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PRELIMINARY REPORT ON PEPPLER LAKE AREA (EAST HALF), SAGUENAY ELECTORAL DISTRICT

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PRELIMINARY REPORT

ON

PEPPLER LAKE AREA (EAST HALF)

SAGUENAY ELECTORAL DISTRICT

BY

L. S. PHILLIPS

QUEBEC
1959

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SAGUENAY ELECTORAL DISTRICT

by

L.S. Phillips

INTRODUCTION

The east half of the Peppler Lake area is approximately 160 miles north-northwest of Sept-Iles, in the northern part of Saguenay electoral district. The area is bounded by latitudes 52°15' and 52°30' and by longitudes 67°30' and 67°45', and is 180 square miles in extent. It includes most of Malapart township, with parts of Menneval, Faber, Thury, Beaudoin and Cabanac townships. This area, mapped during the summer of 1958, lies immediately south of that mapped by the author in 1957 (1).

Access to the area may be had by float plane from Sept-Iles. A road has been completed from Shelter Bay near Sept-Iles to Jeannine lake near Mount Reed, some 32 miles southwest of Peppler lake. Routes of projected railways to Mount Reed and to Mount Wright will approach the area. Mount Wright is 28 miles north-northeast of Peppler lake.

The greater part of the area is between 1,750 feet and 2,250 feet above sea-level. Local relief is generally of the order of 200 feet, and most of the area has a rolling topography composed of drumlinoid ridges and swamps, relieved by small crags and hills of bedrock. The only large hills are Peppler mountain and North Lamêlée hill - both standing 700 feet above the general surface and developed in synclinal structures in Iron Formation rocks. Crystalline limestone and Iron Formation form a low and interrupted north-facing scarp near the southern margin of the area.

Tha land surface has a general southerly slope and the rivers drain southward into the Little Manicouagan River system. Little Manicouagan river crosses the map-area from north to south and, except for a series of rapids south of Peppler lake, is slow-flowing and useful for canoe transportation. Price lake is drained by Lillishen river, which joins Little Manicouagan river south of the area. Both rivers flow through broad drift-filled valleys.

Most of the area has a light cover of spruce forest and caribou moss. Where bedrock reaches the surface, the forest is thicker and steep slopes often have stands of birch. Alders are common along stream courses, and on some eskers jack pine occurs. Forest fires of several ages have affected small areas north and east of Jean lake and in the southwestern and southeastern corners of the area. Muskeg and string bogs are common, particularly southeast of Peppler lake.

GENERAL GEOLOGY

Three-quarters of the area is covered by glacial deposits, and outcrops are abundant only on large hills such as Peppler mountain and those north of Jean lake. Elsewhere, outcrops occur only where small crags protrude through this cover or in stream beds.

The area is within the Grenville sub-province of the Canadian shield, and all the consolidated rocks are of Precambrian age. Most of the area is underlain by regionally metamorphosed sedimentary rocks. These comprise gneisses and migmatites, with some thin concordant layers of amphibolite and granite gneiss. Crystalline limestones, quartzites, schists, and some iron-rich metasedimentaries are overlain by gneisses which, in the southern part of the area, are graphitic. These rocks are believed to be the metamorphosed southwesterly extension of the iron-bearing sequence of the Labrador trough.

All the rocks mentioned above are cut by small bodies of gabbro, peridotite, and granodiorite, and by dykes of pegmatite and aplite.

The structure of the area is complex, with tight, commonly overturned folds trending north or northwest. A contemporaneous or later folding along east-northeast trending axes is also indicated.

PRECAMBRIAN

Gneisses and Migmatites

Gneisses and their migmatized equivalents underlie most of the area. They are the metamorphosed equivalents of pelitic and semi-pelitic sediments and are believed to be older than the Iron Formation. They may be divided into three types.

Gneisses characterized by hornblende, epidote, and biotite underlie much of the northern quarter of the area. They are believed to be the oldest rocks exposed. The typical rock is white or grey. Gneissic layering may be distinct or faint. The rock is predominantly oligoclase (An_{20}) with subordinate microcline and about 15 per cent quartz. Hornblende is accompanied in most specimens by green and brown biotite and euhedral epidote. In the central part of the area, between Price lake

and Little Manicouagan river, biotite is absent and the rock is so massive as to resemble a quartz syenite. Locally, hornblende and biotite have been replaced by chlorite, and plagioclase has been replaced by saussurite.

