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INFORMATION REPORT ON LIMESTONE OCCURENCES

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Énergie et Ressources
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Québec 

QUEBEC (Prov.of).

LIMESTONE OCCURENCES.

1948.

Charlevoix-Saguenay Counties &
North Shore of the St.Lawrence &
Anticosti Island.

by G.W.Waddington.

QUEBEC DEPARTMENT OF MINES

25 JAN 1960

MINERAL DEPOSITS BRANCH

No G M- 9427

LIMESTONE OCCURENCES

in

CHARLEVOIX & SAGUENAY COUNTIES

NORTH SHORE of the ST. LAWRENCE and ANTICOSTI ISLAND

Compiled by

G.W. WADDINGTON

1948

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Limestone Occurrences in Charlevoix & Saguenay Counties,
North Shore of the St. Lawrence and Anticosti Island,
Compiled by G.W. Waddington, 1948.

Claveau, J.: Province of Quebec, Dept. of Mines, P.R. 188,
1945. Aguanish to Washicoutai Bay, p. 3.

"That they are of sedimentary origin, however, is clearly shown by the presence, in places, of typical impure quartzites, well banded quartz-biotite schists, and, more rarely, of beds of coarsely crystalline limestone. All these bodies of sedimentary rock have suffered pronounced and repeated granitic injections which have created a great deal of complexity in their mineral composition."

Faessler, G.: Mining Operations in the Province of Quebec,
1928, pp. 177-182.

"In the region examined, the Grenville limestone always occurs in bands, varying in extent, in paragneiss. These bands have the same strike as the paragneiss, approximately north and south with slight diversions towards the East or towards the West, from N. 12 E to N. 8W.

The Grenville limestone is always greatly silicated, containing pyroxenes, frequently in large crystals of one inch and more in length, hornblende, tremolite, serpentine and other minerals. The presence of chondrodite could not be determined with certainty. Tremolite which is a favourable indication of the presence of lead and zinc minerals was very rarely observed and in none of the outcrops of Grenville limestone examined, did we find either galena or zinc blende. On the other hand, magnetite is frequently present, as well as graphite, the latter filling very narrow fissures in the calcite.

The Grenville limestone is usually white in colour, slightly yellowish in tints, but is also found rose coloured. It is coarsely crystalline, cleaving easily along the calcite planes, or it is sometimes quite fine grained, assuming the texture of marble.

1. St. Féréol. - A band of Grenville limestone outcrops near the house of Théophile Paré on the main road between Ste. Anne and St. Féréol, lots 402, 403, 404. This limestone shows in the ditches on both sides of the road, the band appears to have a width of 120 feet. We could not determine the strike with any degree of certainty.

The limestone occurs here in paragneisses, associated with a dyke of pegmatite. It is much altered to silicates, the paragneiss contains a little pyrite in large crystals and rusty zones.

A few yards further, in the direction of St. Féréol village limestone occurs with a little tremolite in a cut on the road.

2. St. Tite des Caps.- A band of Grenville limestone occurs on the highway between St. Joachim and St. Tite des Caps, near the house of Wilfrid Cauchon. It is present in the ditches, on both sides of the road near the mile post "M. 30", thirty miles from Quebec. This band has a strike of N. 12° E and in following this direction across the lots small outcrops of this limestone are encountered as far as the rise of the ground where the limestone is lost under the forest growth. The extension of this band is seen at the Seven-Falls.

The limestone band can also be followed for a certain distance along the highway in the opposite direction, S. 12° W.

The limestone is greatly silicated and contains much magnetite. The country rock is paragneiss in places, resembling mica schist or amphibolite.

3. The continuation of the limestone band described in paragraph 2, outcrops at the Seven-Falls near a small suspension bridge. Its strike is here N. 12° E also. The limestone bands are here 30 to 50 feet wide and alternate with bands of paragneisses. The total width of the limestone zone is 600 to 800 feet. Further down, paragneiss is replaced by a very hard pink quartzite.

The limestone is altered to silicates, sometimes it is rose coloured; below the little bridge much magnetite is present. In this limestone zone there are veins of iron pyrites, and they are numerous in the enclosing paragneiss.

4. A band of Grenville limestone outcrops on the height of the cross-road which connects the national highway at St. Tite with the Cauchon road to St. Féréol. It can be followed on both sides of the road for a distance of a few

thousand feet in a direction S. 8° W. The limestone is altered to silicates and contains large crystals of pyroxenes; the country rock is a paragneiss.

5. Cap Tourmente.- At Cap Tourmente and surroundings Grenville limestone is met with in several places. In going down from St. Tite to Cap-Tourmente on the "Boucher Road" a little crystalline limestone in paragneiss is met with in the ditch on the left hand side, a few thousand feet after crossing the Friponne river bridge. Following up this band of limestone for some 300 feet in the direction N. 12° E. there is an outcrop of Grenville limestone crystallized to a fine grained marble, which in places holds pyrites. The band of marble appears to be some 10 feet wide. Blast holes indicate that some mining was done at this place.

A second outcrop of altered limestone is seen on the side of the trail which leads to the top of Cap Tourmente, some 800 feet after leaving the Boucher road.

A band of crystalline limestone is also seen in the Friponne river valley, in a paragneiss with an almost vertical dip. This place is difficult of access. It was observed while going along the foot of the high cliffs; it is some 800 feet past the Friponne river. The limestone is altered and holds jasper in nodules up to two inches in diameter.

6. Along the cliffs.- In following the railroad (C.N.R.), along the cliffs, Grenville limestone is met with near mile 35, and some other bands were also observed between M. 35 and 36 (from Quebec). Some 200 feet before reaching M. 35, it is seen on both sides of the railroad track, as coarse crystalline limestone which towards the St. Lawrence river passes into a marble. The band of limestone is about 3 feet wide and is found in a garnetiferous paragneiss, which is also graphitic, the strike of both rocks being N. 7° E dipping 10° to 20° to the east. Both the limestone and the marble are much altered, and the latter contains a great deal of graphite.

Similar but smaller bands of limestone or marble, are found in two other places, between M. 35 and M. 36.

Post Grenville calcite.

This carbonate is younger than the Grenville limestone. It differs from the latter in the following respects:

1. It is never altered to silicates; it has not been found accompanied by graphite; it is always very pure, often quite transparent.

2. It is never found as bands, but always in the form of veins, limited in size.

3. These veins are found in the granite-gneiss as well as in the paragneiss; they may even extend into the paleozoic strata.

4. When found in the paragneiss, these veins do not follow the banding or strike of the paragneiss, but cut them usually almost at right angles wherever observed.

5. The general strike of these veins, in the cases observed varies from N. 45° W to N. 60° W. The general strike of the Grenville limestone is N. 12° E. to N. 8° W.

This calcite is due to a filling of fissures by carbonate probably derived from the paleozoic limestone, for these veins are found particularly in the zone of the contact between the paleozoic and the precambrian. Frequently they are mineralized with galena and zinc blende. The source of these two sulphides is uncertain; perhaps it should be looked for, in the zone of contact between the Grenville limestone and the garnite. If such be the case, the calcite of these veins probably comes from the Grenville limestone.

7. Rivière du Moulin, Baie St. Paul. - Several veins of crystalline calcite outcrop at the surface in the contact zone between the granite and the paleozoic, in a distance of about 500 feet; this zone is immediately behind the old mill near the bridge over the Mill river. The veins extend into the granite as well as into the paleozoic.

These veins of calcite contain much green fluorite and galena, the latter being especially located along the walls. The veins measure up to $1\frac{1}{2}$ feet in width and can be followed along the width of the river canyon, about eighty feet.

8. Cap aux Oies, Eboulements seigneurial.-

Several veins of calcite are observed between M. 73 and M. 74, near the Cap-aux-Oies light. Two of these are seen some 900 feet before reaching M. 74, one of which can be followed for a total distance of 150 feet on both sides of the track, while the other is only found on the side nearer the water; the width varies between $1\frac{1}{2}$ feet and a fraction of an inch. Some 500 feet further are seen, on the water side, four veins of calcite which are covered with water at low tide; they are about four inches wide and disappear into the rock in a distance of some 30 feet. One of these veins continues on the other side of the embankment, where it attains $1\frac{1}{2}$ feet and where it is associated with an outcrop of paleozoic rocks. Here the calcite takes the texture of a marble.

All these calcite veins are found in the granite; they hold much disseminated zinc blende, along the walls and in places there are fine crystals of iron pyrites.

9. Nairn Falls, La Malbaie.- Near the dam of the Murray Bay Pulp and Paper Mill Co. small fissures filled with calcite, zeolites and a little galena, are found. In places these veins widen up to one foot and contain, when wide, a large proportion of green fluorite. All these veins are very short and irregular.

10. Port au Saumon, near St. Fidèle.- At Port au Saumon there are two small islets which are accessible at low tide only, on which several crystalline calcite veins occur of which one reaches a width of three feet. This vein crosses the whole width of the islet about 300 feet. Its strike is N. 60° W. and it cuts almost at right angles the bands of country rock, which are paragneiss and pegmatite.

All these calcite veins seem to be barren of useful minerals.

11. Port au Persil, St. Siméon.- About half way between Saint-Siméon and Port au Persil, there is on

the shore of the St. Lawrence, a fissure in the granite, which is filled with debris from the country rock cemented with calcite. Very narrow ramifications which branch out from the main vein are filled with zinc blende; the metallic mineralization of the main vein consists principally of yellow zinc blende and galena. These two minerals are not disseminated in the vein, but are in segregations occupying certain parts of the vein, pieces of pure zinc blende as big as a man's fist can be pried out of the vein.

The vein striking N. 45° W and dipping 60° to the S.W. widens and pinches alternately over its length of about 80 feet, varying between an inch and eighteen inches. At one end it disappears under the water of the river and at the other under the surficial cover and the vegetation.

