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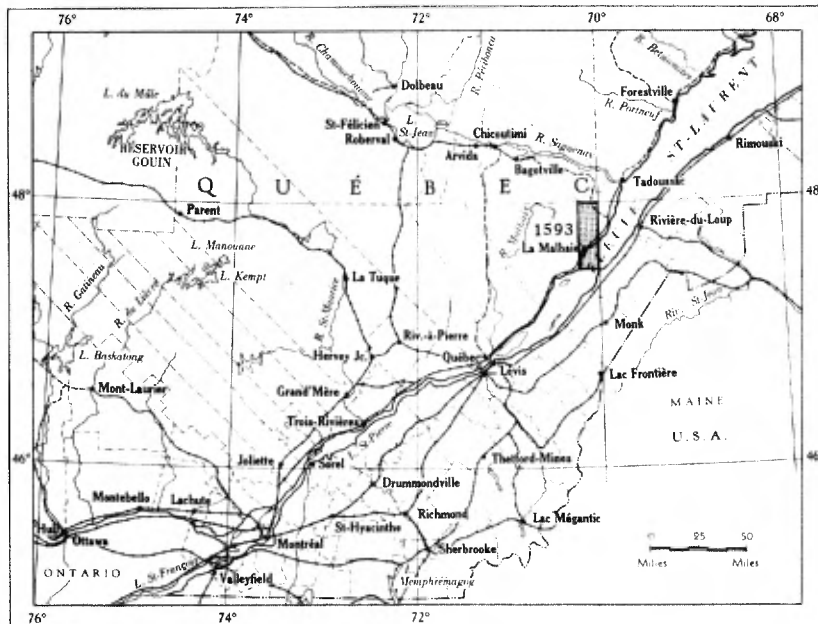
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Geology of LA MALBAIE AREA CHARLEVOIX COUNTY

PRELIMINARY REPORT

by

Jehan Rondot



QUÉBEC

1966

QUEBEC DEPARTMENT OF NATURAL RESOURCES

RENÉ LÉVESQUE, MINISTER

P.-E. AUGER, DEPUTY MINISTER

GEOLOGICAL EXPLORATION SERVICE

H.W. MCGERRIGLE, CHIEF

Geology
of
LA MALBAIE AREA
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LA MALBAIE AREA *

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INTRODUCTION

The La Malbaie area, mapped in the summer of 1964, is located on the north shore of the St. Lawrence river. It is bounded by longitudes $70^{\circ}00'$ and $70^{\circ}15'W$. (with the exception of a small section around the village of St-Fidèle, which extends slightly to the east), latitude $48^{\circ}00'N$., and the north shore of the St. Lawrence river. The area covered is about 305 square miles. The small port of La Malbaie is situated in the southern part of the area, about 80 miles downstream from Quebec City.

Highways 15 and 15-A cross the southern part of the area, and Highway 16 passes through the northeastern part. From Highway 16, bush roads leading to logging operations and fishing clubs give access to the northwest corner of the area or to the village of Clermont in the south.

The southern part of the area is drained into the St. Lawrence river by the Malbaie river and many other coastal streams. The waters of the northern part of the area flow by way of Noire river.

The height of land between the St. Lawrence and Saguenay basins runs along the eastern border of the area as far as the third Marais lake, then passes south of Onésime lake and Deschênes lake before turning again to the north.

* Translated from the French.

The area forms the edge of a much dissected and eroded plateau. Much of the central and northeastern parts of the area has an elevation of more than 2,000 feet, and its highest point, 7 miles north of Clermont, is at 3,000 feet. In contrast, open river valleys, such as those of the Noire Sud-Ouest and Comporté rivers, are at an elevation of 1,000 feet.

GENERAL GEOLOGY

More than half of the area, mainly its low-lying parts, is covered by thick glacial deposits.

The bedrock may be divided into four main geological groups:

1) Charnockitic rocks form the eastern edge of the Laurentide Park mass. These rocks resist erosion and form ochre-tinted hills in the western part of the area.

2) Granitic rocks occupy quite large portions of the northeast and southeast parts of the area. They have developed moderate relief except along Highway 16, where they form large cliffs.

