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PRELIMINARY REPORT ON THE CARHEIL AND LE GENTILHOMME LAKES AREA, SAGUENAY ELECTORAL DISTRICT

P. R. NO. 412

PROVINCE OF QUEBEC, CANADA

DEPARTMENT OF MINES

HON. W. M. COTTINGHAM, MINISTER

GEOLOGICAL SURVEYS BRANCH

# PRELIMINARY REPORT

# ON THE

# CARHEIL AND LE GENTILHOMME LAKES AREA

## SAGUENAY ELECTORAL DISTRICT

BY

D. L. MURPHY

QUEBEC
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## SAGUENAY ELECTORAL DISTRICT

by

Daniel L. Murphy

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## INTRODUCTION

The Carheil and Le Gentilhomme Lakes area, mapped during the summer of 1959, is about 174 miles north-northwest of Sept-Iles. It covers about 310 square miles of an area bounded by longitudes 66°45' and 67°15' and latitudes 52°30' and 52°45'. It includes parts of Esmanville, Saint-Castin, Gueslis, Normanville, and Desjordy townships, as well as parts of townships Nos. 2656, 2657, 2756, 2757(*). It lies immediately east of the Mount Wright area (Murphy,1959) mapped for the Quebec Department of Mines in 1958.

The easiest means of access is by hydroplane from Sept-Iles, Jeannine lake, and Ross Bay. Jeannine lake, the terminus of the road joining Shelter Bay to the Quebec Cartier Mining properties, is 70 miles southeast of the area, and Ross Bay on the Schefferville - Sept-Iles railroad is 40 miles to the northeast. The area is also, but with difficulty, accessible by canoe via Moisie and Ste-Marguerite rivers. Travel within the area is relatively easy along the main, southeasterly-flowing streams.

Areal drainage is southeasterly into the Moisie River system. Carheil and Le Gentilhomme lakes, the largest bodies of water, are in the central part of the area. The south-western corner of the area is drained by Pekans river and its tributaries.

The area is rugged relatively to most of the interior of the Laurentian uplands. Most of the surface is between 1,900 and 2,400 feet above sea-level, with a maximum local relief of about 500 feet. The influence of the nature and structure of bedrock on topography is reflected by the more conspicuous ridges, which consist of folded iron formation, and by the location of several of the larger lakes on axial zones of folds.

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(*) Township numbers refer to subdivisions, used only by the Department of Mines, of unsurveyed territory in the Province.

The area has a variable cover of vegetation and much of it has been destroyed by forest fires. Black spruce is plentiful; tamarack and jack pine are scarce; birch and alder are found mainly on sheltered slopes and along streams. Caribou moss is ubiquitous and, generally, is associated with labrador tea.

## GENERAL GEOLOGY

Pleistocene and Recent deposits of clay, sand, gravel, and erratic boulders cover roughly 60 per cent of the land surface. They are especially thick and widespread in the eastern part of the area, and here bedrock is exposed only on the hill tops. Most of the drift is poorly sorted and unstratified although, in places, eskers, kame terraces, and other fluvio-glacial features may be seen.

The consolidated rocks are Precambrian in age. Paragneisses, paraschists, and metasedimentary iron formation units are abundant and, for the most part, appear to be metamorphic equivalents of relatively unmetamorphosed Labrador Trough rocks to the north. A few widely scattered exposures of amphibolite(?) within the gneisses are apparently derived from basic intrusive rocks. Nearly all the metamorphic rocks of the area have been permeated in varying degrees by granitic material. The youngest bedrock consists of a relatively unaltered gabbroic (and ultrabasic?) to syenitic intrusive complex.

## PRECAMBRIAN

### Paragneisses with Minor Paraschists and Orthogneisses

Paragneisses with minor paraschists and orthogneisses are the oldest and most widespread bedrock units. They underlie most of the eastern half of the area and also crop out in the northwest, southwest, and southeast quadrants of the western half. Biotite is common to all the gneisses. It is either evenly distributed throughout the rocks or concentrated in segregated layers. In some places, these gneisses may be divided into separate units according to the mode of occurrence of biotite. Kyanite-garnet schists constitute a subordinate unit within the biotite gneisses.