12. St. Catherine Bay.-- Between St. Catherine Bay and the Pointe Noire, several calcite veins are observed along the St. Lawrence river. The first one encountered is near the bridge. It is in a fissured zone, where the fissures are filled with fragments of the country rock, a paragneiss, cemented by calcite and crystalline quartz.

This zone has a width of 200 to 300 feet. Further on, between the wharf and the light, three more calcite veins occur, in paragneiss. Two of them attain widths of 12 to 19 inches in places. None of these veins contain either zinc blende or galena."

Ann. Rep. Quebec Bureau of Mines, 1929. Part D. Tadoussac to Escoumains.

p. 82. "A single small exposure of limestone occurs on the west shore of the entrance to the bay of Petites Bergeronnes near the level of the St. Lawrence. It measures 15 feet in length and is 10 feet wide. The beds strike south 30° west, and have a dip of 37° towards the southeast. The rock is a dark grey, fine grained limestone, in parallel beds. Although no fossils were found, the character, position and attitude of the rock lead to the belief that it is an outlier of limestone of Ordovician age, similar to those of undoubted Ordovician age that are found along the St. Lawrence southwest of the Saguenay."

~~P. 89. "A single~~

P. 89. "At Grande Anse (Bay Moulin à Baude), near Tadoussac, there is a vein of very pure calcite, 15 or 20 feet wide, which has been uncovered for a length of 1,300 feet. It trends north and south cutting across the structure of granitic gneiss. The calcite is white and pure, containing no silicates or other impurities. This vein is already utilized for making lime, which is shipped to Port-Alfred near Chicoutimi."

Ann. Rep. Quebec Bureau of Mines, 1931 Part C. Forestville to Betsiamites.

P. 27 "Apart from a single small outcrop of Paleozoic limestone at the junction of the Colombier and St Lawrence rivers, the whole of the area is underlain by rocks of pre-Cambrian age."

P. 27 "These rocks are practically absent below Portneuf (township) as far as the Betsiamites river, but on the east side of that river they reappear in a large exposure of paragneiss and crystalline limestone at the Quinze Milles, in the township of Raffeix. The rocks are in beds, now practically vertical, which strike N 65 E."

Ann. Rep. Quebec Bureau of Mines, 1932 Part D. Betsiamites to Manicouagan.

P. 123 "According to Richardson, also, there is a band of crystalline limestone of Grenville age in this vicinity, but we were not able to find it."

P. 123. "The rock is Grenville limestone, consisting now almost entirely of augite and other pyroxenes, and cut in places by dykes of pegmatite."

Ann. Rep. Quebec Bureau of Mines, 1933 Part D. Manicouagan to Godbout.

P. 160 "No crystalline limestone was found in this area east of the Manicouagan river, but in searching for an occurrence of limestone reported by Richardson, an exposure of Grenville limestone was found on the second portage of the Manicouagan, on the west side of the river, and outside of the map-area. This may be Richardson locality. About midway up the ~~river~~ chute there is a little island of rock forming a sort of pillar twenty feet high and having a surface of about 1,000 square feet. This pillar is composed of bands, all more or less calcereous, but one band five feet thick may be properly termed crystalline limestone."

Here and there it is replaced by metamorphic pyroxenite. The limestone was not seen in the valley banks, which, however, are not well exposed for examination."

Prov. of Quebec, Dept. of Mines. Geol. Rep. 11. Sept/ Iles Area.

P. 12. "The most common rock types are amphibolites and pyroxenites, banded paragneiss with or without garnet, beds of very impure crystalline limestone, and, more rarely, beds of quartzite..... The crystalline limestone and the pyroxenites and amphibolites are well exposed in the district about l'Anse aux Aulnes, four miles below Des Monts point, where the limestone beds attain a thickness of 50 feet. The limestone here is free from impurities but has intercalations of silicified rocks."

P. 23, 24. "The Grenville crystalline limestone in this map area always contains silicate minerals in large amount. The few beds of Paleozoic limestone on Carrier point are also very siliceous. As a consequence, these occurrences are of no economic interest as a possible source of lime. However, fairly large quantities of pure limestone are available on Caye-à-Chaux, in the Sept-Iles district. This occurrence is of special interest because of the possibility that this region may, at some future time, become an important agricultural centre.

The Caye-à-Chaux is a rock-islet entirely devoid of vegetation, lying northeast of Grand Carrousel island (Also known as Carrousel-de-Terre, or as Manowin island, although the latter name is not used locally.) , to which it is joined at low tide by a morainal bar about 1,500 feet long and has the shape of a flattened oval, with a diameter of 150 feet at the widest part. The central portion of the rock projects about 20 feet above low-tide level (see Plate 111-B). At high tide, the rock becomes three small islets, the largest, about 500 feet long by 120 feet wide, standing 10 feet above water level in its central part.

The rock on this principal islet is chiefly rather thin-bedded limestone, the beds being 6 to 10 inches thick. A few beds of arenaceous limestone occur at the base of the outcrop, below water at high tide, and at the top a total thickness of one and a half to two feet of sandstone is intercalated between the limestone beds. The presence of these sandstone beds considerably diminish the economic value of the deposit. The limestone is white or greyish-white. Chemical analysis of a sample of the stone gave the following result:

CaO	MgO	CO ₂	FeO	S
52.43%	0.18%	41.40%	0.13%	Trace

The limestone is highly fossiliferous. This render it rather friable, and hence the stone cannot be used for any purpose where mechanical strength is essential. It would, however, made an excellent 'agricultural' limestone, for use as a neutralizer for acid soils. The stone available could supply the needs of a good sized local market for many years. However, exploitation of the deposit on a large scale would be impossible because of the small extent and low elevation of the rock, which is exposed to the pounding of the waves during the heavy northeast storms. This is the only occurrence of high-calcium limestone seen by the writer in the vicinity of Sept-Iles."

Goudge, M.F.

Mines Branch Pub. no 755, 1935. Limestones of Canada.
PP. 54-58. Charlevoix County.

This county lies on the north shore of St. Lawrence river between the island of Orleans and Saguenay river. So far as known the only outliers of the Trenton formation, one of which occurs at Baie St. Paul and the other at Murray Bay (Figure 5, page 55). The limestone in each of these outliers has a very low content of magnesium carbonate but it is all rather argillaceous. In each locality the limestone is associated with sandstone and shale. At Baie St. Paul small quantities of quicklime and agricultural limestone are produced for local use and the limestone has also been used for local buildings. No use is at present being made of the limestone at Murray Bay though it has been quarried in the past for road metal and for making lime.

Baie St. Paul.

The main outlier of Trenton limestone at Baie St. Paul occupies an area about 3 miles in diameter and lies mostly in the valley of Gouffre river at the head of the bay. Small detached areas of limestone are to be found over a greater area. The limestone is all fine-grained to dense in texture, dark brownish grey in colour, and is in relatively thin, steeply dipping beds with shale, but in places it rests directly on the granitic Precambrian rocks of the district.

About $1\frac{1}{2}$ miles above the highway bridge over Gouffre river on the property of Alfé Simorral, a small quarry having a face of 7 feet has been opened in the Trenton limestone exposed in the steep hillside on the east side of the river above the to Murray Bay. The limestone is fine-grained, dull-lustred, dark brownish blue and is in beds 2 to 8 inches thick, between which are beds of shale up to 4 inches thick, the shale being most prevalent in the upper part

of the deposit. The strata strike north and south and dip to the west at an angle of 13 degrees. It is said that the stone for the post office at Baie St. Paul was obtained from this quarry. Sample 127 represents the limestone in the 7-foot face exclusive of the shale interbeds.

Limestone that would underlie that in the quarry is exposed farther up on the hillside at a distance of about 350 yards from the road, and here the strata dip westerly at an angle of 75 degrees and form a ridge about 50 feet wide along the hillside. The beds are very uneven and possibly rest directly on the steeply sloping, uneven granite floor, outcrops of which rock are seen farther up the hill. The limestone is similar in appearance to that in the quarry except that it is not so dull-lustred and has less interbedded shale. As shown by the analysis of sample 128, which was taken across the beds exposed in the ridge, it contains less impurities, but even so it is impure.

Exposures of limestone of the same general type are to be seen along the road $\frac{1}{2}$ mile north of here and again $\frac{1}{2}$ mile south, the latter outcrops being on the property of Ernest Simorral.

One-half mile west of the village, on the road to Quebec, Alfred Bolly produces agricultural limestone from limestone ~~from~~ obtained from the bed of a brook. The limestone used is similar in appearance and probably in composition to that on top of the ridge where Sample 128 was obtained. The limestone is crushed in a small jaw crusher and then passed through a set of rolls. The capacity of the plant is 2 tons per hour. Messrs. Bolly and Filion also make lime for local use in a small pot kiln at this locality.

In the bed of the river at Baie St. Paul fine-grained dark brownish blue limestone in uneven beds up to 14 inches thick is exposed. Here the strike is N.40E. and the dip is southeasterly at an angle of 35 degrees. Sample 129 represents the stone.

Along the shore east of the village limestone is exposed for 800 feet in the railway cutting. The stone is in fractured ~~beds~~ beds of variable thickness up to about 12 inches and dips westward at an angle of 40 degrees. (Plate IX A.) Very little shale is present between the beds except toward the base of the section. An almost vertical face of limestone 80 feet in height is visible here. Sample 130 consists of fragments taken at intervals of 10 feet along the cutting.

Small quantities of lime for local use are made in several small field kilns in the neighbourhood of the village.

Murray Bay:

The outlier of Trenton limestone at Murray Bay is somewhat larger than that at Baie St. Paul, isolated patches of limestone being observed as far distant as $6\frac{1}{2}$ miles northwest of the village. The limestone resembles the Baie St. Paul limestone in general appearance and in its low content of magnesium carbonate but there is a greater variation in the silica content, some being very sandy and consequently very siliceous, but some contains much less silica than that at Baie St. Paul.

Cliffs of limestone, sandstone, and shale are exposed along the shore of the bay on both sides of Murray river, but the cliffs on the west shore in the vicinity of the pier are mostly sandstone and contain only thin belts of impure limestone. But along Murray river and on the east side of the bay, limestone is the predominant rock.