3) Gneisses and migmatites are abundant northeast and south of La Malbaie.

4) Paleozoic deposits occur in the La Malbaie-Clermont basin and along the St. Lawrence in the southern part of the area.

The structure of the gneiss bordering the charnockitic mass is very complex and cut by numerous faults, the most spectacular of which are parallel to and near the border of the mass.

GNEISSIC SERIES

The paragneisses of the La Malbaie area are mainly fine-grained rocks with an even stratification and indistinct schistosity (except in very micaceous varieties).

They form about 10% of the area's outcrop, occurring in two narrow bands in the northeastern part of the area, over a large part of the east-central part of the area, and along the coast from Cap-à-l'Aigle as far as the village of St-Irénée.

These are the oldest rocks of the area. They may be divided into two groups: one in the northeastern corner of the area composed of mica schists and two-mica gneisses; the other, more widespread group is composed of gneisses of diverse composition.

The most common type of gneiss from the second group is a very quartzose gneiss (leptynite). A nodular layer occurs in the leptynite east of Morin lake. All the paragneiss zones include varieties of gneiss containing sillimanite, garnet and graphite, which tend to rust on alteration. A very thin horizon of carbonate-diopside rock occurs near Cap-à-l'Aigle. Certain quartzite horizons crop out over hundreds of square feet forming hillsides which are conspicuous from a distance. However, the most resistant rocks of the paragneiss group are the amphibolites and hornblende gneisses. These rocks are well exposed and form low, narrow chains of hills which may be traced for several miles through the paragneiss zones. The amphibolites also resist granitic invasion and form thick bands within the migmatites.

Amphibolite and hornblende gneiss

Amphibolite and hornblende gneiss are grouped with the paragneisses although the possibility of their being ancient lavas is not ruled out.

They are dark, fine- to medium-grained (up to 2 mm.), massive rocks containing between 40% and 60% mafic minerals (hornblende with a little biotite and opaque minerals). Some layers are very continuous and more than 500 feet thick. Where its contacts may be observed, the rock passes abruptly into the other gneisses. It is the most easily recognized type of gneiss in the migmatite zone, and practically the only type to occur as inclusions in the granite. Large (six-inch diameter) crystals of red garnet formed in some places at the contact with the sillimanite gneiss.

Table of Formations

Cenozoic	Marine and fluvial deposits	Sorted deposits, sand, terraces
	Glacial deposits	Unsorted deposits, moraines, eskers
Paleozoic	Limestone (Trenton)	Dark, argillaceous, and carbonaceous limestone Arenaceous limestone, light gray limestone
	Detrital sedimentary rocks	Gray green puddingstone, and white sandstone White and green arkose, and white sandstone
Precambrian	Basic dikes	Diabase, Peridotite
	Alaskite	Pegmatite, aplite and alaskitic injections along faults
	Pegmatite	Muscovite pegmatite. Radioactive pegmatite
	Granites	Gray St-Fidèle granite Gray Cap-aux-Oies granite Pink porphyritic granite
	Charnockitic series	Charnockitic dikes. Diorite Syenite and quartz monzonite Charnockite Green-feldspar migmatite
	Migmatites	Injection gneisses bordering granites
	Gneissic series	Mica schist and muscovite gneiss Sillimanite, garnet, graphite gneiss Nodular gneiss Leptynite Quartzite, impure quartzite Carbonate-bearing rock Hornblende gneiss, amphibolite

Carbonate-bearing rocks

A thin horizon of carbonate-bearing rock with a heterogeneous appearance crops out at the village of Cap-à-l'Aigle. The grains are of different sizes but the largest are chiefly hornblende. The rock effervesces in acid. It is composed of hornblende, feldspar, calcite, diopside which is partly uralitized, sphene and epidote.

Quartzite and impure quartzite

Although they form quite large outcrops (200 feet in two places), the quartzite horizons cannot be traced on the ground, probably because of the friability of their fractured portions. However, they seem to be as common as the amphibolites in the paragneiss zone in the center of the area.

