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MOISIE AREA, SAGUENAY COUNTY

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PROVINCE OF QUEBEC, CANADA

Department of Mines

Honourable Jonathan ROBINSON, *Minister*

A.-O. DUFRESNE, *Deputy-Minister*

DIVISION OF GEOLOGICAL SURVEYS

I. W. JONES, *Chief*

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GEOLOGICAL REPORT 21

**MOISIE AREA**

SAGUENAY COUNTY

by

Carl Faessler.



QUEBEC  
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1945

Ministère des Richesses naturelles  
SERVICE DOCUMENTATION TECHNIQUE

MOISIE AREA, SAGUENAY COUNTY

by Carl Faessler

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## MOISIE AREA, SAGUENAY COUNTY (x)

by Carl Faessler

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### INTRODUCTION

#### Location and Area

In 1939, the writer mapped for the Quebec Department of Mines an area extending easterly along the north shore of the St-Lawrence river from Des Rapides river to longitude 66°00' West and for a distance inland of fifteen to twenty miles, or to one mile south of 50°30' North latitude. The area examined, totalling about 275 square miles, includes part of the townships of Letellier and Moisie, Saguenay county.

This work was a continuation of the programme of geologically mapping the north shore of the St-Lawrence which had commenced in 1929 at Tadoussac and which in the previous season had reached Des Rapides river (1).

#### Previous Work

Few geologists had previously visited the area. H.Y. Hind (2), of Trinity College, Toronto, carried out explorations along Moisie river in 1862. James Richardson (3), of the Geological Survey, mapped the geology along this and adjacent sections of the north shore during the years 1866-69, but did not proceed far inland. Count Henri de Puyjalon (4) made similar explorations in 1880-81. T. Sterry Hunt (5), P.E. Dulieux (6), and J. Obalski (7) have reported on the occurrence and exploitation of the magnetite-bearing 'black sands' along the coast near Moisie river, to which further reference is made on a later page.

#### Base Map and Acknowledgments

The base-map from which the geological map accompanying this report was prepared was furnished by the Quebec Department of Lands and Forests.

In addition to the writer, the field party included W.C. Howells, graduate student at McGill University, assistant; Philippe L'Homme, of Ecole Polytechnique, student assistant; Walter Giasson and Germain Bois, packers, and Willie Bourgeois, cook, all of Sept-Iles. All carried out their duties efficiently.

The writer takes this opportunity of recording his cordial thanks to Mr. Robert Ross, Mayor of Sept-Iles, to Mr. E. Murphy, Manager of the Adams Fishing Club, and to Mr. A. Levesque, Guardian at Matamec, for many services rendered the party.

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(x) Translated from the French.

(1) Numbers within brackets refer to Bibliography, at end of report.

### Population

There are but two villages along this section of the north shore of the St-Lawrence, Sept-Iles and Moisie.

Sept-Iles, about 320 miles below Quebec city, is one of the principal centres on the north shore. It was formerly the site of the provisional bishopric of the Gulf of St-Lawrence, which was transferred to Havre-St-Pierre, 120 miles downstream, after the archbishop's residence was destroyed by fire in 1917. The village is seventy-five miles almost due north of Ste-Anne-des-Monts, on the south shore of the St-Lawrence. It has a white population of about 650 (approximately 120 families), and adjacent is an Indian reservation on which about sixty families of Montagnais live. Together with Moisie, it forms the municipality of St-Joseph-de-Letellier.

Sept-Iles is the most easterly port of call on the north shore for the regular summer boat service between the north shore and Matane and Rimouski, on the south shore. Buildings in the village include a church, parsonage, school, branch of a bank, post office, and telegraph office. There are also several fair sized stores, boarding houses, and a resident doctor. Direct telephone service with Clarke City, Ste-Marguerite, Moisie, and the Adams fishing club is available.