On the west bank of Murray river about 75 feet of limestone beds are exposed in a railway cutting 350 yards above the highway bridge. The prevailing dip is to the southeast at an angle of 4 degrees. At the base of the section the limestone is dull-lustred and more impure than that above, and in the bottom 25 feet of the section are some beds of shale 16 to 21 inches thick. The remainder of the exposed section is composed of dense-textured thinly bedded, dark brownish grey limestone with only a small amount of interbedded shale. The hill rises steeply for about ~~about~~ 100 feet above the limestone outcrops, but no rock is seen on the upper slopes. Sample 131 represents the top 15 feet exposed; Sample 131A the middle 35 feet; and Sample 131B the bottom 25 feet. No shale is included in any of the samples.

Exposures of limestone are visible along the west side of Murray river for $1\frac{1}{2}$ miles above the highway bridge at Murray Bay.

Along the shore three-quarters of a mile west of Cap l'Aigle post office is a cliff composed of sandy, calcium limestone in the lower part, then above this is a zone of thin-bedded, very fine-grained, shaly limestone, which is overlain by a 25-foot thickness of fine-to medium-grained limestone nearly free from shale; this in turn is overlain by very fine-grained, ~~thinly bedded~~ thinly bedded shaly limestone and finally by shale. All the limestone appears to be siliceous. The strata are undulating but the prevailing dip is toward St. Lawrence river at a low angle.

Inshore from this cliff, at a place about 500 feet north of the road paralleling the river, a small quarry was at one time worked for road metal on the property of Arthur Desmeules.

The quarry is opened on the southeast side of a hill in limestone strata that dip to the southwest at an angle of 32 degrees. The stone in the quarry consists of alternate beds of hard, dark brownish blue, very fine-grained limestone, and shale. The shale beds vary from 6 inches to 9 inches in thickness, and the limestone beds are slightly thicker. The top bed in the quarry face is shale. When freshly broken the limestone smells of petroleum. Sample 132 represents the limestone beds in the quarry face.

Analyses of Charlevoix County Limestones												
Ratio of CaO to MgO	sample	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	Ca ₃ (PO ₄) ₂	CaCO ₃	MgCO ₃	Total	S	CaO	MgO	
156:1	127	15.10	0.69	1.87	0.22	80.45	0.61	98.94	0.11	45.17		.29
163:1	128	9.18	0.59	1.21	0.17	86.98	0.63	98.76	0.08	48.86		.30
42:1	129	8.86	0.50	1.78	0.22	84.36	2.35	98.07	0.21	47.36		.12
52:1	130	9.60	0.48	1.36	0.24	84.79	1.91	98.38	0.17	47.48		.91
124:1	131	4.44	0.60	1.40	0.07	91.02	0.86	98.39	0.26	51.01		.41
131:1	131A	4.72	0.54	1.44	0.07	91.14	0.82	98.73	0.63	51.08		.39
140:1	131B	9.52	0.60	1.14	0.09	87.20	0.74	99.29	0.11	48.88		.35
98:1	132	9.32	0.65	1.93	0.20	85.38	1.03	98.51	0.11	47.92		.49

- 127. Baie St. Paul. Seven feet of limestone in quarry on property of Alfé Simor
- 128. " Fifty feet of strata in ridge on hill above the quarry.
- 129. " Bed of river at village.
- 130. " Railway cutting east of the village.
- 131. Murray Bay. Top 15 feet of strata in railway cutting on west side of Murray river, 350 yards above the highway bridge.
- 131A. " Middle 35 feet of strata in railway cut.
- 131B. " Bottom 25 feet of strata in railway cut.
- 132. " Small quarry on property of Arthur Desmeules.

Laflamme, Abbé:

Geol. Survey of Canada Vol XIV, 1901, pp. 190A-195A

"The geological study accomplished at Anticosti during the past summer extends from English Head to the north as far as Pavillon river to the south west, that is, it covers a distance of slightly over 100 miles. All the observations here recorded therefore, only apply to that part of the shore..... All the strata seen on the island are limestone, with the exception of some thin and irregular layers of sandstone at Pointe aux Graines, Rivière aux Canards and Rivière Becsies. The Hudson River beds themselves which form the whole northern shore from west point as far as Baie aux Renards are also limestones, but the latter are more argillaceous than those on the southern side.....

..... Besides the coarse limestone which can be used almost everywhere for the production of lime, large quantities of a pink crystalline limestone are found between the South-west point and Pavilion which probably would take a fine polish and could be used as an ornamental stone. The limestone abounds in crinoid stems which are completely mineralized of a reddish tint, darker than the background, and would present a very pleasing appearance when polished. Of course the economic value of these deposits cannot be definitely ascertained without some preliminary work, with the view of testing the lower beds to see whether the quality of the stone improves in depth.

Other crystalline limestones are found to occur in the vicinity of South-west point; these are bluish-grey in colour and would make very good building stone. Moreover, I was told that beds of sandstone occurred on the south-~~west~~ east shore of the island, which could be used for the same purpose."

Logan, W.E.

Geology of Canada.--1863, pp119-122

"It has already been stated that in the eastern part of the province the formation is not recognized with certainty for several hundred miles beyond the position where it comes up against the Chicot fault. It does not appear to succeed the Potsdam at St. Ambroise; and it is not until reaching the Mingan Islands, between 500 and 600 miles to the northeastward, that we have any of its characteristic fossils. At Bay St. Paul ~~eastward of the~~ and Murray Bay, however, there is met with a calcareous sandstone which in the latter place rests on the quartzite that has been mentioned as occurring there. It probably belongs to a higher rock, but the Calcareous formation between that and the Mingan Islands may be covered up by the waters of the St. Lawrence.

At the Mingan Islands and on the neighboring coast, there appears an interesting exhibition of this formation extending from Minger River to Ste. Geneviève Island, a distance of about forty-five miles. It occupies the inner range of islands and most of the coast, with the exception of a projecting block of land at Clear Water Point, which is composed of the succeeding deposit. The contact of the formation with the lower rock, whether Laurentian or Potsdam, has not been seen; but proceeding from west to east, the summit appears to run outside of Harbor Island, and to strike into the mainland in the corner of the bay above Clear Water Point. From this it trends to Wood Island, so that the whole of Hunter's Island and of Ste. Geneviève Island belong to this formation.

The rock is here a brownish-yellow and yellowish-grey arenaceous magnesian limestone, holding many geodes and irregular masses of yellowish-white calcopar, and many nodules and patches of yellowish-white chert, which sometimes replaces organic remains. The rock weathers to a dark yellowish-brown, and presents a carious and fretted or honey-combed surface, with a multitude of pits sinking to the depth of sometimes three and four inches; while the salient parts, which are tough and strong, often resemble a confused and tangled collection of twigs; sometimes the surface is worn into rough deep fretted botryoidal shapes. The strata are in general somewhat massive, and dip to the south at a small angle, probably not exceeding a hundred feet in a mile.

In many parts, and particularly in the island of Ste. Geneviève, there are circular areas, varying in diameter from a few paces up to a hundred yards, around which the strata for a short distance dip suddenly and considerably ~~of 10° to 15°~~ towards the interior, which is confusedly filled with amorphous masses of rock of coarser and softer character than the strata around, and yielding more irregularly and freely to the weather. In some places, where partial sections of these are seen in the cliffs of the island, the areas appear to be connected with funnel-like forms, which suggest the idea that they may be the effect of ancient springs, which rose to the surface through the yet unconsolidated sediment, washing away the finer particles, and disturbing and confusing the arrangement of the strata.

The Mingan development of the Calciferous formation, in a thickness which may reach 250 feet, has added greatly to the number of species characterizing its fauna. On the island of Ste. Geneviève, where chert replaces some of the forms, in addition to *Stenopora fibrosa*? and crinoidal columns resembling some of those of the genus *Glyptocrinus*, there are met with, *Trochonema tricarinata*, *Maclurea matutina*, and the operculum of another species not yet known, *Helicotoma uniangulata*, *Piloceras Canadense*, *Orthoceras multicameratum*? *O. Becki*, and *Bathyrus Cybele*. On Hunter's Island, with *Piloceras Canadense* occurs *Holopsea turgida*. In a bay near the Pointe des Morts, the rock, which is a tough yellowish-grey arenaceous magnesian limestone, holds many specimens of *Pleurotomaria Laurentina* and *Subulites calcifera*. In the bay above Clear Water Point there occurs a white limestone at the summit of the formation, in which is found *Conocardium Blumenbachii*; and in the same rock on Birch Island, outside of Harbor Island, there are *Pleurotomaria abrupta*, *P. miser*, *Eunema prisca*, and *Murchisonia linearis*.

/// "At the Mingan Islands the Chazy formation bears
R22541355ca1A characters somewhat different from those which have
been given above.

