss Dioritic and gabbroic rocks Pyroxene-hornblende-feldspar gneiss
		Mixed gneisses
	Metasedimentary and meta- igneous(?) rocks	Hornblende-biotite-plagioclase gneiss Amphibolite Biotite-quartz-feldspar gneiss Quartz-orthoclase gneiss Quartzite Augite-orthoclase gneiss

Metasedimentary Rocks and Associated Metaigneous (?) Rocks

General Statement

Metasedimentary rocks are considered the oldest rocks in the area. Faessler (1942, p. 12) assigns them to the Grenville series. Less than 10 per cent of the map-area is underlain by them. They occur throughout the area, and they are common particularly along the shore of Walker lake, where outcrops are relatively abundant. In order of decreasing abundance, they are hornblende-biotite-plagioclase gneiss, amphibolite, biotite-quartz-feldspar gneiss, quartz-orthoclase gneiss, quartzite, and augite-orthoclase gneiss.

The paragneiss occurs as isolated, discontinuous, generally concordant, lenticular layers in the granitic rock. They are from less than 1 inch to at least 50 feet thick. Isolated outcrops of paragneisses and mixed gneisses are shown on the accompanying map. Outcrops are generally abundant in the area, and it is believed desirable that the reader have some idea of the frequency with which the paragneisses and mixed gneisses occur.

Hornblende-biotite-plagioclase gneiss - Except for the paragneiss near the central part of the south boundary of the area, they are almost entirely of the hornblende-biotite-plagioclase type. It is a component of practically all the mixed gneisses.

Hornblende-biotite-plagioclase gneiss generally shows schistosity which is barely visible, although some is massive. It is dark grey to nearly black on the fresh surface. In thin section, grains are subhedral to anhedral, and range in size from less than

0.1 mm to 2.0 mm. Most grains range from 0.3 mm to 1.5 mm. Green hornblende makes up from about 15 per cent to 30 per cent of the rock, whereas brown biotite makes up from about 10 per cent to 15 per cent. The feldspar is generally fresh, and appears to be entirely plagioclase, although the bulk of it is untwinned. None was found with an index of refraction less than balsam. Microcline was not seen. Twinned plagioclase was determined to be in the oligoclase-andesine (An_{21} - $_{37}$) range. Apatite and magnetite are common. There are traces of pyrite, zircon, chlorite, garnet, muscovite, sericite, leucoxene, and iron oxide.

Hornblende-biotite-plagioclase gneiss is generally free from relatively fine groundmass material. However, some specimens are "dirtier" than others. These specimens are slightly finer grained than the "cleaner" variety. They are characterized by up to 3 per cent magnetite, nominal sericitization of plagioclase, relatively abundant apatite commonly less than 0.10 mm in size, irregular, small shreads and columns of biotite and hornblende, distinctly granular and fused plagioclase, and traces of carbonate and chlorite.

Hornblende-biotite-plagioclase gneisses showing different field relationships have practically the same mineral composition and texture. It was found that hornblende-biotite-plagioclase gneiss from outcrops showing clear compositional layering, presumably metasedimentary, is quite similar in thin-section to the same rock type where its borders lie oblique to foliation in the surrounding granite gneisses. Determination of petrogenesis from thin-sections, in such cases, seems unlikely.

Amphibolite - Hornblende-biotite-plagioclase gneiss seems to grade, here and there, into a rock relatively rich in hornblende.

It is impossible for the writer to estimate the proportions of each throughout the area. Moreover, although containing somewhat more than 50 per cent hornblende, it is questionable that the majority of people would call much of this amphibolite. The writer does not doubt, however, that at least some of the relatively hornblende-rich rock would be considered amphibolite.