They are made up of quartz which is generally milky, in places glassy, and occasionally pink. Other minerals besides the quartz are feldspar, muscovite, and, in some places, tourmaline. Some quartzites show a foliation which must be due to crushing. Their quartz crystals are generally small, and form interlocking grains with sutured boundaries.

In addition to the relatively pure quartzite bands, quartzite also occurs interlayered with other paragneisses, particularly sillimanite gneiss. This impure quartzite shows rusty weathering and contains graphite and pyrite.

Leptynites

The leptynites seem to be the most common rock type of the gneissic series, especially in the center of the area. However, because of their low resistance to erosion, they are exposed only in low-lying areas along streams or roads, or on fault scarps.

The most widespread variety is a fine-grained, very quartz-rich gneiss, with a pale gray color and a hackly fracture. In addition to quartz it contains feldspars and biotite, and, with an increase in the amounts of these minerals, it passes into common fine-grained biotite gneiss.

Nodular gneiss

A three-foot-thick layer of nodular gneiss occurs in the quartzose and arkosic gneiss three-quarters of a mile east of Morin lake. The "nodules" are flattened, 1 inch to 2 inches in diameter, and rich in quartz and sillimanite. They are most common in the lower parts of the bed. The matrix is formed of biotite-rich gneiss. The bed dips about 20° to the northeast.

Sillimanite, garnet, graphite gneiss

The sillimanite garnet is quite widespread. It forms layers 50 to 200 feet thick, which, in places, include beds of amphibolite or impure quartzite.

It is a dark, fine-grained rock containing garnets 1/2 cm. and more in size. Thin streaky layers of white feldspathic pegmatite are common. The gneiss is composed of quartz, plagioclase, plus rare potassic feldspar, garnet, biotite, sillimanite, and occasionally graphite. Mineral composition varies greatly between samples. For example, some of the gneiss is very quartzose, and other varieties are rich in plagioclase or mica.

Mica schist and muscovite gneiss

Another group of paragneiss crops out in the northeastern corner of the area. Although this type of gneiss is exposed only in a few places, the muscovite-bearing horizon persists over a thickness of many hundreds of feet. It appears either in the fine-grained quartz feldspar gneiss or in the very micaceous beds.

Migmatites

Paragneisses in the neighborhood of the many granitic masses of the region are injected by granitic material to form migmatites. Although the migmatites are not very abundant (about 5% of the exposed rock types), several sorts can be distinguished.

The contacts between gneiss and the porphyritic pink granite take different forms. In several places in the eastern part of the area the passage is quite abrupt. Here, across several hundreds of feet, the rock changes from true granite to the gneiss described above by gradation through abnormally mica-rich granite and micaceous gneiss with abundant feldspar, especially coarsely crystalline potash feldspar. In other places, such as the north central part of the area, the transition occurs over a wider, more heterogeneous zone. In these places, some types of gneiss (amphibolite, quartzite) remain almost intact in a mainly granitic terrain. The migmatites are always coarser and more feldspathic than the gneisses.

The passage from gneiss into other types of granites takes a different form. The migmatites occurring along Highway 15 between Cap-à-l'Aigle and St-Fidèle are heterogeneous, with layers or lenses of medium-grained granitic material separated by finer-grained gneissic layers. The edge of the granitic mass is marked by the abrupt disappearance of gneissic inclusions.

The passage from St-Fidèle granite to gneiss is well exposed by a road cut on Highway 15 at the eastern edge of the area. Here the amphibolite inclusions are coated by rims of biotite.

CHARNOCKITIC SERIES

The charnockitic rocks of the area form part of the Laurentide Park massif and include several intrusions of different compositions. They cover more than a third of the area's surface. Most of the rocks are syenitic, some facies contain appreciable quartz; other, less common types, are dioritic. Dikes or minor intrusions and migmatites with green feldspar form the remainder of the series.

Syenite and quartz monzonite

Charnockitic syenite occupies a large portion of the western and northwestern parts of the area. The cross overlooking the town of Clermont is built on a hill of charnockitic syenite.