## TABLE OF FORMATIONS

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| CENOZOIC | RECENT AND PLEISTOCENE | Moraines, eskers, alluvial deposits, elevated beaches | |
| | | Unconformity | |
| PRECAMBRIAN | PROTEROZOIC(?) | Basic (and Ultrabasic?) to Syenitic Igneous rocks | Gabbro and syenite; meta-peridotite? |
| | | Granite gneiss and related rocks | Pegmatitic, aplitic and quartzose dykes; Granite gneiss, injection gneiss and/or migmatite |
| | | Basic meta-igneous rocks | Amphibolites? |
| | | Paraschists and minor paragneiss | Hornblende-quartz-garnet rock and biotite-quartz-garnet schist; Mica-schist with variable kyanite, graphite and garnet, locally gneissic; Hornblende-garnet gneiss |
| | | Iron Formation | Magnetite-quartz ironstone; Silicate-carbonate-quartz ironstone; Quartzite; Marble |
| | ARCHAEAN(?) | Paragneisses with minor paraschists and ortho-gneisses (?) | "Banded" biotite gneiss; Mica-kyanite-garnet schist and gneiss |
| | | | "Massive" biotite and minor biotite-hornblende(?) gneiss |

Near the contact with the iron formation sequence the gneisses are distinctly layered and are probably of sedimentary origin. The typical rock consists of bands of quartz and feldspar in about equal amounts alternating with layers of biotite, quartz, and feldspar. The layers vary from 1/8 inch to ¾ inch thick, and are remarkably uniform in thickness for hundreds of feet along strike. Biotite flakes are oriented parallel to the layering. Within the felsic layers, the quartz is fine- to medium-grained and nearly colourless, whereas the feldspars are slightly coarser grained and colourless to light grey. The appearance of the mafic layers differs from place to place owing to a variation in the amount of biotite, although at a given locality the black mica content is fairly uniform. An average mafic layer consists of 25 per cent biotite, 50 per cent quartz, 20 per cent light-coloured feldspar, and small quantities of garnet. On the weathered surface, the banded gneiss is rusty brown to brownish grey, and small trough-like depressions are common on the biotite-bearing bands.

Away from the gneiss-iron formation contact, the gneisses are followed by a massive biotite rock. No transition zone was seen. A massive variety of gneiss was observed at several places in the eastern part of the area. Here, biotite is generally evenly distributed throughout the rock although in places it is in ill-defined laminae a fraction of an inch thick. The massive gneiss probably is a mixture of para- and ortho-types and may be the basement complex.

In the eastern part of the area, a mica-kyanite-garnet schist appears to lie between the well-banded biotite gneiss and the massive variety. The rock is medium- to coarse-grained and has a variable mineralogical composition. Where the micaceous constituents are abundant the rock is markedly schistose and, where the feldspar content is high, it is almost gneissic. An average specimen of schist is composed essentially of 10 per cent kyanite, 10 per cent garnet, 40 per cent biotite, 15 per cent quartz, 20 per cent feldspar, and 5 per cent muscovite.

## Iron Formation Sequence

The "iron formation" sequence includes all the iron-rich rocks, regardless of their mineralogical composition, and the underlying marble and quartzite. In the western half of the area, units belonging to this group are continuous and may be used as marker horizons in outlining broad fold structures. To the east they are discontinuous, and occur in small synclinal basins in the lower gneisses. These rocks are commonly lenticular as, for example, in the centre of the small anticline surrounded by marble northeast of Carheil lake.

Marble appears to be the most continuous and wide-spread unit, and is generally the basal member of this sequence. Quartzite lies between the marble and the iron formations proper (ironstones). The ironstone units consist of an oxide facies and a silicate and/or carbonate facies.

## Marble

The marble consists of variable amounts of carbonates, quartz, and calc-silicate minerals. These minerals generally occur in layers that probably represent original bedding. It is light grey to white on the fresh surface and weathers to shades of dark brown to dark grey. Differential weathering is commonly seen with the more resistant quartz-silicate layers standing out in relief. In several places the marble forms small sinuous hills standing above the adjacent gneisses and schists.