A rock undoubtedly amphibolite was found in the eastern part of the basin structure, northeast of the right-angle bend in Rivière aux Roches. The rock appears to be a hornblende-rich variety of hornblende-biotite-plagioclase gneiss. It is fine- to medium-grained, dark grey to black, and massive. Barely visible, irregular layering can be seen here and there.It contains more than 70 per cent green hornblende; plagioclase and quartz are accessory. The plagioclase is light grey, and occurs in varying proportions, thus determining variations in the color of the rock. Irregularly shaped concentrations, or clots, almost entirely of hornblende occur up to several feet across. These tend to be coarser-grained than the rest of the rock.

It is not known whether this rock was originally sedimentary or igneous. It occurs in outcrop through a distance of about ¼ mile across the strike. Discontinuous along the strike, it is bounded by granitic and minor metasedimentary rocks.

Biotite-quartz-feldspar gneiss - This rock is scarce in the map-area. It is associated very commonly with hornblende-biotite-plagioclase gneiss, and both sharp and gradational contacts occur between the two. It looks as if it could be a gradational facies between the hornblende-biotite-plagioclase gneiss and the pink, granitic rocks of the area. It occurs also in isolated outcrops in granitic rocks.

Some specimens of the biotite-quartz-feldspar gneiss have the mineral composition of calcalkali granite. They are mapped as paragneisses because of their appearance in the field. The weathered outcrops generally show faintly visible to prominent compositional banding. The layers represented range from less than 1 inch to about 1 foot thick. Garnet up to ¼ inches is found in some layers, being controlled probably by the original composition of the layers. Furthermore, these rocks are strikingly more mafic than the dominant, pink granitic rocks of the area.

Biotite-quartz-feldspar gneiss is light to medium-dark grey. It contains up to about 15 per cent quartz, 10 per cent greenish brown biotite, and 10 per cent green hornblende, although some specimens do not contain hornblende. Alkali feldspars, including microcline, and oligoclase (An_{12-22}) occur in some specimens in roughly equal proportions, and in others twinned plagioclase is subordinate. Apatite is present in all the specimens, and most have magnetite, zircon, allanite, sphene, sericite, and iron oxide. Garnet is rare, although it is common along both sides of Walker lake, opposite the fire tower on the west side. Grain size ranges up to about 2.0 mm; it is generally less than 1.0 mm. Texture is subhedral to anhedral, equigranular

Quartz-orthoclase gneiss - This paragneiss is confined to the region east and west of the southern extension of Quatre Lieue lake. It was not seen elsewhere in the area. The rock is equigranular, and both fresh and weathered surfaces are dark brownish grey. Weathered surfaces commonly show faint color banding, although much of it is uniform in color. Banding is measured in fractions of an inch, and it is represented on the map as bedding.

Quartz and orthoclase make up the bulk of the rock. Two thin-sections were stained for potash feldspar, and it was found that nearly all the feldspar is orthoclase. No microcline was seen. Perthite is common, showing plagioclase intergrowths characteristically in the form of hair-like stringers and blebs. Antiperthite occurs also, for in some grains the intergrowths have a lower index of refraction than the enclosing feldspar.

One section shows about 15 per cent quartz and the other about 40 per cent. The section with less quartz has 15 per cent chlorite-biotite. Nearly all of the biotite is at least partially altered to chlorite. The section with abundant quartz is much "cleaner", showing only a few traces of mafic minerals. Very minor accessories are magnetite, apatite, and garnet, along with traces of carbonate, ilmenite, hematite, sericite, zircon, and pyrite. Megascopically, conspicuous milky quartz is characteristic of some facies.

Grains are anhedral and equigranular. Size ranges from 0.2 mm to 2.0 mm, with an average of about 1.0 mm. The feldspar is slightly zoned, there is a little myrmekite, and quartz shows wavy extinction. Quartz, however, is not granulated or broken. Boundaries between grains are here and there sutured.

A few grains of strikingly euhedral orthoclase occur. These are slightly zoned and surrounded by interstitial quartz. These may represent phenocrysts from a volcanic rock, such as rhyolite, or authigenic crystal growths.

