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PRELIMINARY REPORT ON LYONNE AREA, ROBERVAL ELECTORAL DISTRICT

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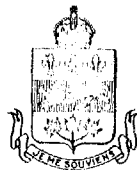
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PRELIMINARY REPORT
ON
LYONNE AREA
ROBERVAL ELECTORAL DISTRICT

BY

J.-GUY BRAY



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INTRODUCTION

The Lyonne area was mapped during the summer of 1958. It occupies approximately 200 square miles, being bounded by latitudes $48^{\circ}15'$ and $48^{\circ}30'$, and by longitudes $72^{\circ}30'$ and $72^{\circ}45'$. The centre of the area is 21 miles west-southwest of the town of Roberval on Lake St-Jean. It includes the southern half of Lyonne township, the western half of Ross township, and the northwestern corner of Chabanel township. The southwestern half of the area lies in unsurveyed ground.

The area is popular for hunting, fishing, camping and blueberry-picking; consequently there are many roads and trails, and no part of the area is more than 4 miles from an automobile road. The Roberval-La Tuque road of the Consolidated Paper Corporation crosses the area from east to west near its mid-length. Club and logging roads extend north and south from this road. An International Paper Corporation road branches from the main road $1\frac{1}{2}$ miles east of the area and provides access to the southeast corner at Ennuyant lake. A road from St-Felicien via François lake comes close to the northeast corner.

The elevation of the area is from 1,150 to 1,850 feet above sea-level, with an average of about 1,500 feet. Local relief is up to 400 feet. Continental glaciation has left extensive glacial and fluvio-glacial deposits. These are found chiefly on areas of gneiss and meta-gabbro, which tend to have low or moderate relief. The younger intrusive rocks have little drift cover and form comparatively rugged highlands. A few eskers over 40 feet high and numerous smaller ones trend southwards.

The drainage has been glacially deranged and lakes and rapids are common. The northeastern third of the area drains into Lake St-Jean, either directly or via Ashuapmuchuan river. The rest of the area drains southwards into the St-Maurice River system. Several deep valleys, which are occupied by rivers and lakes and apparently are controlled by foliation or jointing, are thought to be pre-glacial. Glacial or post-glacial lake and stream terraces are common in the southern part of the area.

The northeastern half of the area is thickly wooded with spruce, jack pine, birch, and poplar; low, marshy ground carries alders. In the southwest, as a result of extensive and repeated fires, some areas are bare of trees and others are covered with a dense second-growth vegetation.

GENERAL GEOLOGY

All the consolidated rocks of the area are Précambrian. Gneisses of Grenville aspect, with a general west-northwest to north strike, underlie most of the area. A large body of meta-gabbro with local concentrations of titaniferous magnetite intrudes the gneisses in the northwest, and smaller bodies occur throughout the area. Large plutons intrude these older rocks in the north and south. They consist chiefly of pyroxene-quartz monzonite. The associated hornblende-biotite granites are thought to be younger than, but genetically related to, the quartz monzonites.

Glacial striae, observed in the northwest of the area, show that the last glacier moved north or south; the distribution of erratics suggests a southerly movement.

Table of Formations

Pleistocene and Recent	Sand, gravel and till
P R E C A M B R I A N	Gneissic hornblende-biotite granite; aplite, pegmatite and hybrid dykes
	Pyroxene-quartz monzonite, aplitic sills, pegmatite, and hybrids
	Meta-gabbro, and granitized equivalents
	Mixed gneisses: hornblende gneiss hornblende-biotite gneiss (Not in order biotite gneiss of succession) amphibolite pegmatite quartzite pyroxenite (metamorphosed limestone?) granitized gneiss

Mixed Gneisses (Perhaps mainly paragneisses)

The mixed gneisses belong to the granulite or high amphibolite facies. Gneisses of many different compositions are closely interlayered and even a small exposure may show several distinct types. For this reason it is impossible to map separate units on the 1/2-mile scale. A typical gneiss contains 40 to 50 per cent grey to buff plagioclase (oligoclase or andesine), 20 to 25 per cent quartz, 15 to 20 per cent pinkish orthoclase, and 10 to 20 per cent ferromagnesian minerals. Differences in composition are marked principally by differences in ferromagnesian content, and in the proportions of hornblende and biotite. The strong but irregular layering of the gneisses makes it difficult to determine the tenor of ferromagnesian minerals except on small exposures. The ratio of hornblende to biotite is somewhat more constant however, and, on this basis, three main types of gneiss are tentatively distinguished: hornblende gneiss (with minor biotite), hornblende-biotite gneiss, and biotite gneiss (with minor hornblende). These three types comprise most of the gneiss in the area. Garnetiferous gneisses are rare.

The mixed gneisses are variably grey, medium- or coarse-grained, and strongly and usually coarsely foliated. Leneation is visible, though rarely well developed, and shown by elongation of ferromagnesian crystals or clusters, and quartz blebs.