The lowest part seen of the deposit occurs in the bay above Clear Water Point, and the following is a section of the strata in ascending order:-

	feet
Reddish cream colored compact limestone with a conchoidal fracture, weathering pale yellow	1
Greenish and brownish-black shale	1
Reddish cream colored limestone as before, in beds of from one and two inches to a foot, interstratified with greenish shale in beds of about the same thickness	28
Greenish shale with <i>Rhynchonella orientalis</i> (which is a variety of <i>R. plena</i>) in great abundance	3
Grey granula limestone with false bedding, holding comminuted fragments of encrinites and other organic remains, including <i>Bolboporites Americanus</i> , <i>Rhynchonella orientalis</i> a few of <i>Camerella longirostrata</i> , and other species	13
Grey nodular limestone with <i>Columnaria parva</i> , <i>Stenopora adherens</i> , <i>Fenestella incepta</i> , <i>Orthis piger</i> , <i>Strophomena incrassata</i> , <i>Ctenodonta nasuta</i> , <i>Nautilus Jason</i> , <i>Amphion Canadensis</i> , <i>Harpes antiquatus</i> , <i>Iliaenus globosus</i>	20
Grey magnesian limestone, with <i>Murchisonia aspera</i> , <i>Maxlurea Atlantica</i> , <i>Orthoceras multicameratum</i> , <i>O. bilineatum</i> , <i>O. natator</i> , <i>O. Maro</i> , <i>O. Antenor</i> , <i>O. Minganense</i> , <i>O. Shumardi</i> , <i>Illoenus Bayfieldi</i> , and other fossils	12

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The following section, in ascending order, occurs on Large Island at its most northern point; it is supposed to belong to the Chazy formation, and, from the fewness of the organic remains in it, probably overlies the previous beds:-

	Ft.	In.
Yellowish-grey limestone, weathering yellow, probable magnesian ..	5	8
Green and black shale,	2	0
Yellowish grey concretionary limestone, weathering yellowish-brown; the concretionary masses are from six to eighteen inches in diameter, and the concentric layers of the concretions thin,	4	0
Dull-drab colored limestone, weathering slightly yellow, with nodules of chert; the surfaces of the beds show fucoids..	6	0
Dull drab colored compact limestone, weathering slightly yellow, in beds of from six to twelve inches,	18	0
Drab colored mottled arenaceous limestone, weathering yellowish-brown, in beds of from three to nine inches, with corals.	10	0
Pale yellowish-grey arenaceous limestone, weathering yellowish-brown, in beds of from three to nine inches, well marked with fucoids on the surfaces and with impressions of <i>Straparollus</i> ,	12	6
Measures concealed,	7	9

	Ft.	In.
Yellowish-white arenaceous limestone, in beds of from one to two feet thick, without observed fossils; this would make an excellent building stone,	8	0
Green calcareo-arenaceous shale,	1	6
Light greenish-white coarse grained calcareous sandstone, in ill defined beds, with numerous obscure fragmentary fossils, and several small black nodules and patches	5	0
Measured concealed,	4	0
Green and grey shale,	11	0
Drab colored argillaceous limestone in even beds, some of which would probably yield hydraulic lime; ripple-mark occurs on some of the surfaces,	7	0
Greenish shale,	1	9
Greenish-drab compact limestone, mottled with yellowish-drab organic remains; this would make a handsome marble, ..	10	0
Greenish-drab very compact limestone, resembling lithographic in its texture, but unfitted by the presence of small transparent crystals of calcspar; the beds are from three inches to one foot thick; this would make a very fine building stone,	5	0
Light drab compact but brittle limestone, in beds of from six to eight inches, with no observed fossils,	45	0
	171	5

It is not certain that this includes the top of the Chazy, as between the section and the lowest organic remains of the succeeding formation there is a thickness of seventy-eight feet, of which the character has not been ascertained. It would however appear probable that the total volume of the formation in this part does not exceed about 300 feet. It appears to include all the islands outside of Harbor Island, from the Perroquets to Clear Water Point, and with this point the islands to the east of it as far as Wood Island. From this range, however, is excepted the southern part of Large Island, which appears to belong to the succeeding formation."

PP. 163,164

"Between Murray Bay and the Mingan Islands, the series of rocks under description is not yet recognised, and the only position that has been heard of, as possibly presenting them, is at the entrance of the Bay of Seven Islands, where limestones are said to exist resembling those of Mingan, but there has not yet been any opportunity of inspecting them.

In the southern part of Large Island of the Mingan group, the beds which have been given as belonging to the Chazy formation are followed by about thirty feet of yellowish-white pure limestone, some portions of which are filled with *Maclurea Logani*. The beds making up this mass are therefore supposed to belong to the Birdseye and Black River formation. Before however this is rendered certain, it would be necessary to obtain a larger number of characteristic fossils from the locality, which is the only one in which these strata have been observed among the Mingan islands."

Longley, W.W.: Mingan to Aguanish, North Shore, Saguenay County.
P. 31- Paleozoic sediments:

"All of the Mingan islands, and most of the points from Indian point to Havre St.-Pierre, are underlain by Paleozoic sediments. These are capped by a resistant limestone (Figure 20^g), and underlain by shales and sandstone. Twenhofel has made a study

Twenhofel, W.H., Geol. Soc. Am. Bull., 42, 1931

of the stratigraphy of these Paleozoic sediments.

The total thickness of the Paleozoic sediments remaining in the area is probably not much more than 200 feet. They have a very low dip to the south. Thus there is a tendency toward a gentle dip slope on the southward side of the islands, and an erosion scarp on the northern side."

P. 55-

"Much of the massive limestone would work up readily to good quality building blocks. Some of it is somewhat crystalline, and should take a good polish, with a buff greyish color.

The horizons suitable for building purposes or for polished stone, are only a few feet thick, consequently the cost of quarrying would be high in relation to output."

Richardson, L.
G.S.C. Rep. of Prog. 1853-56., PP. 77/77/ 235-236.

"In the immediate neighborhood of Southwest Point, coarse granular limestone for building purposes is displayed in abundance among the strata belonging to Division F. It occurs in beds from six to eighteen inches in thickness, is easily dressed and yields good blocks of a yellowish white color.

The lighthouse at the point is built of it, and so is that at Health Point, both of which, notwithstanding the coarse and rather open texture of the stone, have stood for upwards of seventeen years. I believe, without shewing signs of decay."

Rock. E: Anticosti Island (R.A. Brown translation.)

"The Chicotte limestone could furnish a good ornamental stone and a cheap marble. The argillaceous limestones with graptolites of the Jupiter formation seem to be suitable for natural cement and I would advise that some analyses be made of this rock."

Twenhofel, W.H.

Geological Society of America, Special Paper No 11, Geology and Paleontology of the Mingan Islands, Quebec. PP.13-25.

Geologic Structure:

"In general, the strata of the Mingan Islands sequence dip gently to the south, but reversals are common, and over extensive areas the dips are negligible and the strata are essentially horizontal. Richardson estimated the inclination of the strata at 70 to 80 feet per mile in a direction about S 8 to 9 W. It is thought that this figure of inclination is too large. The southward dip on Inner Birch does not seem to exceed 40 to ~~50~~ 45 feet per mile. On Large Island, with a north-south length of about 4 miles, the top of the Romains formation is not more than 40 feet above sea level on the north end of the island on the northwest corner. The top reaches sea level on the north point of the deep bay of the east side, more than a mile south, thus showing a dip to the south of less than 40 feet to a mile; the top of the formation then remains at sea level for about a mile south. The measured section on the east side of Large Island approximates 145 feet, giving a dip to the south of less than 40 feet per mile. The section on the west side is about 225 feet, thus giving for that side a dip of about 56 feet per mile. There are places where the dips rise to 3 to 4 degrees, and there are several places where the inclinations are northward. The inclinations in the concealed intervals that parallel the strike are, of course, not known. The estimates of inclination of the strata have bearing on the thickness of the section concealed beneath the waters of the North Channel between Mingan Islands and Anticosti. Logan (1863, p. 220-221), in his estimate of an inclination of 90 feet per mile to the south, postulated a concealed thickness of 1700 feet of strata in this channel. An estimated inclination of 40 feet per mile reduces the thickness to about 800 feet, and it is possible that this thickness may be too great.

Three small faults are present on the southwest corner of Inner Birch Island. The throw in each case is southward, with magnitude of throw from north to south of 1, 2 $\frac{1}{2}$, and 4 $\frac{1}{2}$ feet. There may be other faults of larger magnitude that are not exposed, but there are no data.

There is a decided erosional and angular unconformity between the pre-Cambrian crystallines and the lowest strata of the Mingan sequence, but this unconformity has not been seen in any section. It seems probable that it has little relief. There is a marked unconformity between the top of the Mingan strata and the overlying Pleistocene or later sediments, and this unconformity has decided relief. There is also a marked unconformity between the Romaine and Mingan formations of the Mingan Islands sequence. In small exposures the impression may be given that the two formations have parallel beds, but on the east side of Large Island the contact is excellently exposed for a quarter to half a mile, and there the basal sandstones of the Mingan formation rest on eight different beds of the Romaine formation with a slight divergence of dip between the strata of the two formations.

GEOLOGIC SECTION

General Statement- The Mingan Islands sequence is composed of two formations: the Romaine below and the Mingan above. The exposed parts of the Romaine formation consist of dolomite and a little shale. There may be a sandstone at the base. Beds are generally thick and more or less rough in appearance, and in some places they appear kneaded together. The texture ranges from microscopically crystalline to fine grained, and many beds have an abundance of small cavities. Some horizons are nicely bedded as may be seen on the north end Eskimo Island, but, in general, the bedding is uneven and rough. In places, as in Pillage Bay, there are thin-bedded dolomites. The Romaine formation contains a little chert in the form of oddly shaped nodules. These seem to be most common where the beds have a kneaded appearance. The chert is considered epigenetic. Fossils are rare and almost always poor. The thickness is placed at about 260 feet.

The Mingan formation has a variable thickness at the base composed of conglomerate, sandstone, and shale. In some exposures the three forms of clastics are present and in others not more than two. These clastic strata are overlain by limestones whose basal 20 to 30 feet were limestones' sands at the time of deposition. These strata contain much fragmentary fossil material and locally are poorly cemented. The larger part of the formation consists of fine-grained limestones of which some have semilithographic texture. Fossils are locally common and frequently abundant. The exposed thickness is estimated not to exceed 155 feet.

The Mingan Islands sequence is presented by giving every local section measured and then organizing these into a general section.

As some of the sections have been remeasured, descriptions and figures of thickness vary from those given by the writer in previous papers. There may be some slight duplication for some of the zones.

Parroquet Island.- The Parroquet Island section is exposed on the most western of the group and the one on which is the lighthouse. This island, estimated to have a length of 900 feet and a width of 300 feet, has a cliff on all sides except the north-east and east, and the exposures are excellent. The zone numbered 9 is not exposed on the lighthouse islet but on the two low islets a short distance southeast. It is not known that zone 9 rests directly on the highest zone of the lighthouse islet, but if such is not the case it is certain that not a great thickness of strata is missing.

