

RP 538(A)

PRELIMINARY REPORT, GEOLOGY OF UPPER HART-JAUNE RIVER AREA, SAGUENAY COUNTY

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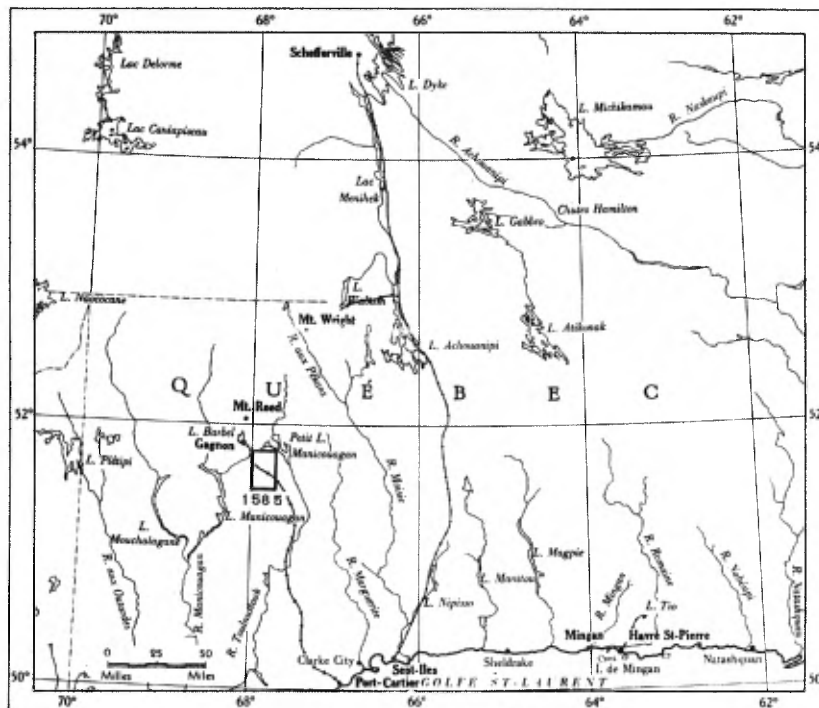
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Geology of UPPER HART-JAUNE RIVER AREA

SAGUENAY COUNTY

PRELIMINARY REPORT

by
L. Kish



QUÉBEC

1965

QUEBEC DEPARTMENT OF NATURAL RESOURCES

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GEOLOGICAL EXPLORATION SERVICE

H.W. MCGERRIGLE, CHIEF

Geology
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UPPER HART-JAUNE RIVER AREA

Saguenay County

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INTRODUCTION

The Upper Hart-Jaune River area, mapped in 1963, is the third of a group in a section that extends eastward from Manicouagan lake along the Hart-Jaune River basin. It is bounded by latitudes 51°30' and 51°53' and longitudes 67°45' and 68°00' and covers about 280 square miles. It includes parts of Hesry, Conan, Fagundez, Godefroy, Jauffret, and Belle-Roche townships and some unsurveyed ground.

Baie-Comeau, on the north shore of the St. Lawrence, is 170 miles south of the southern border. The Jeannine Lake iron mine and the town of Gagnon are 3 miles west and 8 miles northwest, respectively, of the northwestern corner of the area. A road from the mine to Gagnon and to the dams on Hart-Jaune river provides access to the northern part. Also, the railway line between Port-Cartier on the north shore of the St. Lawrence and Jeannine lake crosses the northern part. The town of Gagnon is serviced regularly by Quebecair and Northern Wings, respectively from Baie-Comeau and Sept-Isles. The rest of the area is accessible by floatplanes on some of the lakes or by portages or helicopters.

Hart-Jaune river follows more or less the divide between the two topographic patterns within the area. It rises in the westernmost part of Petit Manicouagan lake in the northeastern corner and flows west-southwest. The drainage of the entire area is through this river.