The rock is generally altered to a pale orange color to a depth of several feet. Fresh surfaces have an olive-green color, due to their clear olive-green feldspar grains. These grains are commonly $\frac{1}{2}$ cm. in size and may reach 1 cm. The mafic minerals, mainly pyroxenes, are finer grained and generally make up 10% to 15% of the rock. Alignment of the mafic minerals results in a weak foliation in some localities. In many places the rock is granulated, and takes on a sugary appearance.

Quartz occurs irregularly through these rock types, but it never exceeds 10% of the volume.

Charnockite

A chain of hills running from Mont-à-Peine to Thomas lake is underlain by a more acidic rock. It is a medium-grained rock, varying from pale olive-green to cream depending on its degree of alteration. Quartz is common (about 20%) forming large 2 to 5 mm. lenses. Feldspar forms large grains. The ferromagnesian minerals are not common (5%) and are altered.

Charnockitic diorite

A small body of medium-grained diorite is exposed on the shores of Chaud lake. Fine-grained rocks of the dioritic facies, which seem to belong to the same mass, cut the syenite. In the coarsest-grained diorite some euhedral feldspar crystals exceed 1 cm. in size; the ferromagnesian minerals are interstitial to the feldspar and make up 25% to 30% of the rock.

Green feldspar migmatite

The rocks mapped as green feldspar migmatite form quite wide bands at the borders or within the charnockitic massif.

They are mixed rocks, dark olive, rich in ferromagnesian minerals, and finer grained than the charnockitic rocks. They include various petrographic types. In most, the foliation is marked by mafic-rich lenses or layers in the green feldspar.

These lenses range from a few millimeters to several centimeters in thickness. Elsewhere the rock is fine to medium grained, much altered, and shows a somewhat more even distribution of the mafic minerals.

Charnockitic dikes

Numerous fine-grained and generally thin dikes cut the charnockitic rocks, particularly the green feldspar migmatites. The most common dikes are fine grained and very feldspathic; other equally fine-grained types contain more dark minerals. In several places irregular-shaped green feldspar pegmatites were noted. They are generally quartz-rich and poor in mafic minerals.

GRANITIC ROCKS

Granites

Granitic masses underlie about 20% of the area. Three distinctive granites occur in different masses.

Pink porphyritic granite

The pink porphyritic granite is the most common of the granitic rocks. It occurs between the northeast corner of the area and La Malbaie village and surrounds the most important of the paragneiss zones.

Typically it is a medium-grained, grayish pink rock containing feldspar phenocrysts up to 2 cm. long. Almost all of the granite is foliated and crushed. It contains a fair amount of quartz (25%), feldspars, biotite, and many accessories. Garnet occurs in almost all parts of the mass.

The granite lies with irregular contact against the charnockitic massif. Where the contact is exposed southwest of Rivière Noire lake, it is subconcordant with the foliation in the green feldspar migmatite. In the contact zone a band of

augen gneiss about 20 feet wide was formed in the green migmatite, while elongate inclusions of fine-grained green migmatite occur in the granite for several hundred feet away from the contact.

The contact between the granite and paragneiss is concordant and gradational across an intermediate zone of augen gneiss or injected gneiss. Between Rivière Noire lake and the village of Grands Fonds the granite is mixed with paragneiss bands which have been assimilated to different degrees depending on its composition.

Cap-aux-Oies granite

The Cap-aux-Oies granite forms a mass more than 4 miles long and $1\frac{1}{2}$ miles wide in the southwest corner of the area, and occurs in a separate small body exposed on the hill northeast of St-Irenée.

It is a gray, crushed, and lightly foliated granite composed of quartz, microcline, oligoclase, biotite and accessory minerals (allanite). In places it contains garnet. Its grain size varies through the mass. At Cap-aux-Oies, continuous exposures show gradational or abrupt changes between coarse-grained facies formed of 5 mm. to 1 cm. crystals (some feldspars are larger than 1 cm.) and medium-grained facies formed of grains scarcely larger than 1 mm.

The main mass contains inclusions of amphibolite, but the contact with the other rock types is only exposed in the occurrence north of St-Irenée. Here the transition is marked by a zone of migmatite, or gneiss with injections of quartz and white feldspar.