Sept-Iles bay, and its chain of islands, forms a safe, natural harbour for boats of any size. In the bay are two wharfs, that of Clarke City on the west shore, and that of Sept-Iles on the east shore. At low tide, however, the latter will not accommodate boats drawing more than fifteen feet, owing to its proximity to the bank of clay and large boulders that, with a width up to two miles, encloses the bay in the form of a crescent, extending from Post point, near the village of Sept-Iles, to the isthmus leading to Marconi peninsula, near the Clarke City wharf. This clay bank is exposed at low tide. It would, however, be easy to build a wharf in deep water at Pointe-aux-Basques, two miles south-east of the existing one at Sept-Iles. The channels between the islands of the archipelago are very deep and form natural shelters which are much appreciated by those navigating along this section of the north shore.

Sept-Iles is primarily a hunting and fishing centre. To a lesser degree, the packing and shipping of fish, lumbering, and farming, are carried on. A certain number of tourists come every summer for game fishing.

The village of Moisie is on the west bank of the estuary of Moisie river, 13 miles east of Sept-Iles. The two villages are linked by a wagon road and a telephone line. The white population of Moisie is about 200, and there are also about fifty families of Montagnais, belonging to the Sept-Iles reservation.

There is no wharf at Moisie. The sand banks of the river extend about two miles out into the St-Lawrence and prevent vessels from coming up to the village from the open gulf. To reach the village, it is necessary for them to enter the river, but the channel is narrow and often impassable, especially when the wind is onshore.

As a landing place for aircraft, however, the

wide sheet of calm water which forms the estuary of Moisie river is ideal. As a consequence, Moisie is the base for aircraft serving the mining and lumbering interests of the interior of Canadian and Newfoundland Labrador. It serves as the airport for Sept-Iles.

At Moisie there is a chapel served by the parish priest from Sept-Iles, a post office, a telegraph office, and a local telephone exchange. Mail reaches the village twice a week via Sept-Iles, where it is put ashore from the boats which, in summer, connect the north shore directly with Quebec and Montreal.

In Moisie, as in Sept-Iles, hunting and fishing are the principal sources of revenue. Hunting is carried on chiefly by the Indians, fishing by the whites. The Adams Fishing Club on Moisie river provides considerable employment for several weeks each summer.

#### Hunting and Fishing

The Indians of Sept-Iles and Moisie leave for their hunting grounds after August 15th, most of them ascending Moisie river. They return the following May or June by the same river or by the Ste-Marguerite, west of Sept-Iles, or, more rarely, by one of the other rivers. The annual revenue from the fur trade is estimated at \$100,000 (8).

Fishing is the principal occupation of the people of this part of the north shore. There was formerly a factory near the Clarke City wharf where fish refuse was treated, especially that of whales harpooned in the gulf, but this plant was destroyed by fire several years ago. The fishing is chiefly for herring, halibut, mackerel, salmon, and cod. The Provincial Government has erected a refrigerating plant at Sept-Iles for packing and shipping fish. From here, frozen fish (especially salmon) are shipped to Canadian and American markets and even to London (England). For the most part, the salmon shipped is the catch of members of the Adams Fishing Club.

This Club is eight miles by road upstream from Moisie village, the cottages and other buildings being on a terrace on the east side of the river. It is possible to reach the Club by water this stretch of the river being navigable. However, this route is rarely used since the building of a good road which connects the Club with both Moisie and Sept-Iles. The latter village, because of its facilities, has become the base of operations for the club. This is the largest fishing club in the whole Gulf of St-Lawrence region. Most of the members are Americans.

#### Lumbering

No systematic logging is done in this region, but the Gulf Pulp and Paper Company operates a pulp mill at Clarke City, nine miles west of Sept-Iles bay, which employs a considerable number of the residents of Sept-Iles. The wood is cut in the valley of Ste-Marguerite river. There is also timber of good quality, mostly spruce, along Des Rapides river, but the turbulent character of the stream makes its exploitation almost impossible. Moisie river, on the other hand, with its large tributaries, would be an ideal stream for log driving. Rightly or wrongly, however, its basin is considered to be more or less devoid of workable forest. It is true that, in the present map-

area, the timber is of very poor quality. It has been burned over in the past, and evidences of the fires may still be seen. In places there are swamps littered with sunken tree trunks, but devoid of standing trees. In others, there is a second growth of hard woods of little value to the pulp industry. But it is not at all likely that there unfavourable conditions still obtain any great distance above the 'first fork' of the Moisie, near the northern boundary of the map-area.