To supply power for the mining development to the north, the Quebec Cartier Mining Company built a hydroelectric complex on Hart-Jaune river. Three 22,000 H.P. turbines are now in operation and provision has been made for future expansion.

Hart-Jaune river divides the area into two types of topography. Along and north of the river elevations are between 1,500 and 2,000 feet above sealevel and the surface is gently undulating. On the other hand, that part of the area south of the river belongs to the Manicouagan highland. This is a dissected plateau that extends between Manicouagan and Petit Manicouagan lakes, where elevations generally exceed 3,000 feet above sealevel. The highest hill, southeast of Lucie lake, rises to 3,592 feet.

In general, vegetation is sparse. Spruce forests and patches of birch grow on the hills near the western margin north of Hart-Jaune river. South of the river, spruce is found in some valleys and the hills are covered with grass. Lakes are frozen until the end of June and, in some valleys, snow remains until mid-summer.

The whole area has been glaciated. Extensive glacial deposits cover most of the bedrock in the northeastern section, where streams are sinuous and lakes are small and shallow. In the highlands the effects of the glaciation are shown by erratics and some striae that trend S.20°E. The streams flow in valleys parallel to the strike of the main joints in bedrock and the lakes are narrow and elongated.

GENERAL GEOLOGY

The bedrock is Precambrian. In the southern part of the area igneous and sedimentary rocks have been metamorphosed to the granulite grade. The metamorphic basic igneous rocks, called granulitic gabbros, are either homogeneous or contain layers of diverse compositions. Some of the layers are metamorphosed silica- and alumina-rich sedimentary types and others are cataclastic zones into which silica has been introduced. Deformed pegmatites and siliceous material of unknown origin also occur.

An important anorthosite massif crops out between the rocks of the granulite grade to the south and the rocks of the amphibolite facies to the north. Anorthosite occurs also in the granulitic gabbros.

North of the main anorthosite massif, the paragneisses belong to the amphibolite grade of metamorphism. In places, the biotite and hornblende paragneisses have been injected by granitic and pegmatitic material to produce mixed gneisses.

Table of Formations

Pleistocene		Sand, gravel, boulders, till
Unconformity		
PRECAMBRIAN		Diabase Granite and pegmatite
	Amphibolite facies	Mixed gneisses Granitic gneiss with chlorite and epidote Hornblende-plagioclase gneiss Biotite-plagioclase paragneiss occasionally with kyanite and garnet Dolomite
	Igneous rocks	Anorthosite and associated anorthositic gabbro, olivine-gabbro and dunite, magnetite-ilmenite layers
	Granulite facies	Layered and amphibolitized gneiss at the margin of the granulitic gabbro Granulitic gabbro and diverse granulites: Homogeneous granulitic gabbro with minor pyroxenite Layered granulitic gabbro Graphite-pyroxene granulite Graphite-sillimanite granulite Quartzite

The north side of the anorthosite complex is separated from the biotite and hornblende paragneisses by a zone of fractured and sheared pink granitic rocks with much chlorite and epidote. A zone of layered and amphibolitized gneisses occurs between the granulitic rocks and the anorthosite massif.

Diabase dikes cut both the anorthosites and the granulitic gabbros.

Rocks of the Granulite Facies

In the high hills of the south and extending beyond the limits of the area, a complex of gabbros and paragneisses is metamorphosed to the granulite facies. The granulitic gabbros may be homogeneous or layered. The paragneisses occur in layers within the gabbros and are specially common south of Mora and Lucie lakes. These high-grade paragneisses are composed of mineral assemblages completely free of hydrous minerals and hence are massive or poorly foliated.

Homogeneous granulitic gabbro: Part of the granulite body is homogeneous and is composed of calcic plagioclase and pyroxenes, occasionally with garnet. The grain size rarely exceeds 3 mm., and the rocks are either foliated or have a "pepper and salt" texture. The pyroxene to plagioclase ratio is about 1:1, and variations in this ratio produce a weak layering in shades of gray that is best shown on freshly stripped glaciated surfaces.