About ½ mile west of Quatre Lieue lake, near the south boundary of the area, the quartz-orthoclase gneiss contains a zone of at least 50 feet of relatively pure quartzite.

There is a variation in facies which occurs here and there within the quartz-orthoclase gneiss. It is characterized megascopically by prominent pink feldspar and dark green chlorite. Pink patches are up to ¼ inch across. In thin-section, this rock shows a poorly sorted aggregate of orthoclase, quartz, and chlorite. Orthoclase and quartz are in roughly equal proportions. Microcline was not seen. Chlorite, making up about 10 per cent of the rock, is relatively fine grained, forming radiating clusters around other minerals, as well as minute flecks scattered through the section. Magnetite and sericite are prominent, along with very minor plagioclase, carbonate, muscovite, hematite, and zircon. Grain size ranges from 0.05 mm to 1.6 mm; sorting is poor.

The chlorite in these specimens represents a metamorphic facies of lower rank than that attained in these rocks. It must be attributed to retrogressive metamorphism, although pseudomorphs of higher grade minerals were not noted.

Quartzite - Quartzite forms less than 5 per cent of the metasedimentary rocks of the area. Pure and impure quartzites are exposed extensively east of Rivière aux Roches, northeast of the right-angle bend in the river. Generally, however, only isolated

outcrops were seen, and these rarely. All the quartzites observed are interbanded with other metasedimentary rocks, except in the southwest corner, where relatively pure quartzite forms a prominent ridge in granitic rocks. This ridge can be traced around on the aerial photographs.

The rock is greyish white to light grey. Feldspathic varieties weather slightly pinkish, whereas, in others, weathering to rust color is common. In the more impure varieties, layers range from less than 1/8 inch to 1 foot in thickness.

It is difficult to know the amount of quartz in the fresh quartzite. All the specimens examined are at least somewhat weathered, and leaching in these leaves the impression of a slightly higher proportion of quartz than actually would be found in the fresh quartzite. Taking this into account, it is estimated that the most pure quartzite observed has at least 90 per cent quartz. The most impure variety studied, a feldspathic quartzite, contains about 80 per cent quartz. Micaceous quartzites are very common, but none of these were seen in thin-section. Anhedral grains of microcline, with traces of plagioclase, are found commonly as inclusions in quartz grains. Microcline, associated with sericite, makes up to about 15 per cent of some specimens. Biotite and hornblende are common. There are traces of garnet, zircon, muscovite, chlorite, and apatite. Magnetite can be seen here and there on weathered surfaces.

Quartz grains are not notably rounded. More generally they are of irregular, angular shapes. Quartz ranges from 2 mm to 5 mm in size. The texture is one of an interlocking, fused aggregate

of anhedral grains. Obviously, extensive recrystallization of quartz has occurred. Quartz grains usually show wavy extinction, but fracturing and granulation are rare. Perhaps these metamorphic effects have been obliterated by fusion. Secondary growths of euhedral quartz were not seen.

Augite-orthoclase gneiss - West of the southern extension of Quatre Lieue lake, there is a dark greyish green, well-layered paragneiss. It lies adjacent to quartz-orthoclase gneiss, in a zone at least ½ mile wide across the strike. This is the only occurrence of the augite-orthoclase gneiss found in the map-area.

Euhedral to anhedral augite makes up about 50 per cent of the rock. Anhedral orthoclase makes up about 40 per cent. Microcline or plagioclase were not found. Pale green hornblende, aligned parallel to layering, forms about 3 per cent. The rest is quartz and sericite, with traces of muscovite, apatite, zircon, and carbonate.

The rock contains beige-weathering layers of orthoclase, with minor quartz and sericite, alternating with layers almost entirely of very dark green augite. Sharp contacts separate these highly segregated layers. The part rich in augite contains very little feldspar, quartz, and sericite. Likewise, the feldspathic layers are almost free of augite. Hornblende accompanies the pyroxene.