#### Farming

With industrial centres such as Bay Comeau, Shelter Bay, and Clarke City nearby, the large tracts of arable land to be found in the area should be brought under cultivation. It does not seem reasonable that these centres should import potatoes from Prince Edward island and beef from western Canada when all products of the farm could be produced in more than sufficient quantity for local needs on the fertile plains stretching from Ste-Marguerite river to the Matamec. Much of this district was long ago subdivided into lots for colonists. The soil in the high banks along both sides of Moisie river is also excellent. A few colonists have established themselves around Sept-Iles bay, but the lack of means of communication by land renders their existence difficult. The success of agriculture in the district depends on the building of the long-planned road to connect Sept-Iles with Clarke City.

#### PHYSIOGRAPHY

As is the case in other sections adjacent to the North shore of the St-Lawrence, three distinct physiographic units are represented in the map-area: the Champlain plain, the Laurentide plateau, and the Laurentian foothills.

##### The Champlain Plain

Sand and clay deposits of the Champlain plain cover a zone from two to nine miles in width adjacent to the St-Lawrence and extend without a break from the western to the eastern boundary of the map-area. A magnificent sand beach, without a single rock outcrop, borders the St-Lawrence from Sept-Iles to Matamec. This plain extends northerly up the river valleys to reach an elevation of over 400 feet. Hundreds of ponds and many swamps feature the plain, whose drainage is quite erratic.

##### The Laurentide Plateau

North of the plain and occupying most of the area is the Laurentide plateau. Almost everywhere, it rises abruptly above the level of the plain to an elevation of over 1,000 feet. The scarp thus formed parallels the St-Lawrence for a distance of several miles, marked by high and often vertical promontories, facing southeast. From the discharge of the first of the Des Rapides lakes, it follows the north shore of Deschenes river and then forms the high cliffs which bound the north shore of the lake of the same name. From there it follows Daigle river to the Moisie, where it passes along the north shore of Bill lake; it then follows Rat-Musqué (Muskrat) river in that part where it flows east-west about eight miles north of the southeast corner of the map-sheet. North of the line just described, the country is very rugged. Fluvial and glacial valleys are deeply incised in the plateau, whose general elevation is about 1,000 feet above sea level. There are many lakes and they are typically bordered by high cliffs.

### The Laurentian Foothills

The Laurentian foothills which buttress the Laurentian escarpment are almost completely covered with Champlain sediments. They rise above the level of the Champlain plain in the form of very low hills which probably nowhere exceed 600 feet in height. The boundary between the Laurentide plateau and the foothills or the Champlain plain is marked in most places by a river valley or a chain of lakes; but lakes are rare in the foothills district itself.

### Rivers

The largest rivers of the area are the Des Rapides and the Moisie.

Des Rapides river empties into Sept-Iles bay. Desmeules river, its most important tributary, enters it at the head of the second Des Rapides lake. Des Rapides river is very rapid and turbulent. Wherever the writer saw its channel, it was found to follow a very youthful post-glacial valley where high falls follow each other in quick succession. Desmeules river, on the contrary, follows a wide and old valley, whose continuation downstream from the second Des Rapides lake is probably the valley followed today by the lower part of Deschenes river. There are many lakes along Des Rapides river and its tributaries, and they abound in trout. Salmon ascend the river as far as Cran-de-Fer (Iron Cliff) falls, a short distance from the coast. There is a fishing club at the first Des Rapides lake.