The carbonates are white to brownish white and medium- to coarse-grained. Dolomite and calcite, or both, may be found in the purer layers, whereas calcite predominates in the other cases. Discontinuous layers of greyish white quartz, from 1/8 inch to 4 inches thick, occur here and there. Quartz is also disseminated in the carbonate layers, as in those near the west shore of Jonquet lake. The silicates, which include grey to greenish grey diopside and white, fibrous tremolite-actinolite, occur in scattered lenses, pods, and layers in the more siliceous portions of the marble. Such layers are as much as one foot thick and are probably metamorphic reaction zones between carbonate and quartzose portions. Tremolite tends to become actinolitic near the contact of the marble with the silicate-carbonate-quartz ironstone. West of Low Ball lake calc-silicate minerals make up more than 50 per cent of the marble.

The thickness of the marble varies throughout the area as a result of plastic flowage and tight isoclinal folding. However, a short distance southwest of Carheil lake, the apparent normal thickness has been estimated to be 500 to 600 feet. Although the marble generally is at the base of the iron formation sequence, closely spaced outcrops near Horseshoe lake in the southwestern corner of the area indicate that it is, at least in part, isofacial with the silicate-carbonate ironstone.

## Quartzite

Quartzite, as a distinct stratigraphic unit, was observed at only three localities in the area. West of Low Ball lake it is highly fractured and consists of medium-grained, colourless to milky quartz with small scattered lenses and veinlets of specularite. In the area between Carheil and Jonquet lakes, approximately 100 feet of quartzite lies above the marble. Here, the rock is relatively pure except for a zone transitional to the underlying carbonate. Near the northwestern corner of the area, the quartzite lies between the silicate-carbonate ironstone and the quartzite-specularite ironstone. This association is similar to that at Mount Wright.

## Silicate-carbonate-quartz Ironstone

The silicate-carbonate-quartz ironstone is the most common type of ferruginous rock. Its distribution within the area closely parallels that of marble although it is less continuous. Typically, the rock is composed of well-defined layers of quartzite, iron silicates, and/or iron-bearing carbonates. In places, owing to differential erosion, the limonite-stained quartzite stands 6 inches above the adjacent silicate and carbonate material.

The silica layers are composed of a uniform mosaic of fine- to medium-grained grey quartz, locally with minute veinlets or disseminated grains of pyrite. The ratio of carbonate to silicate varies within the iron-rich layers. Siderite and ankerite(?) predominate northeast of Carheil lake, whereas dark green hypersthene and light brown grunerite are the principal constituents west of Low Ball lake and immediately south and southeast of Côté lake. Commonly, the silicate-rich variety of ironstone carries magnetite, especially near the transition zone between it and the overlying magnetite quartzite. The magnetite is in blebs, small lenses, and fine disseminations.

## Magnetite Quartzite

Magnetite-bearing quartzite is the uppermost unit of the iron formation sequence. It has a limited and very erratic distribution. All gradations from a relatively pure magnetite-quartz rock to magnetite-bearing silicate-carbonate-quartz ironstone are found.

Northeast of Carheil lake, this oxide facies is a flaggy-weathering rock composed of layers and lenses of a fine-grained quartz-magnetite aggregate alternating with layers of similar composition but of much finer grain size. Individual bands vary from 1/16 inch to ½ inch thick. West of Low Ball lake the banding is less sharply defined. Here, magnetite and quartz may be mixed or be in separate and distinct layers. Interfingering and crenulation of the layers is common. Southeast of Côté lake the oxide facies is transitional with the silicate facies. Layers between ½ and ¾ inch thick of a fine-grained green silicate (hypersthene ?)-magnetite-quartz mixture alternate with layers between 1/8 and ¼ inch thick of quartz and subordinate magnetite. In all these localities the oxide ironstone is very thin and traceable for only short distances along strike. West of Low Ball lake, magnetite constitutes as much as 50 per cent of the rock in some parts of the outcrop. The Carheil lake and Côté lake deposits average 30 to 35 per cent iron oxide.