TABLE OF FORMATIONS

ERA or PERIOD		DESCRIPTION
PLEISTOCENE AND RECENT		Sand and gravel esker deposits; ground moraine and bouldery till; erratic boulders; alluvials.
PRECAMBRIAN	INTRUSIVE ROCKS	Pegmatite and aplite dykes. Granodiorite. Peridotite and amphibolite. Gabbro.
	METAMORPHOSED SEDIMENTARY ROCKS	Quartzo-feldspathic biotite gneiss. Graphitic biotite gneiss (southern part of area only).
		Iron Formation: Garnet-mica schist ± kyanite. Garnet-hornblende gneiss. Chlorite-silicate-magnetite schist. Magnetite and/or specularite quartzite. Silicate-carbonate quartzite and silicate gneiss. White quartzite. Crystalline limestone.
		Migmatite and granite gneiss. Amphibolite. Biotite gneiss ± garnet Hornblende-epidote-biotite-gneiss.

The second group comprises gneisses in which hornblende is absent or present only in included layers of amphibolite. Rocks of this group include gneisses stratigraphically above and below the Iron Formation. The rock type is characterized by marked layering from 1 inch to 1 foot thick, a result of segregation of felsic and mafic components during recrystallization. This layering is commonly planar, but near faults and in zones of tight folding or migmatization it is highly contorted. Drag folds and pinch-and-swell structures containing segregation pegmatite pods are common. In these rocks dominant oligoclase is accompanied by microcline, with green-brown biotite and subsidiary epidote as mafic minerals.

Garnet is rare in the hornblende-bearing gneisses, but some layers within the biotite gneiss group contain abundant crystals of pink garnet between $\frac{1}{4}$ and $\frac{1}{2}$ inch in diameter. Richly garnetiferous gneisses occur south of Price lake and in the extreme northeast corner of the area.

Granite gneisses and migmatites are much less abundant in this area than in the Tuttle Lake area to the north. They are characterized by pink microcline and green biotite and appear to have been developed by injection along foliation planes and by replacement. Linear feldspathic and epidotic zones are common near Jean lake.

Layers of amphibolite occur within the gneisses. The layers are commonly less than 10 feet thick, are concordant with the foliation of the adjacent gneisses, and show all degrees of incorporation into the latter. They antedate the regional metamorphism and may have been of either igneous or sedimentary origin.

Iron formation

The rare exposures showing contacts at the base and top of the Iron Formation suggest but do not prove that the Iron Formation is conformable with the underlying and overlying gneisses. Local interfingering and gradational contacts support this view. The Iron Formation in the strict sense overlies crystalline-limestone and comprises three facies:- silicate, carbonate, and oxide together with meta-pelites. The individual members of this group vary considerably in thickness and mode of occurrence over the area. A generalized stratigraphic description is therefore impossible, and the structure and stratigraphy of contineous occurrences are described under "Economic Geology". Petrographic descriptions of the rock units follow.

Crystalline Limestone

The base of the Iron Formation sequence is marked almost everywhere by a white coarse-grained crystalline limestone. The original bedding is indicated by diopside-tremolite bands,

and Little Manicouagan river, biotite is absent and the rock is so massive as to resemble a quartz syenite. Locally, hornblende and biotite have been replaced by chlorite, and plagioclase has been replaced by saussurite.

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Crystalline Limestone

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in which some individual crystals are a foot long. Towards the top of the crystalline limestone, quartzose bands one or two inches thick with calc-silicate margins are common. Locally the crystalline limestone is absent at the base of the section. In places, lenses of similar limestone less than 10 feet thick occur near, and at the top of, the Iron Formation. Southwest of Seabee lake the sequence includes two thick layers of crystalline limestone.