The Moisie is one of the largest rivers of the north shore; it is navigable for a distance of thirteen miles from the St-Lawrence up to the Adams fishing club. Above this, a long series of rapids and falls begins, around which a portage six miles long passes. Above this portage, the river is again navigable for a long distance. At the place called 'First Fork', at the north boundary of the map-area, there are several fishing camps owned by the Adams club. Here the Moisie is joined by one of its principal tributaries, the Nipissis (or Tukquatiwapou) river. Other important tributaries within the map-area are the Daigle, Kachiwiss (Sucre), and Grand-Mercier, all on the west side, and the Trout, a small stream flowing in from the north.

Moisie river is famous for its abundance of salmon; the tributaries mentioned, with the exception of Grand-Mercier, are all noted for trout.

The country lying east of the Moisie is almost entirely drained by Rat-Musqué river, a tributary of the Matamec.

### GENERAL GEOLOGY

Geologically, the area is a continuation of that to the west, which was examined by the writer in 1938 (1). The oldest formations are gneissic rocks of sedimentary origin (Grenville series). These are much intruded by granitic gneisses, which underlie most of the area. Anorthositic and granitic rocks of the Morin series appear to intrude both the granitic gneisses and the Grenville series.

Table of Formations

Quaternary	Recent Champlain Glacial	River and beach deposits Marine sand and clay Moraines, erratics, varved clay and sand
<u>Long period of erosion</u>		
Precambrian (?)		Diabase dykes
Precambrian	<u>Intrusive contact</u>	
	Morin series	Gneissic granite, gabbro, a- northosite, titanomagne- tite, pegmatite, aplite
	<u>Intrusive contact (?)</u>	
	Granitic gneiss series	Granitic gneiss, augen gneiss, aplite, pegmatite
	<u>Intrusive contact</u>	
	Grenville series	Paragneiss, quartzite, am- phibolite

Grenville Series

Nowhere in the area do rocks of this series outcrop over large areas by themselves; what are shown on the map as areas of Grenville rocks are actually Grenville alternating with rocks of the granitic gneiss series. This state of affairs is due to the fact that the granite has intruded the Grenville rocks as lit-par-lit injections. Such banded rocks occur in a zone two to four miles wide on both banks of Moisie river. Similar rocks, but more typically metasediments than those along Moisie river, appear along the eastern boundary of the area mapped. They form the western margin of zones of these rocks which are known to extend for a great distance east of the area here discussed.

It must be noted, too, that in many places the rocks mapped as granite contain various sized inclusions of banded rocks which undoubtedly belong to the Grenville series. Most of these inclusions are micaceous schist, but some are quartzite and others are amphibolite.