St-Fidèle granite

Within the area, the St-Fidèle granite forms a mass 5 miles long and more than $1\frac{1}{2}$ miles wide, elongated parallel to the regional foliation. The mass extends much farther to the north, and in the south is limited by the St. Lawrence river.

It is a calc-alkaline granite, gray to pinkish gray, medium grained, homogeneous, and in places slightly foliated. In most places it is crushed and partly altered. Quartz and plagioclase are the dominant minerals; biotite everywhere makes up about 10% of the rock.

The eastern contact with the gneiss can be traced quite accurately in spite of many quartz-plagioclase injections in the gneiss, and fluted, spindle-shaped inclusions in the granite. These inclusions are predominantly of amphibolite or hornblende gneiss. Near the St. Lawrence river, the contact is obscured by coarsely-crystalline masses of quartz and plagioclase.

Ste-Mathilde granite body

A granite body more than $1\frac{1}{2}$ miles long and almost $\frac{1}{2}$ mile wide outcrops northeast of the village of Ste-Mathilde. It is a medium-grained, pale pink, heterogeneous rock composed of orbicular plagioclase held in biotite and quartz. The granite is surrounded by a migmatite zone hundreds of feet wide, and injected by many bodies of pegmatite.

Pegmatites

Radioactive pegmatites

Radioactive pegmatites outcrop around the Ste-Mathilde granite body, to which they are apparently related, and also occur at the village of Cap-à-l'Aigle and south of the village of Bas-de-l'Anse.

The pegmatites are exposed over surface areas of many hundreds of square feet. They are gray to pale pink and heterogeneous. The feldspar is mainly plagioclase and tends to be enclosed in the quartz. The radioactive minerals are associated with the more mafic-rich parts of the rock. Biotite, magnetite, muscovite, allanite, monazite, and apatite occur in some parts of the pegmatite.

Muscovite pegmatite

In the northeast corner of the area, small masses of muscovite pegmatite cut the porphyritic granite and the muscovite gneiss. One of the bodies is 400 feet wide and almost half a mile long. These pegmatites are composed of quartz, feldspar, a little mica, and, in places, garnet.

Alaskite

Small amounts of alaskitic rocks occur through the area, generally associated with important faults. They are most apparent in the charnockitic massif where their color and composition contrast with those of the surrounding rocks. The alaskitic rocks are mainly aplites, pegmatites, and some rare injections.

They are pink in color and vary from fine through medium grained to pegmatitic, in places with progressive changes in grain size. They are composed of microcline and a large amount of quartz and very small amounts of the ferromagnesian: magnetite, green biotite, and, locally, garnet.

The alaskite cuts all the rocks described above and is the youngest of the granite rocks.

Peridotite

Two masses of peridotite crop out along the railroad about 1 3/4 miles northeast of St-Irénée. The main mass may be traced for almost 1/4 of a mile and shows traces of fracturing and local alteration. Its northern contact runs east-west and has an almost vertical dip. The other mass occurs as a dike in the granite.

The peridotite is a greenish-black rock with crystals reaching 4 mm. in length. It is composed essentially of magnesian amphibole, olivine, and a little enstatite, anthophyllite, spinel, phlogopite, and opaque minerals.

Diabase

The rocks described above are cut by many basic dikes along the St. Lawrence river, particularly between the eastern edge of the area and Bas-de-l'Anse. They are for the most part thin dikes, 4 to 6 feet wide, which have been injected along large faults parallel to the shore, and have sometimes been affected by later movement along these faults.

They are black rocks, finely crystalline in the centers of the dikes and aphanitic in contact with the enclosing

rocks. In places where they are well crystallized and unaltered they are composed of plagioclase laths penetrating pyroxene and iron ores, but in most places only the laths of more or less altered plagioclase can be recognized in the alteration minerals: chlorite, serpentines, calcite, and iron oxides. The contact facies is always altered, and here recognizable laths and micro-lites occur in the above-listed alteration minerals and in a semi-vitreous matrix.

Carbonate-bearing veins

Many breccias and mylonites are exposed in a much fractured zone along the coast. Except for the excellent exposure along the shore these friable rocks would probably not have been seen. Some of the breccias are cut by veinlets of calcite, or prehnite and calcite, fluorite and calcite, or a brick-red iron carbonate.