White Quartzite

This rock is typically dull white, buff or grey in colour; however, where very pure it is a milk-white "quartz rock". It is coarsely crystalline, with a vitreous lustre on the broken surface. Original bedding is outlined by faint colour bands. As this purer quartzite grades upwards with increasing iron silicates into the silicate iron formation, it develops the more pronounced banding of the latter. The white quartzite is less resistant to erosion than the adjacent crystalline limestone and silicate iron formation (probably because of its closely spaced fractures) and commonly underlies a line of swamps.

Silicate-carbonate Quartzite

This quartzite represents the mixed silicate-carbonate facies of iron deposition. It contains four mineral components: iron silicates, calcium and iron carbonates, quartz, and magnetite in extremely variable proportions. The rock is typically composed of layers of grey quartz from 1 inch to 2 inches thick alternating with layers of mixed silicates and carbonate. The rocks are mostly medium-grained, but some of the silicate minerals are commonly several inches long, particularly where the amount of quartz is small or the quartzose layers widely spaced.

The quartz has a granular texture and shows optical strain. The predominant silicate mineral is dark green hypersthene. Grunerite occurs as multiple twinned crystals or as brown fibrous aggregates commonly replacing the hypersthene. Actinolite, sodic pyroxene and diopside also occur. The carbonates, siderite and ankerite, commonly weather to limonite, and their proportion relative to silicate minerals increases towards the top of the group. Magnetite is often present in more than accessory proportions in the silicate-carbonate layers, but the total percentage in the rock is small. The transition from silicate-carbonate quartzite into the iron-oxide-silica facies occurs by reduction in the amount of silicate and carbonate and increase in the tenor of magnetite both within and between the quartzose bands.

Commonly the thickest member of the Iron Formation, the silicate-carbonate quartzite, gives rise to prominent relief, typified by Peppler mountain and North Lamêlée hill.

Magnetite and Specularite Quartzites:

These rocks represent the oxide facies of iron deposition. They commonly occur at two horizons within the Iron Formation. The typical rock types are granular aggregates of quartz and iron oxide. The magnetite-bearing quartzite tends to have a banded appearence similar to that of the silicate quartzite, whereas in the pure specularite quartzite types the banding is less distinct. In mixed varieties the magnetite tends to occur in quartz-poor layers between specularite-bearing quartzose layers. In local brecciated zones, magnetite forms veins in brecciated specularite quartzite. The layers are believed to represent original bands of sedimentary magnetite and hematite cherts. The ratio of iron oxide to quartz is very variable, 20 per cent iron oxide being an average figure; along restricted horizons, this may rise to 40 per cent or even higher where leaching of oxide minerals has occurred.

Chlorite-silicate-magnetite Schist:

A distinctive green schistose rock composed of nodular porphyroblasts of hypersthene set in a groundmass of chlorite, grunerite and carbonate occurs within the carbonate-silicate quartzite member of the Iron Formation. Magnetite is commonly a major constituent, and actinolite occurs in the marginal facies, but quartz is notably absent. The rock is extremely tough and weathers to a very rough rounded surface. The hypersthene nodules reach 3 inches in diameter east of Jean lake. This rock type occurs in lens-shaped bodies, commonly near the iron oxide horizons.

Garnet-hornblende Gneiss:

In the Peppler Mountain structure a medium-grained gneissic rock composed of garnet, hornblende, quartz, and plagioclase occurs near the base of the carbonate-silicate quartzite member. It is believed to be of metasedimentary rather than metaigneous origin.

Garnet- and Kyanite-mica Schists:

Northwest of Fina lake, the Iron Formation is overlain by highly schistose muscovite-biotite rocks with conspicuous garnet porphyroblasts. A similar rock occurs within the Iron Formation in the northern part of the Peppler Mountain structure, but is characterized here by coarsely crystalline segregation pods of kyanite.

Graphitic Biotite Gneiss

Near the southern margin of the area the persistent eastwest trending band of crystalline limestone and Iron Formation is succeeded southwards by highly graphitic biotite gneisses. The rock is medium- to coarse-grained and is composed of oligoclase, quartz, red-brown biotite, muscovite, and garnet. The graphite

occurs in coarse flakes and is most abundant near the Iron Formation, the upper part of which is also highly graphitic. The outcrops of this rock are deeply weathered, extremely rubbly, and very iron stained. Southwards the graphite gneiss becomes more garnetiferous and passes upwards into quartzo-feldspathic gneisses similar to those underlying the central and northern parts of the area.