## Paraschists and Minor Paragneisses

Micaceous schists (locally gneisses), a hornblende-garnet gneiss, nearly massive hornblende-garnet-quartz rock, and a biotite-quartz-garnet schist are the youngest metasedimentary rocks in the area. They are well exposed in the western half of the area and in the centre of remnant downwarps in the eastern half. Mica-rich schist is the most abundant rock type and includes graphitic, kyanitic, and garnetiferous varieties. In places the kyanite content seems to increase where permeation by younger granitic material has been intense. The stratigraphic relationships between these various rocks are not known.

### Hornblende-garnet Gneiss

Hornblende-garnet gneiss is one of the lower units of this younger rock group. It was observed at only two localities: one-half mile south of Carheil lake and about one mile east of the lake. At these places, the gneiss seems to overlie directly the marble, although the actual contact was not exposed. The rock generally weathers to a dark grey and consists principally of hornblende, garnet, and light grey to greenish grey plagioclase. Quartz and biotite are present in subordinate amounts. East of Carheil lake the gneiss is weakly layered and coarse- to very coarse-grained with garnet porphyroblasts as much as ¾ inch to one inch in diameter. South of the lake the rock is more massive.

### Mica Schists

Micaceous schists are well exposed along the shores of Carheil and Knife lakes. Near the southeast end of Carheil lake, from the shore to the marble on the ridge to the south, a nearly continuous section of this rock is well exposed. Mica-quartz-kyanite schist, with minor light-coloured feldspar, may be seen along the shore. Within a few hundred feet of the shore the rock becomes progressively more feldspathic and kyanitic and contains local concentrations of garnet. Farther uphill, and stratigraphically lower in the section, a graphite-bearing mica-quartz-feldspar schist appears to be the dominant rock. The top of the ridge is underlain by biotite-quartz-feldpar schist with variable amounts of garnet. Here and there, the rock is gneissic owing to a greater quantity of feldspar. Graphitic schists and gneisses are abundant around Knife lake. At one locality, about ¼ mile west of the lake, there is a 3-foot zone of nearly pure graphite within the schist.

### Hornblende Rock and Biotite Schist

A nearly massive, medium-grained, hornblende-quartz-garnet rock and a biotite-garnet-quartz schist appear to be the youngest rocks of the upper schists and gneisses. In a few places, these rocks directly overlie the iron formation sequence. Excellent exposures of the hornblende rock may be seen along the southwest shore of Carheil lake and along the shore of Gibraltar lake. It varies from a schistose, nearly pure hornblende type to a massive hornblende rock with 20 to 25 per cent garnet and 15 to 20 per cent quartz. A thick sequence of medium-grained, biotite-garnet schist with minor hornblende and quartz occupies the centre of a syncline south of Carheil lake.

## Basic Meta-igneous Rocks

Several isolated outcrops of a poorly foliated, fine-grained hornblende-plagioclase-garnet rock (amphibolite?) are concordantly interlayered with the biotite gneisses midway between Carheil and Côté lakes. A primary igneous origin is inferred for this rock type in view of its similarity to basic meta-igneous rocks in the Mount Wright area to the west.

## Granite Gneisses and Related Rocks

Most of the Precambrian rocks of the area show some degree of intrusion and permeation by granitic material. The gneisses and schists underlying the iron formation sequence seem to have been more affected than other units.

The granitic material consists primarily of salmon pink to light grey feldspar and colourless to slightly milky quartz. Where injection has been intense, only relic patches of the original rock remain in the granite gneiss. Bordering these areas are injection zones in which the introduced quartzo-feldspathic material is concentrated in pinch and swell structures and interwoven stringers. Small and widely scattered dykes of pegmatite and aplite were observed within the upper and the lower schists and gneisses. In the Mount Wright area, similar rocks cut both the iron formation sequence and the younger meta-sedimentary rocks.

## Basic (and Ultrabasic?) to Syenitic Igneous Rocks

The youngest consolidated rocks in the area consist of a sequence of basic (and ultrabasic?) to syenitic igneous rocks. Exposures of these rocks were observed at only three localities in the area: along the east shore of Rainy lake, ½ mile east of Carheil lake, and 6 miles southeast of Jonquet lake.