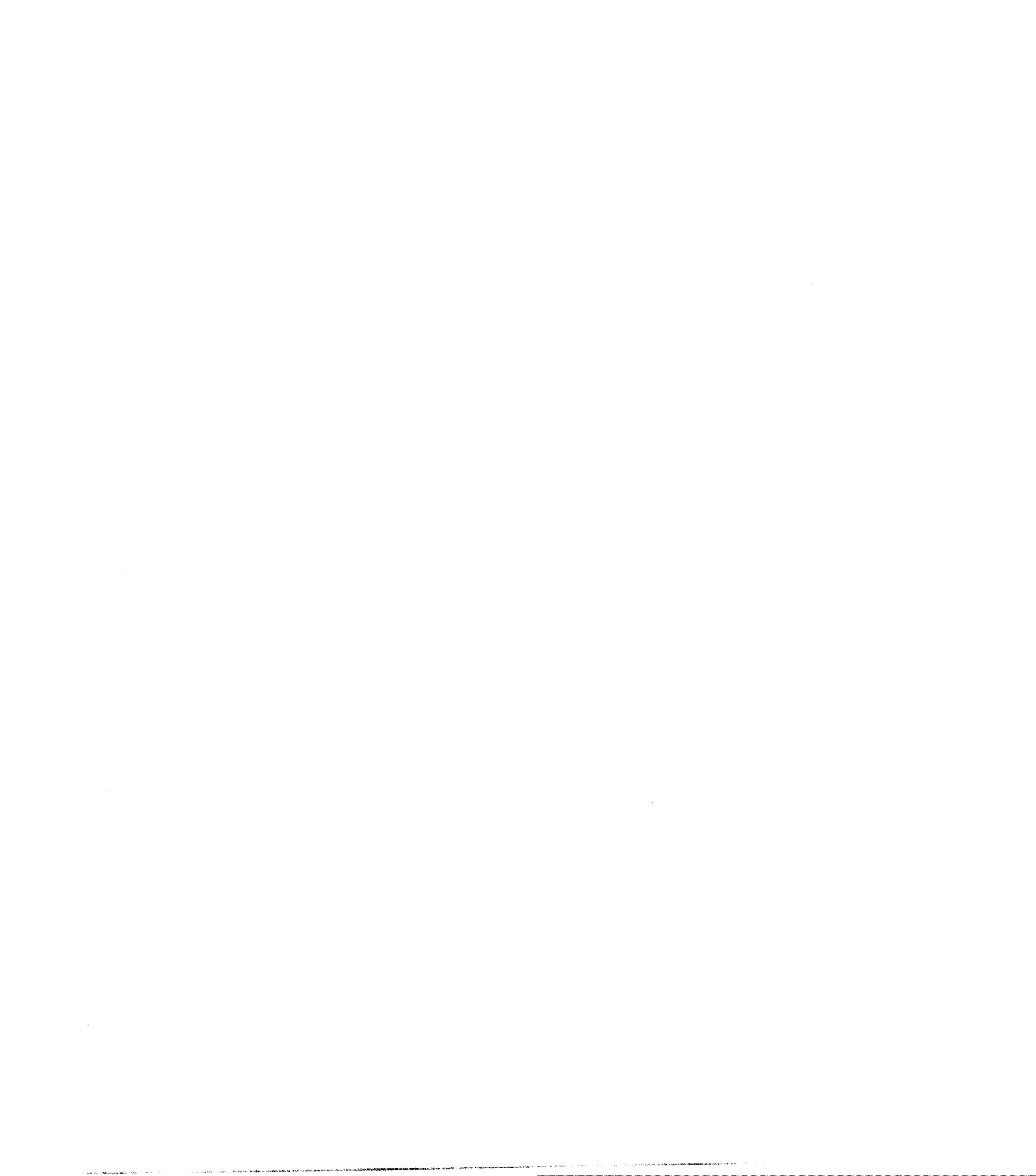
The rocks of the Grenville series are typically banded, but in many places, even in outcrops that are very close together, the strike and dip are altogether different. The granitic rocks lying between layers of metasedimentary rock invariably



A.—Moisie river, near Grand Mereier river.



B.—District between Moisie and Matamec river; Charlotte lake.



have the same strike, dip, and dislocations (drag folds, etc.) as the rock on either side, which proves that deformation occurred after the intrusion of the granite.

The paragneiss is often only distinguishable from the granitic gneiss by its ribbon structure. It is composed essentially of quartz, orthoclase, and biotite, with or without hornblende, and it usually contains also a little plagioclase. An accentuation of the gneissic character of the paragneiss and an increase in its mica content may, in many places, be noted near contacts with the granitic gneiss. In such instances, the rock becomes a mica schist. The inclusions found so abundantly in the granitic gneiss are almost all of this schistose variety of paragneiss. In many localities, the paragneiss is garnetiferous.

Pure quartzite is of rare occurrence, although bands of paragneiss very high in quartz are abundant.

Large bodies of amphibolite occur on the bank of the stream between Godé and Ramé lakes. The rock is gneissic, black in colour, and is composed almost entirely of hornblende.