Nearly every exposures shows some concordant pink granitic material. This is usually coarse-grained, and ranges from single feldspar crystals or quartz augen to thick lenses and layers, often pegmatitic. Most of this material appears to have no connections with magmatic igneous bodies, and is thought to be the result of metamorphic differentiation or of differential fusion. It commonly makes up 5 to 15 per cent of the outcrop surfaces, and migmatites with higher percentages of granitic matter are common.

Amphibolite

Layers of amphibolite, from less than an inch to more than 10 feet thick, occur throughout the gneisses, and account for 10 to 20 per cent of their area. The rock is dark grey, medium- to coarse-grained, and well foliated. It contains up to 60 per cent hornblende, buff to greenish plagioclase, and minor biotite, magnetite, apatite and hypersthene.

The amphibolites generally show lineation, and usually act as the resistant unit in the boudinage structures that are so common in the area.

Pegmatite

Irregularly lenticular bodies of pegmatite, parallel to the foliation, are common in the gneisses. They consist chiefly of pink microperthitic feldspar and glassy quartz, with some sodic plagioclase. Biotite and large crystals of magnetite are common.

Quartzite

Impure quartzites are interbanded with the gneisses at several places in the southern part of the area. They are light-coloured medium- to coarse-grained rather massive rocks, consisting chiefly of glassy quartz, with variable amounts of pink or buff feldspar and a little mica. They probably represent siliceous sediments.

Pyroxenite (Metamorphosed limestone?)

Only two exposures of pyroxenite were observed, both being within the gneisses near quartzites and quartz monzonite. That at the south end of Corne lake is a dark, medium- to coarse-grained rock, consisting of variable proportions of green pyroxene (probably hedenbergite), amphibole, red garnet, white feldspar, and carbonate. A small amount of typical grey to buff impure "Grenville" marble is present.

The exposure northeast of Cygne lake is a green medium- to coarse-grained rudely gneissic biotite pyroxenite. The pyroxene is diopside, the biotite and secondary amphibole are magnesium-rich. The rocks contains 15 to 20 per cent of an unidentified mineral.

The mineralogy and field relations of these pyroxenites suggest that they are metasomatized, impure limestones.

Granitized Gneiss

Gneisses mapped as granitized include those at or near the margins of the quartz monzonites and granites. They show diverse stages of magmatic and metasomatic invasion and alteration. They are intended to exclude the migmatites mentioned above in which little or no introduced material is thought to occur.

One type, commonest in the southwest corner of the area, shows gradations from a gneiss with numerous sills of quartz monzonite-aplite to a hybrid quartz monzonite with relics of gneiss.

A second type, of wider occurrence, generally shows only a few granitic dykes or sills, but it is recognized by a pink colouration of the feldspar and a lower tenor of dark minerals. In thin section, potash feldspar is seen to be much more abundant than in the average gneiss, and a pseudo-uniaxial hornblende similar to that in the intrusive rocks is present. North of Huard lake the gneiss is veined with epidote.

Meta-gabbro

This is a medium- to coarse-grained dark grey or green rock, which shows a strong lineation marked by elongated crystals of pyroxene. The green or grey plagioclase (andesine or labradorite) weathers white or buff and makes up from 30 to 80 per cent of the rock. Orthopyroxene with strong schiller structure is the dominant ferromagnesian mineral; clinopyroxene and secondary hornblende and biotite also occur. Clusters of dark minerals give much of the weathered surface a spotted appearance. Apatite is locally abundant; magnetite-ilmenite concentrations are common and may be of economic value (see Economic Geology). The meta-gabbro is generally concordant with the gneisses and in several cases is in recognizable sills; in only one exposure, west of Toulady lake, were discordant intrusive relationships observed. The smaller bodies show the effects of metamorphism most strongly; the large pyroxene crystals are replaced by magnetite, clear recrystallized orthopyroxene, hornblende, and garnet, and the plagioclase is clouded with dark inclusions. Near contacts with gneiss, biotite is generally the principal dark mineral.

Dykes and sills of fine-grained and porphyritic gabbro cut the coarser types, but are rare in the gneiss.

The granitized meta-gabbro is cut by numerous granite and pegmatite bodies. Large porphyroblasts of feldspar are developed in the gabbro near granite contacts at several places, and most gabbro xenoliths in quartz monzonite have gradational margins.

Pyroxene-quartz Monzonites

These rocks intrude the gneisses and meta-gabbro. They are brown or greenish, white-weathering, and coarse- to medium-grained.

A crude foliation or limestone is present in many larger exposures. The principal mineral is a brown, complex micropertthite or antiperthite with from 30 to 50 per cent plagioclase. Sodic plagioclase in amounts from 10 to 20 per cent, also occurs as separate crystals. Ferromagnesian minerals, mainly a green augitic pyroxene with a little hornblende and biotite, rarely exceed 15 per cent. Magnetite, in amounts up to 5 per cent or more, is locally present. Quartz, which varies from below 5 to more than 20 per cent, is very difficult to see on a fresh surface. Quartz-rich and quartz-poor types were distinguished in the field, but they seem to be randomly distributed.