PALEOZOIC

Detrital sedimentary rocks

A layer of detrital sedimentary rocks occurs in some places between the Precambrian rocks and the (Trenton) limestone. It has a variable thickness but never exceeds 300 feet. In the La Malbaie basin, between Manoir Richelieu, Clermont and Pointe-Plate, the detrital layer is composed mainly of arkose formed near the place of deposition, whereas farther south, between St-Ir n e and the southern end of the area, it is a puddingstone in which the rounded components indicate some transport.

White and green arkose and white sandstone

The white and green arkose is a comparatively soft rock which crops out mainly along the beach at Baleine c pe. It is composed of kaolinized feldspar fragments and quartz grains. Some layers are more quartzose and pass into fine-grained, white sandstone.

The contact with the Precambrian rocks is gradational through a zone of much altered Precambrian, or abrupt with the arkose resting directly on slightly altered gneiss or granite. The arkose grades into limestone and the contact between the arkose and limestone is difficult to locate exactly. The arkose has a variable thickness and is absent in many places.

Gray-green puddingstone and white sandstone

In the southern part of the area, detrital sedimentation begins with a 20-foot layer of white sandstone which rests directly on unaltered or slightly altered Precambrian rocks. This sandstone is very pure and composed of fine quartz grains less than 1/2 mm. in diameter. It is overlain by about 300 feet of a greenish gray conglomeratic formation. At the base of this formation, the fragments, which are mainly quartz, reach up to 5 cm. in diameter, but quickly pass into 1 cm. or 1/2 cm. grains higher up. It is this rock composed of small angular or rounded fragments in a greenish gray matrix which is called puddingstone.

The contact with the limestone is abrupt. Another difference distinguishing these detrital sediments from those of La Malbaie is their continuity. Wherever the Precambrian-limestone contact can be seen, the white sandstone and puddingstone are present and have a thickness which remains about constant or decreases towards the north.

(Trenton) Limestone

Arenaceous limestone, light gray limestone

The limestone beds begin with about 100 feet of light gray or yellowish gray, alternately calcareous and marly beds. At the base of the section there are several layers of arenaceous limestone and nodular limestone, in which the proportion of quartz grains may exceed the carbonate matrix. Exceptional grains reach 1 cm. in diameter but more commonly they are in the order of millimeters.

The arenaceous limestone passes progressively through a zone of alternating layers into a gray or yellowish gray coarse-grained limestone containing some fossiliferous beds. This limestone has been quarried as building stone at Cap-à-l'Aigle.

Dark argillaceous and bituminous limestone

There is no clean contact between the light gray and darker limestone, but the rock becomes more compact and darker as it is followed up the section. The dark limestone may reach several hundreds of feet in thickness but is difficult to measure exactly because of many folds and faults which affect the section.

It is a very dark, often bituminous, limestone occurring in layers several centimeters to several feet thick which are separated by thin shaly joints. The limestone becomes more argillaceous and develops shaly parting near the top of the formation.

Many fossiliferous horizons occur through this formation.

CENOZOIC

Glacial deposits

Glacial deposits are common in the low and flat parts of the area. They are mainly unsorted; however, in the large plains such as those around lakes Deschênes, Sable, Plongeon, and Port-au-Saumon, and the Comporté and Jean-Noël rivers, etc., large stretches of sand dominate, broken only by several passages of gravel or by small hills or mounds of coarser deposits.

The latter are either eskers, such as southwest of Peine mount and Perdrix lake, or moraines such as south of Plongeon lake. Lateral and frontal moraines of one of the last glaciers are visible 2 miles north of the village of Grands-Fonds. The frontal moraine lies on the valley floor at the elevation of 1,250 feet, and at one time held back a small lake. The lateral moraines are perched at several places on the valley walls at an elevation of about 2,100 feet. This valley, in which the Comporté river flows, changes abruptly from a very wide U-shaped valley to a canyon about $1\frac{1}{2}$ miles north of Fraserville. Spectacular waterfalls into the valley (St. George falls, Fraser falls) are one of the tourist attractions of the region. The glacier must

have advanced again towards the south, and, at mount Murray, at an altitude of 400 feet, the sand is overlain by a till containing blocks of all sizes.