Along the portage between Grande Coulée lake and Daigle river, on the height which overlooks the valley of this river, may be seen a large, steeply sloping tract covered with unconsolidated material which at first glance would seem to be Champlain sand. Closer examination reveals, however, that it is composed, not of quartz grains, but of grains of hornblende, chlorite, and mica mixed with larger fragments of rock of the composition of amphibolite. It is the product of subaerial disintegration of amphibolite, outcrops of which occur nearby. The thickness of this unconsolidated material was not determined, but it is known to exceed one foot. Under the microscope, the amphibolite is seen to contain as its main constituent a green, fibrous amphibole, which is fresh and strongly pleochroic. With this are large plates of plagioclase, most of them altered, and a minor amount of calcite.

#### Granitic Gneiss Series

More than half of the three-quarters of the area not covered with Quaternary deposits is underlain by rocks of the granitic gneiss series. These are not banded but in general are strongly gneissic; or contain 'augen'.

The granitic gneiss is mostly red in colour and varies from coarse to fine in grain. It is composed of quartz, feldspar, and biotite. Orthoclase is the most abundant feldspar, but a little plagioclase is usually present. The rock owes its colour to its feldspar content. Its gneissic appearance is due to linear concentrations of biotite, which is generally the most noticeable mineral. The layers of mica are in general thin, and the structure of the rock is thus finely gneissic. In most outcrops, the gneiss has an augen structure. In the writer's report on the adjoining area to the west (1), the hypothesis was advanced that the augen gneiss is genetically related to the anorthositic intrusions, and no evidence to the contrary was found in the course of the 1939 work.

Inclusions are very common in the granitic gneisses. Close to the contact with the anorthositic rocks, these are of micaceous gabbro. In the zones of augen gneiss, the inclusions, many of them of very large size, are chiefly of micaceous schist.

Dykes of pegmatite and aplite seem to be less common than in the area to the west, but their apparent scarcity is very probably to be explained by the fact that these dyke rocks are more difficult to locate in this heavily wooded part of the interior than along the cleared St-Lawrence shore.

#### Morin Series

The anorthosite north of Sept-Iles bay, described in the writer's 1942 report (1), is an isolated mass. It is from 1 to 2½ miles wide and extends for 6 miles northeast of the first Des Rapides lake. It is in contact on the north with rocks of the granitic gneiss series. To the south, it is concealed beneath a thick deposit of Champlain sediments except for a long, narrow tongue which, lying at water level, is exposed along Des Rapides river from its mouth to the first Des Rapides lake. There is a small exposure of anorthosite also about one mile northeast of the second Des Rapides lake.

In the present map-area, true mono-mineral anorthosite is very rare. In most of the so-called anorthosite, plagioclase makes up, at most, 70 per cent of the rock, the balance being mafic minerals. The plagioclase is fairly fresh and is of relatively acidic composition. The larger grains are often strained and in part granulated, and they exhibit pronounced pericline as well as albite twinning. Mafic minerals are hornblende and biotite, and ilmenite and apatite are invariably present as accessories. These rocks are coarse grained and very dark in colour.

All transitional facies between such a rock and one composed almost entirely of mafic minerals (e.g., peridotite) are met with. Most abundant is a rock having the composition of gabbro, or olivine gabbro. In this, the plagioclase seems to be more basic than that in the 'anorthosite'. The olivine, if present, is highly serpentized, and the crystals are surrounded by extraordinarily well developed reaction halves. Hornblende and biotite are the usual mafic minerals, augite being of rare occurrence. Accessory minerals are apatite and ilmenite; garnet was noted in one thin section.

The relatively basic composition of the plagioclase, and the common presence of olivine, suggest that the gabbro is younger than the 'anorthosite'.

Locally, the rock is composed mainly of ilmenite and might be termed a titanomagnetite. Such rock is well exposed in the vicinity of Des Rapides river, near the occurrences of titaniferous iron ore which were described in the writer's report on the Sept-Iles area (1).