Mingan formation

	feet
9. Limestone, gray to white, crystalline. Some beds with semi-lithographic texture contain many clear vugs of calcite. Some beds have considerable ground-up fossil material; and there is a considerable number of sponges and cephalopods. Beds thick and rock hard.	20
8. Limestone, greenish gray, granular, beds 1 to 3 feet thick. Fossils, particularly <i>Camerotoechia orientalis</i> , rather common. Some beds contain sponges. Much of the rock of this zone has a sandy appearance, and it seems that the materials were sands at the time of deposition and were largely produced by grinding up of fossil material. Only 18 feet exposed, but an additional 7 feet estimated in highest part of the island.....	25
7. Limestone, greenish white, granular, crystalline crystalline, probably sands at time of deposition. Contains fossil fragments. One bed.....	3
6. Shale, green.....	0.8
5. Limestone, greenish white, granular, originally limestone sands made from ground-up fossils. One bed.	2
4. Shale, black, carbonaceous, slightly micaceous near top. Contains poorly preserved <i>Lingula</i> . Base rests on white granular limestone on the south side of the island. This limestone is 0.5 foot thick.	6-7.8
3. Shale, greenish black, carbonaceous. No fossils seen.....	5.7

feet

2. Conglomerate, containing small quartz pebbles enclosed in a matrix of white sandstone. A block on the beach that seems to have been derived from this zone indicates that parts of it may carry considerable black mineral that seems to be magnetite or ilmenite. The thickness is about..... 2

Unconformity

Romaine formation

1. Dolomite, gray, compact, and hard, exposed on reef on north side. No fossils seen. Perhaps, 7.5

Mingan Island.- Mingan Island is the low island east of the Parroquet group. It has many "flower pots" over much of the surface. It has also been designated Bald Island because of the absence of trees. The strata are thought to lie above those of the Parroquet section, unless possibly zone 9 of that section may be present in the basal part of this section. The strata belong to the Mingan formation and are considered to be from about 25 to perhaps 100 feet above the base.

Mingan formation

3. Limestone, gray, hard, fine grained, semilithographic texture. Contains many clear calcite crystals. Perhaps 15

2. Limestone, coarse grained, granular, saccharoidal, crystalline. Contains numerous particles of white calcite and geoidal cavities lined with calcite. This zone contains many *Rhynchocamera varians*, *Camarotoechia pristina*, *Fletcheria incerta*, and *Stylarasa parva*. Thickness estimated at 50-60

1. Limestone, fine grained, compact, semilithographic texture. Contains many particles of transparent calcite..... 25

Inner and Outer Birch Islands.- The section has been constructed from the strata exposed on Inner and Outer Birch islands. The strata of Outer Birch may immediately overlie those of Inner Birch Island, but for reasons given below it is possible that some strata are not exposed.

Mingan formation

14. Limestone, gray, in 4 to 24 inch beds. Beds do not readily separate. Few fossils seen. Estimated 25

13. Limestone, gray, firm, fine grained, somewhat lithographic in texture. Bedding well defined with easy separation along bedding planes. Beds 4 to 24 inches thick 6.5

	feet
12. Limestone, dark gray, rough breaking. One bed	1.5
11. Limestone, gray, yellow weathering, splintery, somewhat lithographic in texture; semiconchoidal fracture.....	2
10. Limestone, gray, thin laminated, thin blue shale partings. Beds range in thickness to 18 inches. Some beds much cross laminated with foresets 6 to 24 inches long. These beds evidently were sands at time of deposition. Fragments thought to have come from these strata indicate presence of a mud-cracked layer in this zone, but it was not located.	7
9. Shale, grayish blue, calcareous.	3
8. Limestone, dirty gray, thin laminated, shaly.	3
7. Limestone, gray, granular, interbedded with greenish-blue shale. Beds 3 to 6 inches thick with laminations of shale in the limestone, and laminations of limestone in the shale	2
6. Shale, dark blue, thin laminated.	1.4
5. Limestone, gray breaks very irregular.	2
4. Shale, dark blue, thin laminated.....	1

Unconformity
Romaine formation

It is not certain that the strata of zone 3 form the top of the Romaine formation. The rocks were designated dolomites in the field, but the conglomerate ordinarily present at the base of the Mingan formation was not seen. If it is present in the section there must be a concealed in the channel between Inner and Outer Birch islands. This is possible but not probable.

	feet
3. Dolomite, gray. Well exposed on the wave-cut terrace on the northwest corner of Outer Birch Island. One bed near the middle of the zone is beautifully marked with symmetrical ripples with wave lengths of 3 to 5 inches and heights approximating half an inch. Another bed near the middle is mud cracked with polygons ranging from 8 to 12 inches in diameter. The zone includes the lowest strata exposed on Outer Birch Island.....	8
2. Dolomite, gray, thick bedded. Beds range in thickness to 4 feet (mostly 1 to 2 feet). One bed composed of Cryptozoa, with some domes up to 2 feet in diameter; many secondary domes developed on large ones.	

No other fossils seen. About 25 feet is well exposed and an additional 25 feet is estimated to be present in higher parts of the island. The strata of this zone form the highest rock of Inner Birch Island. 50 feet

1. Dolomite, dark gray, yellow weathering, fine grained, splintery fracture. Beds are thin, ranging from 2 to 6 inches, and there are thin blue shale partings.

The beds are laminated, but there is little separation along lamination planes. Resemble the strata on northwest corner of Large Island and on north side of Eskimo Island. No fossils of any kind seen. These are the lowest strata exposed on the north side of Inner Birch Island..... 10

Large Island.- Two sections were measured on Large Island, one on the west and the other on the east side. The latter is the more complete.

West Side of Large Island
Mingan formation

12. Limestone, bluish gray, conchoidally fracturing, brittle, semi-lithographic texture. Rock contains many small particles of clear calcite. Many small fragments of trilobates in some beds, and nautiloid gastropods and annulated straight cephalopods are common. The rock erodes into "flower pots", and these are present on present and elevated beaches cut on strata of this zone. About 30 feet is well exposed and an additional 15 feet is estimated to be present. The strata seem to be the same as those exposed on Mingan Island. Beds are thick. The zone makes the striking stack, known as Tower Rock, exposed on the southwest corner. 45 feet

11. Limestone, light yellow, compact, brittle; semilithographic texture. Beds 6 to 18 inches thick. Few fossils seen. Erodes into "flower pots." 45

10. Limestone, gray. Some beds sugary, others fine grained. Beds range in thickness from 3 to 12 inches. Few fossils seen.. 5

9. Limestone, gray. Some shaly beds, not well exposed, and only seen at low tide on the reef. Base of Mingan formation and top of Romaine formation are in contact in this zone. 56

Unconformity
Romaine formation (Pl. 3, fig.2)

8. Dolomite, gray, beds 3 to 9 inches thick. Many beds covered with fucoids, and flat-spined gastropods are occasional; all poor. 10 feet

	feet
8. Dolomite, yellowish gray mottled, sandy. Beds 3 to 12 inches thick. No fossils seen other than a straight cephalopod.....	10
6. Dolomite, mottled in different shades of gray, compact and brittle. Some beds shaly; many covered with fucoids. Beds from 6 to 24 inches. No fossils seen.....	18
5. Dolomite, yellowish gray mottled. Contains chert nodules locally; fucoids on surfaces of some beds. No other fossils seen	6
4. Dolomite, gray. Contains many Cryptozoa.	4
3. Dolomite, gray, weathers yellow. No fossils seen.	15.5
2. Shale, greenish black. No fossils seen.....	1.6
1. Dolomite, gray, compact; chert locally present. No fossils seen.	12

East Side of Large Island
Mingan formation

10. Limestone, bluish gray, thick bedded; responsible for the "flower pots" on southwest corner. Fossils are occasional. Twenty feet is exposed south of the deep bay on the east side of the island, and it is estimated that an additional 20 to 30 feet is present along south side of Large Island.	50
9. Shale, blue; passes laterally into sandstones. Contains poor Lingula.....	3
8. Sandstone, yellow, thin laminated, thin shale partings. No fossils seen.....	6.5
7. Shale, blue. Contains thin layers of yellow sandstone. No fossils seen.....	13
6. Sandstone, cross laminated, yellow, somewhat shaly near base. Some beds are marked with current ripple marks and others are mud cracked. No fossils seen other than a sand cast of a crinoid or cystoid. Seen on both sides of the deep bay on the east side.....	8

Unconformity
Romaine formation

5. Dolomite, light gray to dark gray mottled; thinner beds than zone 4. Beds 4 to 12 inches thick. No fossils seen.	10
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feet

- 4. Dolomite, light to dark gray. Massive bedded, weathered surfaces show many cylindrical fucoids. Beds 1 to 5 feet thick; some bedding surfaces regular, others very irregular. No Cryptozoa seen. One bed near the top of the zone has fine granular texture and contains *Bathyurus romainensis* n. sp. The zone contains some gray and brown chert..... 30-35
- 3. Dolomite, light bluish gray to dark bluish gray. Very irregular bedded; many bedding surfaces domal. Beds at top formed from an algal reef or bioherm. This is well exposed on the flanks of a small arch (Pl. 1, fig.2.). NO fossils other than Cryptozoa seen. Beds ~~of~~ 3 to 20 inches thick..... 12
- 2. Dolomite, light and dark gray, thin bedded, with blue shale. Nicely laminated in some beds, others with algal domes. Beds more or less irregularly crumpled due to deposition..... 10
- 1. Dolomite, dark gray. Beds 2 to 8 inches thick (mostly 4 to 6 inches). Bedding surfaces very irregular; many beds seemingly of algal origin. No fossils seen other than domes ascribed to algae..... 9

Harbour Island.- The section exposed on Harbour Island belongs entirely to the basal part of the Romaine formation.