Grain size ranges from 0.1 mm to 1.2 mm, with an average of roughly 0.4 mm. Both augite and hornblende show euhedralism. Moreover, much of the augite is slightly zoned. In view of the

rock texture and the geological history of the region, it is likely that at least some of the pyroxene is of metamorphic origin.

Mixed gneisses - Outcrops of metasedimentary rock containing between 25 per cent and 75 per cent granitic component are mapped as mixed gneisses. Outcrops of granitic rock with less than 25 per cent metasedimentary component are mapped as gneissic granite, granite gneiss, or augen gneiss. This scheme has been used in the past (Jenkins, 1956, p. 4).

The granitic component is of the same composition and texture as the granitic host rock. The metasedimentary component is largely hornblende-biotite-plagioclase gneiss. Layers are generally concordant to subconcordant, formed lit-par-lit, from less than 1 inch to several feet thick. Where layers are thin and closely spaced, the rock looks much like granite gneiss. Granitic bodies which cut layers and folia in the metasedimentary rocks are generally somewhat pegmatitic.

The same relationships hold for mixed hornblende-biotite-plagioclase gneiss and biotite-quartz-feldspar gneiss. This, too, is mapped as mixed gneiss. It is far less common than that described above.

Mafic rocks of igneous (?) origin - The mode of occurrence of some of the so-called metasedimentary rocks suggests that some are of igneous origin. They are of the hornblende-biotite-plagioclase and amphibolite types. They occur generally as concordant inclusions in the granitic rocks, and, at least in some places, these might well represent concordant intrusions in rock which is now of granitic composition. One such place is along the north side of the

southerly road south of Carlos lake. Here, a hornblende-rich layer lies parallel to nearly horizontal foliation in surrounding, pink, gneissic granite. The layer is at least 6 feet thick, forming sharp contacts with the gneissic granite above and below. It can be traced for about 50 feet, where it grades into the granitic rock. Constant thickness, lack of surface banding, and sharp upper and lower contacts suggest an igneous origin. This sort of thing was seen in many places.

Hornblende-Pyroxene-Feldspar Gneiss

Rather extensive areas of hornblende-pyroxene-feldspar gneiss are found in the north-central and northwestern parts of the area. Scattered outcrops of the same rock occur also in the southwestern part of the area. It weathers light beige to medium-dark, tannish grey. Fresh surfaces were not seen owing to deep weathering. Pinkish facies occur locally but are rare. The rock is generally somewhat gneissic, but massive hornblende-pyroxene-feldspar gneiss is common.

Grains are subhedral to anhedral, ranging in diameter from 0.1 mm to 2.4 mm, with an average diameter of about 1.0 mm. Microcline, perthite, and plagioclase make up the bulk of the rock. The plagioclase is albite oligoclase (An_{6-24}). A visual estimation of three stained thin-sections of representative specimens shows wide variations in the proportions of the different feldspars. Plagioclase ranges from approximately 10 per cent to 50 percent. Quartz is common in some specimens, making up a maximum of about 15 per cent.

Pyroxene and hornblende usually occur together in roughly equal proportions, although in a few specimens pyroxene is absent. The combined total is generally less than 2 per cent. The pyroxene is pale green augite, possibly iron-rich, with subordinate hypersthene. Carbonate is concentrated here and there on altered grains which show cleavage and relief characteristic of pyroxene. Hornblende is generally pale greenish grey to green, and some is pale greenish brown. Biotite is present in most specimens, but it is less common than pyroxene and hornblende. Biotite is bluish green, brownish green, and pale greyish brown.

Other minerals present are apatite, magnetite, ilmenite, allanite, muscovite, zircon, and garnet, with secondary chlorite, carbonate, leucoxene, and iron oxide.

Sharp contacts were seen between fine-grained and relatively coarse-grained facies of the hornblende-pyroxene-feldspar gneiss. The fine-grained part is distinctly granular, and contains more biotite and less pyroxene and amphibole than the coarser-grained facies. The fine-grained part might represent meta-sedimentary rock which has been metasomatized.