At the other extreme, there are in the area certain gneissic granites which are believed to be genetically related to the rocks of the Morin series. These are difficult to distinguish from the older, pre-anorthosite granitic gneiss. However, the rock is ordinarily less gneissic than the latter, and it almost always contains bluish quartz, such as has never been noted in the gneisses which have no apparent genetic relationship with the Morin series. In the Sept-Iles area (1), correlation of the several rock types is easier than in the area here discussed, because it is less heavily forested. There, the writer was able to determine that the acidic rocks of the Morin series are closely associated with hornblende aplites and pegmatites; in the present area, it

was impossible to make such determinations. There are many aplite and pegmatite dykes, with either mica or hornblende as the mafic constituent, but their genetic relationship could not be worked out with certainty.

Along Des Rapides river, several contacts were observed between basic rocks of the Morin series and rocks that are apparently granitic. Study of these contacts yielded the following data:

(1) Nearing the contact, the anorthositic rock becomes finer and finer grained and richer in mica. This is probably due to segregation of the mafic constituents of the anorthositic magma.

(2) The granitic rock is evidently younger than the anorthositic rock, for the former always contains numerous inclusions of micaceous gabbro. At certain places, these inclusions are so numerous as to give the contact zone the appearance of a contact breccia.

(3) In general, no contact metamorphism is seen, either in the granitic rock or in the anorthositic rock, unless a weak schistosity common in the micaceous gabbro near the contact is an expression of such metamorphism. This structure is often cross-cutting; thus the intruded magma must have been quite cool at the time it was injected by the later magma.

(4) In several places, the presence of bluish opalescent quartz was noted in the granitic rock as well as in the inclusions it contained. As has already been mentioned, this kind of quartz is of frequent occurrence in the acidic facies of the anorthositic intrusion.

(5) The granite near the contact with the anorthositic rock in most cases has a clearly defined gneissic structure and never contains augen; the larger bodies of augen gneiss are first found only a considerable distance from the gabbro; there is always a progressive gradation between the true gneiss and the augen gneiss.

From these observations it may be concluded that the granitic rocks in contact with the gabbro and anorthosite of the Morin series are probably acidic facies of this same anorthositic intrusion which, toward the margin of the intrusive mass, grades imperceptibly into the older (Laurentian) granitic gneiss. In this transition zone, the gneiss contains augen.

On the map, the rocks which the writer believes to be the acid facies of the Morin series are not differentiated from those of the granitic gneiss series.

#### Diabase Dykes

Dykelets of black ophitic diabase were observed in many places, cutting all the rocks already described. They are always of very small size (from half a foot to two feet wide) and for this reason they are not shown on the accompanying geological map.

#### Quaternary

Glacial material occurs everywhere above the level of the Champlain plain. In general, it consists of moraines and erratics. In the depressions, deposits of sand and glacial varved

clay are of common occurrence.

All the river valleys contain Champlain marine sediments up to about 400 feet above sea level. In the valley of Moisie river, these marine deposits, partially re-worked by the present river, extend for an unknown distance above the 'first fork', which is at the north boundary of the map-area.

The deposits of the Champlain sea, by obstructing the pre-glacial river valleys, have in places forced the streams into new beds, as has already been suggested is the case with Des Rapides river. Still more obvious is the case of Moisie river, which is a smooth-flowing stream above Daigle river, and there occupies its old wide and well defined valley; below the Daigle, it flows in a superimposed valley where falls and rapids follow each other in close succession until the river reaches the Champlain plain. Its old pre-glacial valley to the south is now occupied by Daigle river.

#### ECONOMIC GEOLOGY

##### Titaniferous Iron (Ilmenite)

In the Sept-Iles area, occurrences of titaniferous iron were noted on the banks of Des Rapides river (1). No similar deposits were found in the present map-area. The titaniferous iron deposits of the region have been described in detail by Dulieux (6).

##### Moisie Black Sands

Superficial concentrations of magnetite sand occur along the beaches at many places along the north shore of the St-Lawrence. In the area covered by this report, the most important are near the mouth of Moisie river (3,5,6,7). Here, the 'black sands' extend for four to five miles eastward from the river, and again for about two miles from a point three miles west of the estuary. Also, in the estuary itself, on the concave bank, there is a band several hundred feet long.