Romaine formation

feet

- 7. Dolomite, dark and light gray mottled. Beds up to 3 feet thick. Rock in some beds very fine grained. Contains occasional poorly preserved flat-spined gastropods..... 20
- 6. Dolomite, gray fine grained, and compact. No fossils seen... 3
- 5. Dolomite, dark and light gray mottled. Bedding well defined in places, in others appearing as if kneaded. Chert nodules occasional except in places of kneaded appearance where they are common. Fossils are poorly preserved flat- spined gastropods and straight and coiled cephalopods..... 13
- 4. Dolomite, gray, shaly, in thin beds, with calcareous gray shale. No fossils seen. 1.8
- 3. Dolomite, dark gray hard, three beds of about equal thickness. No fossils seen..... 4.8
- 2. Dolomite, gray, thin bedded, shaly. No fossils seen..... 2
- 1. Dolomite, gray, coarse granular. Beds 1 to 2.8 feet thick..... 15

Moutange (Big Romaine) Island. The section exposed on Moutage (Big Romaine) Island is as follows:

Romaine formation	feet
3. Dolomite, cotted shades of gray, mostly dark. Portions of zone have kneaded appearance, and vugs of calcite are common. Contains a few poorly preserved fossils and some chert.....	40
2. Dolomite, gray, shaly. Base not seen. No fossils seen.....	3
1. Concealed to crystallines of pre-Cambrian. Not more than....	20

Quarry and Niapisca Islands.- The section for these two islands was constructed from several sections made on different parts of the two islands, and it is not unlikely that there may be some error in the thickness of some of the zones due to overlapping.

Mingan formation	feet
14. Concealed in brush on the higher parts of Quarry Island. Perhaps.	25
13. Limestone, gray to tannish gray, fine grained. Contains irregularly shaped particles of transparent calcite, semilithographic texture. No fossils seen.....	30
12. Limestone, gray, fine grained with semilithographic texture. Some beds of granular limestone considered to have been deposited as limestone sands. Contains many sponges of mushroom shape	10
11. Shale, green, exposed on northwest corner of Quarry Island. No fossils seen.....	1.5
10. Limestone, dark gray, thin bedded, fine grained, with semi-conchoidal fracture. Few fossils seen.....	1.5
9. Shale, green, sandy, with thin beds of sandstone and limestone, exposed on northwest corner of Quarry Island. No fossils seen	1.7
8. Limestone, gray, once lime sands with quartz sands, one bed; contains fragments of fossils.....	2
7. Sandstone, gray and yellow, composed of quartz sand with calcareous cement. Exposed at several places on north shores of the two islands. Commonly found on reefs and bases of cliffs. Fossils not uncommon.....	4

- | | |
|---|------|
| | feet |
| 6. Shale, gray to black, sandy. Contains <i>Inocaulus minganensis</i> n.sp. | 7-8 |
| 5. Shale, black, micaceous, with gray limestone. Not well exposed | 10 |
| 4. Sandstone, white to yellow, crumbly, cross laminated, composed of quartz particles. Contains scattered quartz gr pebbles. Many exposures in the bays on north sides of both islands. This sandstone rests on an eroded surface..... | 5 |

Unconformity
Romaine formation

- | | |
|---|-----|
| 3. Dolomite, gray, compact. Bedding generally not well defined; many beds with ripple marks. No fossils seen..... | 6 |
| 2. Dolomite, gray, compact. One bed, with stratification planes 3 to 6 inches apart. No fossils seen..... | 1.5 |
| 1. Dolomite, gray, thin-bedded, hard, compact. Bedding not well defined. No fossils seen..... | 3.8 |

Eskimo Island-. Both the Romaine and the Mingan formations are exposed on Eskimo Island, the former making the lower cliffs on the north side and the latter the higher cliffs and the cliffs on the south sides of the bays on both the east and west sides of the island.

Mingan formation (Pl. 4) feet

- | | |
|---|----|
| 14. Limestone, gray, thick bedded. Beds up to 3 to 4 feet thick and one 13 feet thick. Most beds with semilithographic texture, and of flint-like appearance; others granular and probably sands at the time of deposition. Some beds wave marked; others have even surfaces and still others are nodular. Fucoids, some of which are crystalline calcite, are present on some beds. Sponges are common locally, forming low mushrooms up to 6 to 8 inches in diameter; a large <i>Fletcheria incerta</i> was collected about the middle. The lower beds contain bands filled with small fragments of fossils, and scattered <i>Maclurites</i> and <i>Raphistomina</i> are present in the higher parts of the zone..... | 40 |
| 13. Limestone, dark gray, rubbly, granular, with thin green shale partings. Fossils occasional. | 7 |
| 12. Shale, green, thin laminated..... | 2 |
| 11. Limestone, gray, granular, once a lime sand, and in places a coquina filled with <i>Camarotoechia orientalis</i> | 4 |

	feet
10. Shale, green, thin laminated.....	2
9. Sandstone, gray, cross laminated.....	0.8-2
8. Shale, green, thin laminated.....	6
7. Sandstone, gray, cross laminated, not pebbly.....	6
6. Sandstone, gray to yellow, essentially a conglomerate containing quartz and chert pebbles to an inch in diameter and an occasional pebble to 2 inches; much cross laminated. Contains burrows in vertical and inclined positions and filled with fine-grained green material. Other fossils are <i>Camero-toechia orientalis</i> , <i>Hesperorthis ignicula</i> , and <i>Leptaena incressata</i> . Zone 6 rests on an eroded surface.....	3

Unconformity
Romaine formation

5. Dolomite, gray, irregularly bedded, with gray shale at top. Dolomite contains <i>Raphistomina laurentina</i>	10
4. Dolomite, gray to white, markedly irregularly bedded. Beds to 3 feet thick; some contain lenses which resemble pebbles composed of light-colored dolomite. Several beds near base almost entirely composed of domes of <i>Cryptozoon</i> steeli with domes to 2 feet in diameter and a foot high; most are 6 to 10 inches in diameter and 3 to 4 inches high. Top of this zone may be seen on north side of deep bay on west side of island, and <i>Cryptozoa</i> are excellently shown in the exposures of the shore.....	30
3. Dolomite, bluish gray, dense, hard, fine grained. Beds to 15 inches thick; most bedding surfaces irregular and undulating. No fossils were seen.....	22
2. Shale, blue, hard, interbedded with thin layers of gray dolomite.....	3
1. Dolomite, white. Beds 6 to 15 inches thick, dense, hard, fine-grained, surfaces irregular. No fossils seen. Exposed on wave-cut terraces on north side.....	10-15

Sea Cow Island.- The section exposed on Sea Cow Island is as follows:

Mingan formation

	feet
7. Limestone, gray, thick bedded; some beds nearly black.	

	feet
A few beds near top dense and fine grained, but all or nearly all beds up to 20 feet above the base locally cross laminated and otherwise horizontally laminated. All were evidently sands at time of deposition. Beds are up to 6 feet thick. Some layers locally of full of sponges.....	25-30
6. Shale, blue, with thin beds of sandstone. No fossils seen. Estimated.....	8
5. Sandstone, gray, coarse, cross laminated. Most of cross-lamination is on a small scale, with vertical components 3 to 8 inches and horizontal up to 16 inches. Inclinations of cross-lamination are both easterly and westerly and agent of formation was water. Inclinations are up to 36 degrees. Many ripple marks, mostly of current origin, one of wave origin. No fossils seen.....	10
4. Limestone, gray, fine grained, dense. Few fossils seen.....	3
3. Shale, green calcareous. Contains thin layers of limestone.....	5
2. Limestone, gray, fine grained, somewhat lithographic in appearance. Contains fucoidal markings and flat-spined gastropods.....	8
1. Limestone, gray, foot of blue shale at top. Exposed on wave-cut terrace.....	6

Clearwater and Ammonite Points.- These sections begin in Trilobite Bay on the east side of Ammonite Point and in the Bay on the west side of Clearwater Point. The section on the west side of Clearwater Point is the more complete.

Mingan formation

14. Limestone, gray to brownish gray, mostly compact, brittle, lithographic texture. Some beds are ground-up organic matter and are considered to to have been limestone sands at time of deposition. Fossils are not uncommon in some beds; among them are Maclurites, Raphistomina, Thaleops conifrons, Bumastus globosus, Hesperorthis ignicula, Eospongia, and others.....	25
13. Limestone, gray, beds nodular, shaly, once sands. Some cross-lamination.....	10
12. Shale, green, more or less nodular. No fossils seen.....	4
11. Sandstone, gray, calcareous cement. Fossil fragments.....	2
10. Shale, green.....	0.5
9. Sandstone, gray, thin bedded.....	3.5

	feet
8. Limestone, gray. Beds thick, granular, once a limestone sand. Top of one bed on east side of Ammonite Point is sun cracked with polygons up to about 6 inches across (Pl. 3, fig. 1). Contains fossils commonly, but usually much broken up.....	20
7. Limestone, gray, beds thin bedded, with gray shale.....	2
6. Limestone, gray, in 4 to 6 inch beds.....	1.3
5. Shale, green.....	2
4. Limestone, gray, compact base concealed.....	2
3. Concealed. Sandstone at base of Mingan formation and the contact between the Mingan and Romaine formations is in this interval. Thickness of strata concealed estimated at.....	75

Romaine formation

Some of the concealed strata are almost certainly a part of the ~~lower part~~ ~~of the~~ Mingan and Romaine formations and it is likely that more than half of the concealed interval belongs to that formation.

2. Dolomite, light and dark gray mottled, compact, thick bedded, with bedding planes not well defined. No fossils seen.....	10
1. Dolomite, light and dark gray mottled, thick bedded, with but beds fairly well defined. No fossils other than poor gastropods noted.....	40

The dolomites of zones 1 and 2 of the Harbour Island and Pte. aux Morts aspect, and it is considered that the lighter-colored dolomites of the top of the Romaine formation are present in the concealed interval.