Most of the gabbroic and syenitic rocks are relatively unaltered.

Between Carheil and Jonquet lakes, the gabbros are medium-grained, dark bluish green to bluish grey, and weather to a mottled light tan. They consist of 60 per cent blue-green plagioclase, 30 per cent dark pyroxene, uralitic amphibole, and olivine, and 10 per cent secondary biotite, serpentine, garnet, and magnetite. In places the plagioclase laths and the dark prismatic minerals are finer grained and have a subparallel orientation. The pyroxenes and amphiboles are commonly inside coronas with a garnet and/or biotite outer rim.

The intrusive complex east of Rainy lake includes gabbroic, peridotitic(?) and possibly syenitic rocks. Near the southern margin of the complex, the rock is medium-grained, dark greenish-grey, and practically feldspar-free. The principal constituents include pyroxene and olivine, both considerably serpentinized, garnet, and dark bronze mica. The eastern edge of the exposures consists of light yellowish-grey, syenitic rocks. They contain only 10 to 15 per cent mafic minerals — principally alteration products such as garnet and chlorite with some biotite. The central and western parts consist of gabbroic and perhaps dioritic rocks in which much of the pyroxene and uralite have garnet coronas.

## STRUCTURAL GEOLOGY

### Folds

Most of the structural interpretation is gained from the attitude and distribution of the iron formation units, for these have distinctive lithologies and more definite topographic expressions. The western half of the area is dominated by a large, complex syncline (or synclinorium) that trends approximately north. The northwesterly-trending overturned anticline of the south central part of the area is surrounded by the younger metasedimentary rocks. Within the anticline are the remnants of two smaller synclinal folds. The older rocks appear again in a small anticlinal fan in the southwestern corner of the area. The dips of both foliation and bedding associated with these structures are steep and, in many places, overturned. Such attitudes seem to indicate that isoclinal folding accompanied the development of the large structures.

In the eastern half of the area, along the northern border, Gibraltar lake occupies a small synclinal depression. A few miles southeast, along the east shore of Sandy lake, scattered exposures of marble outline the eroded remains of a small fold. Throughout the remainder of this portion of the area small anticlines occur here and there in the lower gneisses. Such structures appear to be related to the granite gneiss bodies and associated rocks.

### Linear Structures

Good evidence of faulting and shearing is scarce. Some of the topographic linears may be the result of such movements. Most shear zones and joints trend northwest or northeast and seem to have vertical or steep dips.

Lineations in crenulation are locally abundant in the upper schists. Along the southwest shore of Carheil lake, they trend at wide angles across the strike of the foliation with steep plunges. Comparable structures are rare in the lower gneisses.

## ECONOMIC GEOLOGY

### Iron

Oxide-type ironstone, the economically important variety of rock in this region, is thin and discontinuous in the present area. The specularite-bearing type is conspicuously absent. Several localities in the western half of the area are now held under claim by various companies, as follows: Canadian Javelin and Trans-Canada Exploration northeast of Carheil lake; Mallen Red Lake Gold Mines and Roxton Mining and Exploration north and northwest of the same lake; Quebec Cartier Mining immediately west of Low Ball lake; and C. C. Huston and Associates at the southwestern end of Jonquet lake (staked in 1959).

### Sulphides

Small veinlets and disseminated grains of iron, nickel, and copper sulphides occur in the gabbroic rocks near Rainy lake. Pyrrhotite, pentlandite, and pyrite are the dominant minerals, although some chalcopyrite is present. A search for concentrations of these sulphides in the gabbros may be warranted.

### Graphite

Graphite-bearing horizons are common in certain portions of the upper schists. Locally the carbon content is as high as 20 per cent. West of Knife lake, the graphite is concentrated in a 3-foot vein, as described in the section on Mica Schists.

### Sand and Gravel

Well-sorted fluvio-glacial deposits will undoubtedly become important sources of sand and gravel for construction purposes when the iron ore deposits are eventually brought into operation.

## REFERENCE

Murphy, D.L. (1959) Mount Wright Area, Saguenay Electoral District; Que. Dept. Mines, P.R. No. 380.