Because of the pronounced alteration of most of the Precambrian rocks, only a few glacial striae were observed. These indicate that in the northern part of the area the last ice movement was towards the southeast. In two places west of St-Fidèle, striations indicate glacial movement towards the south-southwest.

Marine and fluvial deposits

Traces of old marine shorelines remain at several places along the coast and in the Malbaie basin. These take the form of small but very continuous elevated beaches marked by low scarps. North of St-Irénée, for example, a series of these ancient beaches forms a sort of steps from the level of the plateau on which the airport is built to the present coast. Between Clermont and La Malbaie some of the ancient beaches can be followed for a distance of several miles. The best marked of these beaches is formed at an elevation of about 500 feet above present sealevel.

Sand terraces, both marine and fluvial, were formed at several levels between the 600- and 75-foot elevation in La Malbaie basin and along the coast towards the south. In general the terraces are covered by a layer of yellow sand several feet thick which rests on a sand formed of blue-gray shale particles.

At three places in the shaly sand, near Fraserville and Rivière Mailloux, fossils from the Champlain sea were found at elevations between 300 and 400 feet above present sealevel.

STRUCTURAL GEOLOGY

The primary structures of the area have been greatly affected by the injection of the various igneous masses. Foliation of the gneisses is almost everywhere parallel to the contact of the charnockitic massif, and follows a general NNE.-SSW. direction in the area. Various granitic masses were also emplaced in this direction.

A notable secondary structure occurs in the paragneisses east of Morin lake and in the granite and pegmatite north of Ilots lake. It consists of anticlines and synclines in which the axes, trending mainly east-west, are bowed convex towards the north, as though a north-northeasterly movement in the east had dragged the gneisses and granite differentially in relation to the charnockitic rocks.

Lineations in the charnockitic rocks plunge steeply to the south or southeast. In the gneissic rocks of the eastern part of the area, lineations plunge gently to the north-northeast.

Faults

Numerous faults cut the rocks of the area. Among the most important are the north-south faults which mainly affect the charnockitic rocks in the central and northwestern parts of the area. Another important fault system trends north-northeast and affects mainly the coastal zone which has been intensely fractured particularly between La Malbaie and Cap-aux-Oies. Numerous other minor faults and joints affect the Precambrian and Paleozoic rocks.

MINERALIZATION

Sulfides

Several indications of copper mineralization have been recognized in the area. One, near Cap-à-l'Aigle, has been exposed by stripping and consists of pyrite and chalcopyrite disseminated in the gneiss. A second showing, south of Deschênes lake, was discovered during construction of Highway 16. Here the chalcopyrite occurs with calcite veins several inches wide within a breccia zone. A third showing, on Highway 15 north of Cap-aux-Oies, consists of veinlets of quartz with some chalcopyrite cutting the migmatite.

Radioactive pegmatites

The radioactivity of certain gray pegmatites at Cap-à-l'Aigle, Bas-de-l'Anse, and Ste-Mathilde has been noted by Marcelin Lapointe, a prospector from La Malbaie. Analyses which he had made show the presence of allanite, uraninite, and monazite in the pegmatites.

The highest values recorded in these gray pegmatites occur near concentrations of the mafic minerals, magnetite and biotite. However, even in these places, values are very low.

Micas

White muscovite pegmatites have been stripped in several places in search of mica. Some books of muscovite up to 4 cm. thick and 5 cm. in diameter, more or less speckled with quartz inclusions, have been located. This work never passed the exploration stage.

Geochemistry

Four hundred and thirty (430) samples of river sediment, taken at quite regular intervals through the area, were analysed (for copper, lead, zinc and molybdenum) by the laboratory of the Department of Natural Resources. Samples with metal contents exceeding twice the mode are rare and scattered. Among the copper analyses, for example, only 1% of the results exceeded $2\frac{1}{2}$ times the modal concentration. One of these samples comes from the northwestern corner of the area, two others come from the eastern side, and another comes from the southern side of the area.

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