General Section for the Mingan Islands.- From the different sections obtained on the islands and mainland, no section being complete for any locality, an attempt has been made to (L) construct a section of general ~~possible~~ gaps, one of which is in the channel between the inner islands and the mainland, and the other beneath the water separating the inner from the outer islands. The lower gap may be partly shown in a white sandstone or quartzite exposed on the east side of Pillage Bay. The upper gap may be partly bridged by the exposures on the west side of Clearwater Point, and it is likely that the complete section lies inland from this point but is hopelessly buried beneath the post-Glacial sands, silts, and clays, and overlying swamp and muskeg accumulations.

(L) Read the following after the word "general" : application to the Mingan Islands. This synthetic section has two important gaps,....

Some of this interval may be shown in the cliffs on the west side of Pillage Bay and in Ste. Geneviève Mountain, but these are generally inaccessible. The general section is as follows:

Mingan formation	feet
16. Limestone, bluish gray on fresh fracture, becoming buff on exposure, brittle, generally fine grained, semilithographic in some beds; some beds granular and limestone sands at times of deposition and the fine-grained limestones filled to a greater or lesser extent with crystals of white to transparent calcite. Bedding general-good and beds thick. Fossils, generally common, consist of Maclurites, Raphistomina, various trilobites, and straight and coiled cephalopods. Strata of this zone form the southern end of Large Island, Tower Rock on that island, and "flower pots" wherever the zone is exposed (Pl. 2.). Maximum exposed thickness of the zone is thought to be on Large Island.....	45
15. Limestone, buff gray, yellow to buff on exposure, fine grained, semilithographic, interbedded with minor thickness of granular gray limestone. Fossils generally not common but very abundant on occasional horizons, as on southern end of Mingan Island where there are many Rhynchocamera varians, Stylaraea parva, Fletcheria incerta, Camarotoechia pristina, and Maclurites magnus. Strata on Mingan Island referred to this zone are sugary and are thought to have been limestone sands at time of deposition, but there has been some subsequent recrystallization. Many beds marked with fucoids. Strata of this zone are also responsible for "flower pots", but they are rarely so fine as those of zone 16. The zone has been seen on outer Birch, Large, Niapisca, Quarry, Eskimo, and the southern of the small islands adjacent to Eskimo Island. It is present on Clearwater and Ammonite points and forms parts of St. Charles, Walrus, and Frigle islands. Greatest thickness seems to be on Large Island, but it is possible that as great a thickness is on the outer part of Ammonite and Clearwater points.....	51
14. Limestone, gray, quite generally granular. A few beds fine grained, like zones 15 and 16, generally with well-defined bedding, but many surfaces undulating. Materials of this zone are considered to have been sands at the time of deposition, and some of the beds are still in that condition. Strata of this zone are highly cross-laminated on Sea Cow Island, and some cross-lamination is present on Quin and Outer Birch islands, and on Clearwater Point. On Outer Birch Island and on Clearwater Point, one or more beds of this zone are highly mud cracked with polygons to about 6 or more inches in diameter. Some beds are current ripple marked. Fossils are generally common but are generally broken into fragments. Among the more common are Chasmodonops subluxa, Hesperorthis ignicula, Camarotoechia orientalis, Leptaena incrassata, and sponges of two species of Eospongia.	

It is obvious that at times during the deposition of this zone the surface of the deposit was above sea level and was subjected to drying. This zone has been seen on Parroquet and adjacent island, Outer Birch, Large, Quarry, Niapisca, Quin Eskimo, sea Cow, and St. Charles islands, and on Ammonite and Clearwater Points. Thickness is variable, but the maximum is placed at.....

20

13. Shale, black or green, with occasional beds of quartz sandstone and bands of limestone formed from limestone sands. Shales contain few fossils other than an occasional Lingula, but fossils are not uncommon in the limestone and are occasional in the sandstone. Common forms are Hesperorthis ignicula and Camarotoechia orientalis.

Strata of this zone are well exposed on Parroquet, Large, Quarry, Niapisma, and Eskimo islands, and there are partial exposures on Clearwater and Ammonite points. Thickness is variable, and there is also a variable lithology from place to place. Sixteen feet has been measured on Eskimo Island, 22.5 feet on Large Island and 31 feet on Quarry and Niapisca islands.....

16-31

12. Sandstone and conglomerate, gray to white or yellow. Composed of quartz sands and pebbles together with some chert pebbles, cemented with lime carbonate. Pebbles are up to one inch in diameter, rarely 2 inches, and are composed of vein quartz and rarely chert. Locally the zone contains many fossils, among which are Camarotoechia orientalis and Hesperorthis ignicula. The zone has been seen on Parroquet, Large, Quarry, Niapisca, and Eskimo islands. The thickness is variable, ranging from 4 feet on Parroquet to 3 feet on Eskimo and 8 feet on Large Island.....

3.8

Unconformity
Romaine formation

11. Dolomite, bluish gray, weathers yellow. Most bedding planes irregular and undulating. Many beds are color laminated in different shades of gray or yellow, lamination not related to bedding. Some beds contain lenticular bodies of light-colored dolomite that resemble flattened pebbles. Other beds are almost entirely composed of domes of Cryptozoon steeli with domes up to 2 or more feet in diameter, but most up to 6 to 10 inches. The Cryptozoa beds were seen on Inner Birch, Large, and Eskimo islands. They are best shown on the northwest corner of Eskimo Island ~~several beds contain~~ ^{North} ~~large domes~~ and on the east side of Large Island (Pl. 1, fig. 2). One bed on the east side of Large Island contains common Bathyrurus romainensis, and on Eskimo Island several beds contain common Raphistomina laurentina. This zone is exposed on Inner Birch, Large, north edge of Niapisca and Quarry, and Eskimo islands. It may also be seen in Pillage Bay. Greatest thickness found for the zone is on Large Island. Base is drawn on the top of a shale zone, but it is not certain that this shale zone is always at the same level. The zone is 61 feet thick on Eskimo Island and 63.5 feet on Large Island (Pl. 3. fig. 2).....

63.5

- feet
10. Shale, black or greenish black to greenish blue. Seen on Large and Eskimo islands. No fossils seen..... 1.6-3
9. Dolomite, gray, compact, semiconchoidally fracturing. Chert local but not common. Seen on Large Island on the north side.... 12
8. Dolomite, dark and light gray mottled, crystalline and granular. Contains a little chert. So far as known this is exposed only on the west side of Clearwater Point and Pte. aux Morts. It is possible that some of the strata exposed on the shore between Betchewan Bay belong to this one, and it certainly must be present in the cliffs on the west side of Pillage Bay. Between Eskimo Island and Pte. aux Morts there is a concealed interval, but it is assumed that a part and perhaps the whole of this is represented in the exposure on the west side of Clearwater Point. Fifty feet is exposed on the west side of Clearwater Point, which thickness is certainly adequate to bridge the gap between Eskimo Island and Pte. aux Morts, and if this be added to the thickness exposed on Clearwater Point there will be a total of 75 feet, but it is not certain that all of this can be assigned to this zone. The thickness is placed at 60
7. Concealed. It is somewhat difficult to state the thickness that may be assigned to the concealed interval. It is assumed that 100 feet is concealed in the channel between Inner Birch and Harbour Island, and that 60 feet of this is exposed in zone 8. If this assumption of the concealed thickness is correct there would be 40 feet of which nothing is known..... 40
6. Dolomite, light and gray mottled, beds up to 3 feet thick, fine grained to medium grained, occasional low spired gastropods. Exposed on Harbour, Hunting, and Ste. Geneviève Islands. Probably also exposed on the mainland between Betchwan and Trilobite bays. 23
5. Dolomite, mottled in different shades of gray, thick bedded, more or less rough bedded. Some beds compact, light gray, fine grained; most are macrocrystalline. Thin layers of gray shale are occasional. Chert locally developed but not a great deal except in places where the bedding is very irregular and the strata have a kneaded appearance. There are occasional vugs and irregular bodies of white crystalline calcite (Harbour Island). Fucoids are not uncommon on some beds. Beds range in thickness from 1 to 32 inches. The kneaded appearance is perhaps to be associated with dolomitization; at any rate it does not seem likely that it is due to submarine springs, as suggested by Logan and Richardson. The zone is exposed on Harbour, Moutange, Moniac, Hunting, and Ste. Geneviève islands, and it probably may also be seen on the coast between Betchewan and Trilobite bays. The greatest thickness was found on Moutange Island

	feet
The greatest thickness was found on Moutange Island. Contains many dome-shaped structures which are assigned to an algal origin. Other fossils are poorly preserved cephalopods and low-spired gastropods.....	40
4. Dolomite, gray, shaly, seen on north side of Moutange Island.	3
3. Concealed, estimated at.....	10
2. Probably concealed, but may be represented in white quartzites or sandstones exposed on the east side of Pillage Bay, but these may be pre-Cambrian.....	8
1. Pre-Cambrian crystallines consisting of granites, pegmatites, various gneiss, and schists."	

Twenhofel, G.H.

Can. Geol. Survey, Memoir 154, 1927, Geology of Anticosti Island P. 3. "The quantities of structural stone that may be quarried ~~of~~ ~~are~~ ~~practically~~ ~~inexhaustible~~. Only limestones and sandstones are present; none of the varieties has any particular merit over other good average limestones or sandstones and not all of the limestones of the island are suitable for building purposes. The best stone of all is in the Chicotte formation in its exposures from Southwest point to rivière du Pavillon. The lighthouse of Southwest point was made from this stone. Sandstones of fine grained and of texture easy for trimming may be obtained on the north shore from Grindstone cape to Lousy cove. Blocks of almost any size desired are possible. This sandstone is very porous and would crumble rapidly if exposed to frost. Some layers of the sandstones of the north shore could be utilized for the manufacture of grindstones and perhaps other abrasive tools.