The gneisses that are believed from stratigraphic considerations to overlie the Iron Formation in the areas north and southwest of Jean lake contain no graphite and are identical in composition, structure, and migmatization with the gneisses, as described above, below the Iron Formation.

Intrusive Rocks

Gabbro

A gabbro stock half a mile in diameter occurs 2½ miles north-northeast of the northern end of Jacqui lake. The rock is dark grey and slightly porphyritic, and weathers to a smooth, rounded surface. It is composed of phenocrysts of zoned augite in a medium-grained groundmass of plagioclase (Ab_{50}) laths. About 30 per cent of the rock is composed of fine-grained aggregates of hypersthene, green hornblende, garnet, and biotite, secondary after phenocrysts of an unidentified mafic mineral. Finer-grained marginal facies suggest that the body is not larger than is indicated on the accompanying map, although no contacts with the gneisses are exposed. This body is petrographically similar to the gabbro of the Tuttle Lake area (1) and is believed to have been emplaced at a late stage in the regional metamorphism.

Peridotite

A small body of peridotite is exposed in the channel of Lillishen river north of Seabee lake. It is medium- to coarse-grained, green, and forms well jointed, rounded outcrops. Olivine is the dominant mineral, with schillerized hypersthene generally subsidiary to it. Augite, actinolitic amphibole, and talc occur in small amounts. As contacts are not exposed, the shape of the body is unknown.

Amphibolite-Granodiorite Complex

A small igneous complex is present on the east side of Little Manicouagan river, in the southeastern part of the area, where the Malapart-Cabanac township line crosses the river. Two rock types are involved. The older is an inclined sill-like body of dark green amphibolite formed from an ultrabasic igneous rock. It is composed essentially of secondary hornblende and biotite with relict patches of hypersthene and augite, and it varies considerably in grain size and texture. This body is intruded by mottled white

and pink medium-grained rock composed largely of oligoclase with quartz and a little orthoclase. Mafic minerals make up 7 per cent of the rock and comprise skeletal hornblende and garnet, with green biotite, all apparently of secondary origin. At the contact between these two bodies the ultrabasic rock shows all degrees of incorporation by the granodiorite and a variety of hybrid rock types has developed. The age of this complex relative to the other post-metamorphic intrusive bodies is unknown.

Pegmatite and Aplite Dykes

Throughout the area the gneisses and migmatites contain small bodies of pegmatite. Most of these are pods only a few feet long, and are composed mainly of quartz, microcline, and mica. They are considered to have been formed by segregation and recrystallization processes during the regional metamorphism of their host gneisses. Several larger pegmatite dykes post-date the metamorphism and are probably the youngest consolidated rocks exposed. These are characterized by graphically intergrown microcline-perthite and quartz, with muscovite, biotite, and chlorite. The largest dyke observed, 20 feet thick, cuts the Iron Formation west of Peppler lake. Several smaller dykes cut the igneous complex east of the lower part of Little Manicouagan river.

Glacial Deposits

The continental glaciation of the Pleistocene epoch left most of the area with a thick cover of glacial deposits. Ground moraine and bouldery till are commonly disposed in elongated drumlinoid ridges trending north-northwest. Small crags of bedrock face in this direction, and these and larger hills commonly have a tail of morainal débris on their southern slopes, suggesting that the direction of ice movement was south-southeast. Little Manicouagan and Lillishen (East Branch) rivers occupy broad glacially filled valleys each of which has a large south-trending esker. Erratic boulders of local origin are common.

STRUCTURAL GEOLOGY

The structural pattern of the area is characterized by tight folds and overturned beds. In the northern two-thirds of the area folds trending northwest to north are dominant. A broad dome occupies most of this part of the area. The axes of folds, such as the Fina Lake and North Lamêlée Hill synclines on the northern flanks of this dome, plunge northerly. The rocks of the Peppler Mountain syncline and associated structures are folded along similar northwest-trending axes but are also involved in an east-west-trending synclinal flexure. Farther south the northwesterly fold trend dies out, and a broad anticlinal structure in older gneisses trends roughly eastwards from the southern end of Jacqui lake. Near the southern margin of the area a band of crystalline limestone and Iron Formation overlain by younger gneisses dips gently southwards off the flanks of this structure.