Pink or buff aplitic sills are common in the gneisses near the quartz monzonites. They contain feldspars similar to those of the quartz monzonites, but have 50 per cent or more quartz and no pyroxene. Locally, the main quartz monzonite bodies are pegmatitic.

Contacts, especially with gneiss, are commonly gradational across several hundred feet. In the marginal zone a variety of partly digested and metasomatized hybrid rocks may be seen.

Hornblende-biotite Granite

These are pink, medium- to coarse-grained rocks. Foliation is usually present, but may be so crude that it is not seen on a small exposure. The rock contains from 50 to 60 per cent orthoclase or microcline micropertthite, with a little sodic plagioclase, and about 10 per cent combined hornblende and biotite. Quartz is present up to 25 per cent.

The granite intrudes the gneisses and meta-gabbro. Its relation to the quartz monzonite plutons is not clear; in several places the contact appears to be gradational. However, as the granite tends to occur near the margins of the plutons, or as small plugs in them, it is probably the younger rock.

Pegmatite and aplite dykes, usually less than a foot thick, are found near some of these granites. They transect the gneiss foliation at all angles.

Hybrid rocks are common at the granite margins, though the gradational zone is much narrower than that of the quartz monzonites.

Sand, Gravel, and Till

Large areas, particularly in the east and north, are covered by hummocky ground moraine with numerous large erratic boulders. Fluvio-glacial sand and gravel deposits are found scattered on top of this except on higher ground. A broad, discontinuous belt of eskers and kames extends south-southwest from the northern edge of the area to La Moelle. South of this are several terraced stream and lake deposits of gravel and sand. The largest of these is around Portage lake, and is thought to represent the filling of a broad pre-glacial valley.

STRUCTURAL GEOLOGY

Foliation, Lineation and Folding

Foliation in the gneisses generally strikes northwest. Near the margins of large intrusive bodies the strike swings towards the west or north, giving the concordant structure so typical of the area. With few exceptions dips are northeast and fairly steep. Thus, although individual folds were not distinguished, it is reasonable to suppose that such an apparently thick sequence of gneisses is arranged in isoclinal folds that are generally overturned to the southwest. This might also be deduced from the minor drag folds visible on single outcrops, which also show the characteristic flow structures of the highest grades of metamorphism.

Lineation in the gneisses generally plunges southeasterly at low angles, but it tends to swing with the foliation. Lineation in the meta-gabbro is roughly similar in attitude.

Foliation in the quartz monzonite and granite usually strikes north except near contacts. The dip, where observed, is nearly vertical. The few measured lineations plunge south at moderate angles.

Shear Zones and Faults

The presence of faults was nowhere proved. A north-striking shear zone in the southeast of the area near Coeur lake is marked by a rectilinear valley, contorted foliation and abundant (but apparently barren) quartz veins. This may well mark a fault zone. Frog river flows south in a deep straight valley for much of its length. Gneisses occur on both sides, but those on the east commonly contain numerous aplitic sills which are not seen on the west; thus, the valley may be the locus of a fault.

Joints

Most joints in this area have steep or vertical dips, but diverse strikes were recorded. Many joints appear to be either sub-parallel or sub-perpendicular to the local foliation, but, without statistical analysis, no definite systems can be recognized.

General

In the writer's opinion, sedimentary rocks and concordant basic intrusions were subjected to orogenic metamorphism with the principal stress acting northeast-southwest. At the height of the metamorphism the quartz monzonites, which are typical granulite facies rocks, were emplaced; extensive metasomatism of the surrounding rocks was probably facilitated by the extreme metamorphic conditions then prevailing. The intensely granitized gneisses now seen are thought to be roof pendants or xenoliths in the upper levels of the quartz monzonites. The plutons in this area are probably parts of a batholith, for the intrusions

extend well beyond the margins of the map. In the later stages of the orogeny granite was intruded. Its gneissic structure and mineralogy are more characteristic of a lower metamorphic grade, and the late pegmatites and aplites were injected into rocks capable of sharp fracture.

ECONOMIC GEOLOGY

Titaniferous magnetite in the meta-gabbro is at present the area's most interesting economic prospect. Hundreds of claims were staked in the northwest part of the area, and on the 10⁴ owned by Roberval Mining Corporation, west of Toulady lake, geological and ground magnetic surveys were made, and diamond drilling was completed to the extent of several thousand feet.

Magnetite and ilmenite are disseminated throughout the meta-gabbro, but at several places they are concentrated in layers and lenses which are thought to be primary in origin. The magnetic fraction is unusually low in TiO₂ (1.18%), a feature which would be advantageous if magnetite could be concentrated in commercial amounts. There is some reason to believe that the low titanium content is connected with intrusion of meta-gabbro by granite. Exposures are poor over much of the supposed meta-gabbro body, and an aeromagnetic survey of this area might yield significant results.

A narrow pegmatite dyke east of De-la-Cache lake contains a little beryl. Minor amounts of molybdenite were found in the gneisses southeast of Rats lake and south of Huard lake. A pegmatite body north of Philippe lake contains biotite crystals 3 inches in diameter.

Sand and gravel deposits suitable for construction purposes are abundant throughout the area.