##### Beach Sands:

Dulieux (6) gives the results of systematic sampling of the sands for a distance of two miles along the deposit east of the Moisie. The average width of this band is 35 feet, and the average thickness, 1.6 feet. Dulieux says (p.144): "..... at 29 places, the width and depth of the black sands were measured, and at the same time a sample of about one pound was taken ..... A final sample was obtained by taking from each of the samples ..... a weight proportional to the number of cubic feet that each partial sample represented. This final sample, upon analysis in the Provincial Laboratory, yielded:

	<u>Iron</u>	<u>Titanium</u>	<u>Fe<sub>3</sub>O<sub>4</sub></u>	<u>TiO<sub>2</sub></u>
Sample 153, unseparated	36.42%	7.48%	50.29%	12.84%
Sample 153, magnetic-ally separated	67.17%	1.46%	92.66%	2.44%

"The magnetic concentrate represented 26.23 per cent of the weight untreated.

"The table thus shows that, over 10,600 feet, that is, for about two miles along the shore, there is almost 40,000 tons of sand ore giving 26 per cent of magnetic concentrate, that is to say, containing 17 to 18 per cent of metallic iron". (i.e., the metallic iron that can be extracted by magnetic concentration makes up 17 to 18 per cent of the untreated ore.)

"If these results are extrapolated over the five miles of black beach sand on the east bank, and over the two miles on the west bank, and the figure of 20,000 tons per mile is allowed, a total of 140,000 tons is arrived at.

"The figures are not at all definite; the prevalence of certain winds, and the frequency of storms, may produce re-working or displacement of these sands, and, as they are a superficial deposit, their occurrence is in some respects very uncertain".

#### Sands of the Terraces:

Over unknown distances, the shore terraces contain magnetic sand in beds which are generally horizontal, but which are by no means continuous.

According to samplings and analyses which he had made, Dalieux draws the following conclusions concerning these terraced sands (6, p.153): "..... Basing an estimate on the preceding results, it would be possible to calculate what a square mile of ground would contain, assuming, for example, a workable thickness of six feet. As the borings were never made any great distance in from shore, an estimate can only be made for a belt, say, 500 feet wide, 6 feet deep, and elongated parallel to the shore. Taking the average yield of concentrate as 6.30 per cent (which is about the average of the preceding table), and the weight of a cubic foot of sand as 100 pounds, the result arrived at is that such a belt would contain 57,000 tons of concentrate containing 65.67 per cent of metallic iron per linear mile.

"There are magnetic separators which could give concentrates containing even less titanium (x). In any case, this content of titanium presents no serious drawback to the use of the ore".

The Moisie black sands were worked on a fairly large scale from 1867 to 1875 by the Moisie Iron Company, formed in Montreal in 1867, with Mr. W.M. Molson as President. The Company purchased a great stretch of land east of Moisie river, constructed a wharf, and established a village, with church and a school. Eight 'catalan' furnaces were installed, as well as several ovens, in which charcoal for smelting the ore was made from the local balsam and spruce. The magnetite-bearing sand was gathered by hand shoveling, concentrated by a process of magnetic separation, and compressed into briquettes. At the time of Hunt's visit (5, pp.309-310), only four furnaces were in opera-

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(x) The amount of titanium in the concentrates, according to Dalieux (6, pp.147-152), varies between 1.46 per cent and 3.81 per cent.

tion with a total output of three tons of iron per twenty-four hours. The consumption of charcoal was 1,400 'minots' a day, or 446 'minots' per ton of iron. The pigs were forged on the spot. Almost the whole of the production was shipped to the United States, a small part only going to the Company's rolling mill in Montreal.

The Moisie iron was of excellent quality. It entered the United States as 'pig iron', and as such it was subject to a duty of only \$7.00 per ton. But because of its high quality, and following a protest from American iron workers, it was re-classified in March, 1875, as 'bar iron', upon which the duty was \$33.60 a ton. This proved prohibitive, and, as the domestic market was inadequate to absorb the output, the Company was forced to abandon the operation.

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