Lineations as indicated by alignment of minerals, redding of aggregates of quartz and feldspar, and by axes of minor folds are common in the gneissic rocks and in some members of the Iron Formation. Such structures tend to parallel the major fold trends and to plunge in the same direction as the major folds.

ECONOMIC GEOLOGY

Iron Ore

As part of the potential iron producing region of Mount Wright - Mount Reed, the Peppler Lake area has been prospected and parts of it staked during the last few years, but development has not yet passed the assessment stage. Claims are held within the area by Quebec Cartier Mining Company and by Jubilee Iron Corporation, Limited. The best material, which would require concentration before shipping, is in the oxide facies Iron Formation.

Descriptions of the structure, stratigraphy and potential of the separate occurrences follow.

(1) Peppler mountain:

The Iron Formation here occupies an open syncline 2 miles by 1 mile, bounded on the east by a fault over which a tight overturned syncline in Iron Formation rocks has been thrust. Southwards, this easterly dipping thrust fault merges into the isoclinal overturned southern part of the main structure. The tight syncline east of the thrust may become monoclinal northeastwards and join up with the southern end of deposit (2) below. Oxide iron formation is developed at two horizons in the sequence. The lower horizon is generally less than 50 feet thick and thins out around the northern nose of the syncline. It contains magnetite only and averages about 20 per cent iron oxide. The upper horizon is exposed over large areas in the centre of the main syncline and is more than 200 feet thick in places. It is higher grade, with magnetite dominant except in the central part which is composed of specularite. General lack of overburden, shallow synclinal structure and friability make this deposit an excellent prospect.

Quebec Cartier Mining Company has completed an assessment programme on its property including drilling, detailed geological mapping, and dip needle surveying. The property of this company comprises most of the syncline. Jubilee Iron Corporation, Limited, holds a group of five claims covering the northern end of the Peppler Lake syncline.

(2) Jean lake

Poorly exposed Iron Formation extends southwards from Jean lake and probably joins the eastern part of the Peppler structure. The band dips steeply to the west and is strongly

deformed on a small scale. Exposures suggest that the oxide iron formation member is thin, but data from magnetic surveys indicates a widening in the northern part.

A small part of a synclinal deposit east of Jean lake occurs within the area. One horizon of oxide iron formation may be of value.

These two zones of Iron Formation are covered by claims held by Quebec Cartier Mining Company. Work on these properties consisted mainly of geological mapping and dip needle surveying.

(3) North Lamêlée hill

This structure is interpreted as an overturned isoclinal syncline with a northward dipping axial plane, which has been refolded about a north-south synclinal axis. The lower beds of the sequence have been removed by erosion, but one oxide member containing as much as 30 per cent magnetite and specularite remains. At least one layer, that forming the north-facing slopes of the lunate-shaped hill, is of economic value.

North of this structure the full Iron Formation sequence is exposed in a band offset by several cross faults. Two oxide horizons occur. Both increase in thickness eastwards at the expense of the silicate-carbonate facies, and this increase is accompanied by a change from magnetite to specularite. These exposures of Iron Formation are under claim by Quebec Cartier Mining Company.

(4) Southern outcrop:

A continuous belt of crystalline limestone, accompanied by Iron Formation proper in places, extends across the southern part of the area. South and west of Seabee lake the sequence contains a thin lens of magnetite quartzite. Quebec Cartier Mining has claims covering these outcrops.

(5) Magnetic anomalies were noted midway between the Peppler structure and Jacqui lake, and 3 miles southeast of the southern end of Peppler lake. Exposures are lacking in both places.

OTHER RESOURCES:

Sand and gravel deposits are available in the esker and alluvial materials of the two major river valleys. In some places the white quartzites are very pure and may provide a source of silica. The larger pegmatites might be of value as a source of feldspar.

REFERENCES

(1) Phillips, L.S. - (1958) Tuttle Lake Area, Saguenay Electoral District; Quebec Dep't. of Mines, Preliminary Report No. 377.