The plagioclase is white on the weathered surface and light gray or slightly greenish on the fresh surface. The pyroxene is black in hand specimen. The garnet is generally in equant grains; rarely is it in larger porphyroblasts. Coarser-grained plagioclase-rich facies resemble granulated anorthositic rocks. Sulfide minerals occur in places and are indicated by the rusty brown weathered surface.

Pyroxenite: Layers of pyroxenite, 5-10 feet thick occur in the granulitic gabbros near Lucie lake. The rock is medium grained and massive, and weathers greenish.

Layered granulitic gabbro: This unit consists of layers of variable thicknesses of gabbro and diverse rocks, mainly sillimanite and pyroxene granulites and quartzite. The more continuous and uniform layers aided greatly in determining the structure. Some more irregular layers are made up of very fine-grained, gray, cherty quartz, and feldspar. Other layers are the result of cataclastic deformation. In these, the rocks are mylonites or augen gneisses with pyroxene and garnet porphyroblasts (identifiable with a hand lens).

Graphite-pyroxene granulite is fine grained, light gray and composed of quartz, feldspars, pyroxene, and some graphite. A slight foliation is shown by the graphite flakes. The ratio of potassic feldspar to plagioclase is variable, but in general high.

Graphite-sillimanite granulite: Of the two varieties, the commoner is massive and beige. The minerals are quartz, potassic feldspar, plagioclase, garnet, sillimanite, and graphite with unequiant texture. Sillimanite is present as prisms up to 8 mm. long. Garnet is abundant in places and is pale purplish.

The other type of sillimanite granulite has a fine granoblastic texture and is very similar to the graphite-pyroxene granulite. The sillimanite is in the quartz-feldspar assemblage and appears on the fresh surface as minute shiny needles.

Quartzite is in thin layers, dull gray on the weathered surface and glassy on the fresh surface. More than 80% of the rock is made up of quartz grains 3 mm. in diameter. The feldspar is white. In places the rock contains some mafic minerals and is foliated.

Layered and amphibolitized marginal gneisses of the granulitic gabbro: A narrow zone of fine-grained, locally layered, rocks mark the northern border of the granulitic gabbros. In hand specimen they resemble dark gray amphibolite. Zones of cataclastic deformation and some siliceous bands occur in these marginal rocks. The amphibolitized marginal gneisses may be altered granulitic gabbros.

Anorthosites and Related Rocks

Anorthositic rocks occur in:-

- 1) The oval massif between Raudot lake and Hart-Jaune river, with its longer diameter striking east-northeast across the area. The massif is about 7 miles wide and lies between the granulitic rocks and the paragneisses of the amphibolite facies.
- 2) A small body of about 8 square miles in the southeastern part of the area and extending beyond the eastern limit.
- 3) Patches of rocks of anorthositic aspect in the granulitic gabbros. These rocks have a composition similar to that of the surrounding granulitic gabbros, but have a higher tenor of plagioclase and a coarser granularity.

The oval massif is divided into two parts:-

- a) The southern, in which the rocks appear to be primary, and
- b) the northern and western parts which consist of granulated and partly recrystallized anorthositic rocks with secondary mafic minerals.

In the southern zone the most common rock type is a coarse gabbroic anorthosite. This grades either into anorthosite with plagioclase laths up to 3 inches long, or into medium- to coarse-grained gabbros. They have compositions and a hypidiomorphic granular texture markedly different from those of the granulitic gabbros.

Compositional layers can be seen in the anorthosite massif. Along the southern margin a band up to 2,000 feet thick is composed of medium-grained olivine gabbro with occasional layers of dunite, magnetite-olivine rock, and magnetite-ilmenite. Away from the contact zone the layers become thinner and contain less iron and titanium oxides. Southeast of Jorian (Bucko) lake the oxides appear as thin lamellae arranged parallel to the layers.