Here and there, both within the hornblende-pyroxene-feldspar gneiss and the pink granitic rocks, there are small areas of intimately associated facies which show beige weathering of the feldspars, but which contain very little mafic component. This rock occurs much less commonly than the hornblende-pyroxene-feldspar gneiss. The rock has the same texture as the relatively mafic part. It is characterized by potash feldspar, 15 per cent to 20 per cent quartz, and hypersthene. Microcline can be seen here and there, perthite is common, and twinned plagioclase is rare. Other minerals present are apatite, biotite, muscovite, and zircon. The rock can be called hypersthene granite, or charnockite.

On the other hand, in many places within the hornblende-pyroxene-feldspar gneiss there are strikingly more mafic facies than are generally found. These are similar in texture to the lighter facies. The more mafic facies is most common where the hornblende-pyroxene-feldspar gneiss grades possibly into dioritic rock discussed below. The relatively mafic facies contains upward to about 40 per cent browmish green hornblende. Albite oligoclase (An_{8-28})

make up most of the rest. Quartz and potash feldspar are very minor or absent. It contains about 1 per cent hypersthene and a trace of augite. Reddish brown to brownish green biotite occurs here and there in clusters. Apatite and magnetite are common; zircon, pyrite, iron oxide, and carbonate occur in traces. Irregular blebs of brownish green hornblende occur within crystals of augite. It is probable that this hornblende is derived from the pyroxene.

Dioritic and Gabbroic Rocks

Introduction

Highly mafic rocks, with beige-weathering feldspar, occur sparsely throughout some parts of the area. One of these is obviously gabbroic, whereas others are too light and silicic to be called so. It was found in thin section that the lighter mafic rocks of this group are distinctly dioritic, and that the darkest are gabbroic. They are mapped as a single unit, because of the scarcity of the darker portion, and the impracticality of trying to draw contacts between them. Although they were not seen to grade into oneanother in a single outcrop, it is suggested that they might be derived from the same parent magma.

Dioritic rocks

Some masses of hornblende-pyroxene-feldspar gneiss seem to grade into darker facies. This can be seen through successive outcrops along a traverse, and not in a single outcrop. The mafic feldspar gneiss west of Motaghao lake shows this. It can be seen also about 3 miles northwest of the south end of Walker lake. The darker rock is dark, greenish beige to dark grey.

A subophitic texture is formed by laths of oligoclase and andesine (An_{27-37}), up to 2.5 mm long, in a groundmass of subhedral to anhedral pyroxene and hornblende. The mafic component forms from about 10 per cent to 30 per cent of the rock. The pyroxene, subordinate to hornblende, is largely augite, with a little hypersthene. Hornblende is greenish brown. Reddish brown biotite is common but less abundant than hornblende. Subhedral to anhedral garnet is characteristic of these rocks, making up to 3 per cent. Quartz was not found. Apatite and zircon are common, the former in marked elongated crystals. Traces of sulphide and iron oxide are present.

These rocks are clearly of igneous origin. Augite commonly shows reaction rims of hornblende, plagioclase is zoned and forms laths, and magnetite is almost exclusively enclosed in clusters of hornblende. Laths of plagioclase are largely unbroken, although granular plagioclase is abundant. There is no noticeable preferred alignment of elongated or platy grains.

Gabbroic rocks

One outcrop definitely of this rock-type was seen. This is along the east-west traverse west of Motaghao lake, in the southwestern part of the area. It is brownish black, olivine-bearing, and has up to about 70 per cent andesine (An_{29-46}) and 20 per cent augite. Feldspar laths are up to 10 mm long. Brownish green hornblende and reddish brown biotite are common, and occur almost exclusively as radiating grains around magnetite. Hornblende generally surrounds biotite in these clusters. Here and there hornblende partly or completely encloses olivine. Much of the

biotite and hornblende in this rock may have been formed at the expense of pyroxene and possibly olivine. Olivine is fractured, but it appears fresh. An isotropic mineral, possibly spinel, lies in contact with relatively few grains of olivine. Apatite is common. Serpentine was not seen.