The anorthosite and the coarse anorthositic gabbro weather dark gray, and the ultrabasic layers, rusty brown. On the fresh surface the plagioclase is bluish gray or, in places, greenish or purplish. The plagioclase of the anorthosite is euhedral but exceptionally it may be granulated. In places, the laths are oriented and the rock shows primary foliation. The mafic minerals are interstitial to the plagioclase; olivine is by far the most abundant and pyroxene is less common. Biotite occurs here and there near the margin of the complex. Narrow kelyphitic rims are common between olivine and plagioclase.

In the western and northern parts of the body, all the mafic minerals are changed to amphibole and biotite, and part of the plagioclase is recrystallized and granulated. Shear zones and small folds occur in the narrow gneissic zones of this part of the massif.

The southern margin of the anorthosite massif is cut by coarse syenitic dikes up to one foot thick.

The small anorthosite body in the southeastern part of the area is surrounded by granulitic gabbros. The plagioclase is light gray on both weathered and fresh surfaces; in some finer-grained varieties it is granulated. Some facies of the anorthosite are extremely coarse with plagioclase crystals up to one foot long. Pyroxenes are the only mafic minerals.

Paragneisses of the Amphibolite Facies

North of the anorthosite massif the area is underlain by strongly foliated paragneisses, in places intruded by coarse granitic and pegmatitic

materials. The paragneisses are separated from the anorthosite massif by a zone of highly fractured and sheared rocks with abundant chlorite and epidote.

Biotite-plagioclase paragneiss: In these the minerals are commonly segregated into alternating, thin, dark and pale layers. The pale layers are composed of plagioclase, quartz, and possibly some potassic feldspar. In some varieties garnet, or rarely kyanite, is seen in hand specimen.

Hornblende-plagioclase gneiss: This gneiss is generally more massive than the biotitic rock. Pyroxene and garnet may be present and, in places, the garnet is porphyroblastic.

Dolomite is exposed north of the first storage dam in the northeastern corner of the area. The rock is coarse grained, massive, white, and beige weathering. Some silicates are recognized by their greenish tint.

Mixed gneisses: Some of the biotite-plagioclase gneisses and hornblende-plagioclase gneisses have been injected by granitic and pegmatitic material. The injections are generally irregular and the foliation of the gneisses is distorted. However, in some places the granite is introduced along the planes of foliation, giving lit-par-lit structure. The proportion of introduced material in the paragneisses increases southwestward.

Granitic gneisses with chlorite and epidote are found in a zone of fractured and sheared rocks separating the paragneisses from the anorthosite massif. The rocks are well exposed at the power dam on Hart-Jaune river.

The predominant rock is a granitic gneiss, with abundant pink feldspar. Chlorite and biotite make up less than 10% of the rock. The chloritization of the mafic minerals and the development of abundant epidote are localized in the fractured belt.

An isolated outcrop of meta-pyroxenite lies about 500 feet north of the chloritized gneisses, near Hart-Jaune river at the western border of the area. The rock is dark and massive, contains thin layers of magnetite and quartz, and resembles metamorphosed iron-formation.

Granite and Pegmatite

Pink granites and pegmatites occur abundantly with the granitic gneisses and the biotite paragneisses. Most of the bodies are, however, too small to be shown on the map.

Graphic texture is common in the pegmatitic granite. In some very coarse pegmatites microcline crystals are up to one foot long and surrounded by quartz. Micas are the mafic minerals.

Diabase

Diabase dikes, 1 to 40 feet thick, cut the anorthosite and the granulitic gabbros. The diabase is hard, brittle, and closely jointed. Remnants of chilled borders of dike rock preserved along the walls of many linear depressions suggest that the depressions were once occupied by diabase dikes. The linears are seen on the aerial photographs.

Most of the diabase is fine grained and bluish gray. The center of some dikes shows ophitic texture, with crystals as much as 3 mm. long. The plagioclase of the dikes south of Raudot lake is clouded.

STRUCTURAL GEOLOGY

Each major rock type has its distinct structural features.

The main anorthosite igneous body lies between two groups of metamorphic rocks. In the anorthosite, primary structural features are shown by compositional layers and local orientation of feldspar laths. Along the southern margin the layers strike parallel to the east-trending contact and dip 30°-40° north.

Folds: In the metamorphic rocks the structural patterns are complex. In the southern part of the area, where exposures are abundant, the attitude of folds was determined on the layers. The general southerly trend of the granulitic gabbros along the western border swings east along the edge of the anorthosite body.

The foliation of the granulitic gabbros is also conformable to the outline of the anorthosite body in the southeastern corner of the area.

A syncline occupies the southwestern corner of the area. The axis of the fold trends south-southeast and plunges about 30° south. Lineation of the pyroxene crystals plunges 25°-35° south. The limbs of the fold strike south-southeast and dip 65°-75° east and 45°-60° west. Study of areal photographs suggests that the fold is the northern part of a basin.

In the northern part of the area exposures of the biotite paragneisses are rare, and the structure is difficult to interpret. Adjacent to the Conan-Godefroy township line and near the western limit of the area the foliation of the paragneisses strikes west-northwest.

Fractures, shears: A zone one mile wide of fractured, sheared, and chloritized rocks crops out north of the anorthosite massif.

Cataclastic augen gneisses and mylonites are common within the granulitic gabbro complex and in the amphibolitized marginal gneisses.

Joints: Joints are very common in the granulitic gabbros and associated layers. One nearly vertical set strikes N.45°-50°E., and another set is parallel to the layers.

ECONOMIC GEOLOGY

Rusty zones and mineralized outcrops are indicated on the accompanying map.

Rusty zones: In the southern part of the area the vegetation is sparse and iron-stained rock surfaces are easily seen. Some were formed in place by oxidation of disseminated sulfides in the rock, others are transported deposits of limonitic material in depressions, or in joints and fractures.

Gossans: In several places around Mora lake the rusty surfaces are gossans, as for example on the shore of a small pond about 2 miles southeast of Mora lake. Here, the outcrop, which covers about 50 feet on a slope towards the pond, consists of soft and crumbly limonitic material. Near the shore the gossan is about 2 feet thick, and is made up of fragments of various sizes and shapes in a limonitic cement. The fragments are partly from transported glacial material and partly from local rocks. This zone of gossans was staked by Quebec Cartier Mining Company in 1961.

Copper-nickel: In township 1853, on a slope about one mile east-southeast of Mora lake the surface has been blasted and a massive sulfide vein is exposed over a width of about 2 feet and a length of 5 feet. The host rock is massive, medium-grained granulitic gabbro. The sulfide minerals, as seen in hand specimen, are pyrrhotite, pyrite, and chalcopyrite. Partial chemical analyses indicate:-

0.82% copper,
0.91% nickel,
0.1 % zinc,
0.1 % cobalt.

Quebec Cartier Mining Company holds 2 groups of 4 claims and the mineralization occurs in claim 5, license 174068.

Iron, titanium: Along the southern margin of the anorthosite massif layers of massive magnetite-ilmenite are associated with the olivine-gabbro and dunite. The layers are parallel to the contact of the anorthosite. A typical exposure may be seen about 1,500 feet east of Raudot lake, on the

northern side of the easterly-trending valley. The massive oxide layer is 3 to 5 feet thick. An analyzed specimen gave:-

50.27% iron,
6.37% titanium.

The olivine-rich layers in the anorthosite body also contain variable amounts of iron-titanium oxides.

Iron-formation: The outcrop of meta-pyroxenite mentioned earlier in this report may be a metamorphosed iron-formation. Geophysical investigation of the area north and west of this outcrop would possibly reveal the relations between this outcrop and the iron-formations to the north.

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