Granitic Rocks

Pink granitic rocks occupy at least four-fifths of the map-area. They are gneissic granite, granite gneiss, and augen gneiss.

Gneissic granite and granite gneiss -

Gneissic granite is the most abundant rock type in the map-area. Granite gneiss occurs only locally, where gneissosity becomes prominent. There are many places where classification is difficult, becoming arbitrary where the rock is intermediate in texture between that of granite and gneiss. Granite gneiss is found isolated in the gneissic granite, and all gradations can be found between the two, even in a single outcrop.

The grain size of the gneissic granite is 0.1 mm to 3.5 mm, with an average of about 1.0 mm. The fresh surface is pale pinkish grey to tannish pink and pink. It has a granular and slightly gneissic texture. The grain size of the granite gneiss is about the same as the gneissic granite. The fresh surface is pale pinkish grey to pink, and the rock is characterized by prominent gneissosity. Foliae are generally less than 1/4 inch thick.

A point-count, modal analysis of the quartz-feldspar content of these rocks was made from 11 stained thin-sections.

The specimens were selected randomly from the writer's entire collection, and represent both granitic and gneissic textures. The lowest and highest number of points of any section is 275 and 966, with an average of 575 points per section. The analysis shows from 14 per cent to 37 per cent quartz, with an average of 25.7 per cent quartz, 15 per cent to 44 per cent potassic feldspar, with an average of 30.7 per cent, and from 31 per cent to 55 per cent plagioclase (An_{8-23}), with an average of 43.6 per cent.

Although the design of this analysis is grossly inadequate for final determinations, it seems clear that a trend is revealed that indicates a monzonitic and granodioritic mineral composition for these rocks. It may be th t rocks of granitic composition are a rarity in the area.

In addition, they contain up to about 10 per cent biotite and 3 per cent hornblende, with minor accessory apatite, magnetite, zircon, sphene, sericite, ilmenite-leucoxene, chlorite, epidote, possibly allanite, muscovite, iron oxide, and sulphides. Zoned plagioclase and intergrowths of quartz in plagioclase (myrmekite) are common.

Foliation is more likely to be found where granitic rock is relatively high in mafic minerals. Therefore, it is not surprising to find granite gneiss most commonly where mafic metasedimentary rocks are present.

Incipient augens are found in the rock, especially where it is near augen gneiss.

Augen gneiss

About one-tenth of the granitic rocks are augen gneiss. It is concentrated around the south end of Gilmet lake, and in the southwestern part of the area. Scattered outcrops occur also in the northwestern part. The rock is medium- to coarse-grained, somewhat coarser than the other granitic rocks. Fresh augen gneiss is pale to bright pink. Elongated augens of potash feldspar are from 1/4 inch to 1½ inches long, the long axis lying parallel to gneissosity. Its composition is quite similar to that of the other granitic rocks, except that hornblende is a little more common in the augen gneiss.

The gneiss occurs both as isolated outcrops in the granite gneiss and gneissic granite, and in extensive masses, such as those in the southwestern part of the area.

Both the relative age and genetic relationship of the augen gneiss, to the other granitic rocks, are obscure. Generally, there is a gradational zone of incipient augen gneiss between the augen gneiss and other granitic rocks. This can be seen both on a large scale and in a single outcrop. Sharp contacts were seen in several places between well-developed augen gneiss and biotite-quartz-feldspar gneiss.

Pegmatite and Diabase Dykes

Pegmatite dykes occur here and there throughout the area. They generally cut foliation in the granitic rocks, where they are most numerous. They are rarely more than 2 feet thick, and are generally less than about 8 inches thick. Pegmatite dykes are rare

in the metasedimentary rocks. Potash feldspar, albite, quartz, biotite, and muscovite, with traces of magnetite and pyrite, are constituents. Dykes of granite were not found.

Diabase dykes were seen in about half a dozen places in the granitic rocks throughout the area. These are shown on the accompanying map. The rock is fine-grained, dark grey, and massive. Except for the dyke described below, thicknesses range from 2 feet to about 15 feet.

A specimen is described which comes from a dyke 1 mile north of the camp north of Lac Dagneau, in the southeast part of the area. Where the traverse crosses this dyke it is about 170 feet thick. Laths of oligoclase-labradorite (An_{26-52}), up to 2.5 mm long, are in a matrix of pale to medium dark green hornblende. The hornblende, about 25 per cent of the rock, is subhedral to anhedral, and ranges from minute, prismatic grains to crystals up to 2.0 mm in size. Most of it is in relatively small grains. The larger grains of hornblende are characterized by minute, worm-like intergrowths of quartz. Otherwise, quartz is not found. Brown biotite, about 3 per cent of the rock, forms almost entirely in clusters around magnetite. Pyroxene was not found, but it is possible that at least some of the hornblende is derived from pyroxene. Euhedral to subhedral garnet, from about 0.1 mm to 0.8 mm, makes up to at least 1 per cent of the rock. Magnetite, apatite, sulphides, and iron oxide are accessory.

STRUCTURAL GEOLOGY

Structural elements are represented most prominantly by foliation in the granitic rocks. Layers of metasedimentary rock, as well as layering within them, lie parallel to this foliation. These structures strike generally between northeasterly and easterly directions within the map-area. Steep northerly and southerly dips are common.

Much layering, usually seen as color banding on the weathered surface, of metasedimentary rocks, is probably of primary origin. It is mapped as bedding west of the south end of Quatre Lieue lake, where it is easily seen.

The structure is complex and generally obscure. The two structures most readily identified were seen first on aerial photographs. These are: 1) the northeasterly-plunging anticline in the southwest corner of the area, and 2) the elliptical basin structure northeast of the right-angle bend in Riviere aux Roches. In the former, a layer of quartzite forms a prominent ridge which can be traced around on the aerial photographs. Surface lineations in the granite gneiss here trend northeasterly, plunging 30° in the same direction. In the basin structure, flat surfaces of granitic rock rise step-like toward the central part of the structure. Foliation parallels these surfaces, which dip gently together. These form an elliptical pattern on the aerial photographs which is more clearly developed in the north half of the structure.

Other structural axes on the accompanying map are inferred from the attitude of foliation, and made more probable by possible relationship with either of the two structures described above.

Joints are at least fairly-well developed in most parts of the area. They are generally northerly, although northeasterly and northwesterly strikes are common. Compelling evidence of faulting is not apparent. No faults are shown on the accompanying map.

ECONOMIC GEOLOGY

Traces of metallic minerals were seen here and there in the map-area, but none of these appear to be of commercial value.

Traces of magnetite are disseminated commonly in the granitic rocks, and, in the gabbroic rocks, concentrations in the form of minor stringers and pods are found. The pegmatites show minor amounts of disseminated and aggregated magnetite. Traces of ilmenite may also be present.

Very minor sulphide mineralization can be found here and there throughout the area, although no appreciable concentrations of this were found.

Deposits of sand and gravel are small.

BIBLIOGRAPHY

Faessler, Carl (1942) Sept Iles Area, Saguenay County; Quebec Department of Mines, G.R. 11, 1942.

Faessler, Carl (1945) Moisie Area, Saguenay County; Quebec Department of Mines, G.R. 21, 1945

GREIG, E.W. (1945) Matamec Lake Area, Saguenay County; Quebec Department of Mines, G.R. 22, 1945

JENKINS, J.T. (1956) Manitou River Area, Saguenay County; Quebec Department of Mines, P.R. 326, 1956.