Stone suitable for ornamental purposes occurs in the Chicotte formation. This is about 70 feet thick and is exposed for about 3 miles west of rivière du Pavillon to a little west of Southwest point and in large part is a dense, thick-bedded, crystalline limestone which from a commercial point of view is a marble. Blocks could be quarried up to about 3 feet in thickness and of almost any horizontal dimensions desired. At all localities the rock is filled with stems of fossil crinoids and heads of fossils corals which in most cases differ in colour from the enclosing materials, so that on polished surfaces the pink and white stems of the crinoids, and honeycomb and chain arrangement of the corals give to the rock a unique beauty. The colours range from grey to flesh-red.

This stone closely resembles the well-known Hoburgen marble of the island of Gotland in the Baltic sea, which has been extensively quarried and used in Sweden and other adjacent countries. The two rocks are the same in origin and are not greatly different in characteristics.

Some of the limestones of every Anticosti formation, the Chicotte excepted, may contain the proper percentages of impurities to produce natural cements. Limestone and shale suitable for the manufacture of Portland cement are present at a number of places."

P. 15. " Above sea-level on the south shore of Anticosti there are represented two systems- the Ordovician and Silurian- with a total thickness of about 2,400 feet. The thickness varies with different sections, but on the whole the aggregate is about the same. The lowest 1,159 feet belong to the Ordovician system, embracing the three formations of English Head, Vauréal, and Ellis Bay. On the south shore the rocks of the Silurian system have a total thickness of 1,205 feet, distributed among the four formations composing the system. As both base and summit of the section are concealed by the sea, the total thickness of these two systems may be much greater than has been measured.

Table of Formations

In the following table, after the formation name, are indicated the corresponding divisions of Richardson's section:

6	Chicotte (F 1-4)	Limestone, 73 feet	
	Niagara	Jupiter (D 9-10, E 1-10)	Limest. & Shale foll. by lim. 653'
Silurian	Anticostian	Gun River (D 2-8)	Alternating limest. & shale, 303 feet.
		Becscie (C 12-14, D 1)	Limest. with shale partings, 199 feet
		Ellis Bay (C 1-12)	On south shore, s&l
	Gamachian		On north shore, san foll. by lim. 200'
Ordovician		Vauréal (B 1&11)	Lim. and shale in- terbedded, 730'
	Richmondian	English Head (A 1-6)	Limestone and sha- le, 228 feet.
	Monawkian	Macasty	Black shale.

CHARACTER OF THE SEDIMENTS

The sediments vary in character throughout the section and the variation is not systematic.

Limestones

The rocks of Anticosti are more than one-half limestones which for convenience may be classified as argillaceous shell, coral-crinoid, compact, and crystalline limestone.

Argillaceous limestones are by far the most common, particularly in the lowest 1,000 feet of the sequence. The upper half of the Gun River formation also contains great thickness of this type. As a rule the colour is grey, and the thickness of an individual bed rarely exceeds 6 inches. In most cases the bedding planes are irregular.

Shell limestones and shell breccias occur in limited quantities at many horizons, and nearly every bed of limestone is locally a mass of shells. Limestones of this type are particularly prominent in the upper half of Becschie formation in which, on the south side of the island, there is a zone more than 50 feet thick locally almost wholly composed of the shells of *Atrypa*, *Stricklandinia*, and *Pentamerus*, and in places broken crinoid stems make up large parts of the Chicotte formation. Also there is a zone in the Ellis Bay formation almost completely made up of shells of *Parastrophis reversa*.

Coral limestone occurs at many levels, formed of entire or comminuted corals, in some cases to the almost total exclusion of other organic remains. The English Head and Vauréal formations contain large masses of coral and coral heads. The Ellis Bay formation contains the lowest coral reef limestone. This has a thickness of about 5 feet and the coral masses rise like ant-hills on the present wave-cut reef. The common species belong chiefly to the genera *Clathrodictyon*, *Paleofavosites*, *Lyellia*, and *Halysites*. The northern shore outcrop of this zone is not a reef, but coral abounds, and there is a small reef on Vauréal river. Small reefs are in the Becschie, Gun River, and Jupiter formations, the total thickness of coral in the three formations probably exceeding 50 feet. It is in the Chicotte formation, however, that the corals make their greatest record, and here they occur in association with a great abundance of crinoid fragments. Locally the entire thickness ~~(73)~~ (73 feet) appears to be a structureless mass of *Favosites*, *Clathrodictyon*, *Halysites*, and other genera, one overgrowing the other and with included fragments of crinoid stems.

Compact limestone is well bedded, light coloured, very compact extremely fine grained, turns yellowish white on exposure, and has a somewhat conchoidal fracture. This limestone appears to be that which Richardson described as bituminous. This rock contains few fossils, except on the surfaces of the beds, where in some cases they are thickly crowded, although mostly consisting of fragments. The

The larger part of the lower half of the Beesie, the lower part of the Gun River, much of the upper part of the Jupiter, and considerable parts of the upper third of the Ellis Bay formations are composed of this class of rock, and small thickness exist in each of the other formations except the Macasty and Chicotte.

Crystalline limestone is found in the Chicotte formation alone. Parts of this formation are "marble" with almost all fossils destroyed. The rock is compact, of fairly coarse texture, and has probably been diagenetically changed from the organic matter of which it was originally largely composed.

Extensive studies of the Anticosti limestones were made for the writer by Mr. A. W. Weeks, and these have shown that each limestone bed studied has a remarkable degree of individuality in its texture and constituents; and so far as studied no two beds have been found which are alike.

Sequence of Sediments

Macasty Black Shales

The lowest known rocks of Anticosti are the soft, black, highly bituminous shales of which fragments are found in the material composing the beach about the northwest end. At Makasti cliff was found a block weighing fully 500 pounds, from which five species were collected. The occurrence of this rock was first noted by Logan in 1863, who considered it the probable equivalent of the Utica of New York state.

Fragments from this horizon have been found only along the north shore eastward from English head for about 75 miles, and they make their largest contributions to the beach materials adjacent to the southern end of a submerged north-south trending divide which crosses the north channel from near Makasti bay to the western end of Mingan islands, suggesting that the parent formation outcrops on this ridge and possibly lies only a short vertical distance beneath the lowest visible strata of Anticosti. How thick it is, upon what it rests, and its stratigraphic and structural relations to the English Head formation are altogether unknown; but it is considered probable that it is disconformable either to the English Head formation or to one which may lie below the latter.

English Head Formation

So far as known, the black shales are directly followed by the alternating beds of blue, grey, and green shales, and argillaceous and other limestones of the English Head formation. Many of the limestones are made of entire or fragmentary shells, particularly the latter, and intraformational and other conglomerates with pebbles, boulders, and slabs of lime-

stone are marked features of the formation from base to summit. Irregular ripple-marking is present on many surfaces, and many beds are merely lenses of short kilometer. Heads of *Paleofavosites prolificus*, some of which attain diameters of 2 feet, occur on almost every level, and *Buthotrephis* impressions are extremely abundant. The topmost bed of the formation is a fine-grained, subcrystalline limestone covered with cylindrical paired impressions (*Saerichnites abruptus*), supposed by Billings to be tracks. These are so thick that hardly a square yard can be found that is not marked by them. No other fossils are known to occur in this bed.

The type section for the formation is at English head, the bold promontory on the northwest end of Anticosti. The base of the formation is not exposed. The upper limit, known as the "track bed" has its western terminus in the back of baie Ste. Claire and its eastern extremity passes beneath the sea at the foot of Observation cliff. Here it was seen by Richardson in 1856 and by the writer in 1909 and 1919, and it probably does not appear east of that point. At many points between its most eastern and most western determined limits- White cliff, High cliff, West cliff, Makasti hill, and elsewhere- this bed is well exposed on the reef. On other parts of the coast it is high in the cliffs or inland.

Vauréal Formation

The Vauréal formation was described by Schuchert and Twenhofel as the Charleton, in the belief that the strata in the cliff at Carleton (Charleton) point belonged to it. This view has been found to be incorrect, making necessary the renaming of the formation. Lithologically the formation is little different from the preceding, save perhaps that corals become more abundant. Some individual heads attain diameters of 2 feet, Ripple-marking is commonly present, and there are many *Buthotrephis* impressions. Shale is thought to make a greater proportion of the thickness on the north coast with about 100 feet of poorly fossiliferous shale whose equivalent on the south side consists of grey limestones and sandy shales.

Richardson's section on the south shore gives to the formation a thickness of 730 feet. The Vauréal River section is 541 feet thick with the concealed, in which it is probable that about 200 feet occur, so that the thicknesses on opposite coasts do not greatly differ.

The type section is that exposed on Vauréal river, where the sequence given on pages 44-46, 48-51 occurs. On the west ~~side~~ end of Anticosti the section begins in the back of baie Ste. Claire and extends around West point southeastward to Junction cliff, a distance of about 7 miles. The other extremity forms the coast from Observation cliff to point Joseph, where its summit is placed at the top of a sandy shale exposed on the west side of the headland.

Practically every foot of the sequence of the north coast is exposed in broken-down cliffs, and these are supplemented by splendid exposures in the cliffs of Vauréal and MacDonald rivers and rivière à l'huile. On the western end of the island the exposures are on the reefs and in a number of elevated cliffs about 150 yards from the shore. Plenty of rock is exposed on the reef, but the fossils are usually so worn as to be worthless, and in the old cliffs the overgrowth of vegetation on the talus favours neither the exposure nor preservation of the fossils.

It would be possible to place both this and the English Head formation in a single division, but the rarer occurrence of limestone conglomerates with fragments of large dimension and the greater proportion of shale are features of difference and the presence of the "brack bed" gives a convenient place of separation. The faunas merge into each other, but new species appear in the Vauréal formation and some of those of the English Head drop out so that the separation into two formations seems justified.

Ellis Bay Formation

(L) In the coastal exposures of the north shore the Ellis Bay formation contains much sandstone, in some beds of which there is an abundance of *Beatricea* and *Paleofavosites*. In some beds the sands are greatly cross-laminated, and two beds, one of which is a channel filling, consist of quartz pebble conglomerate. On Vauréal river, not over 25 miles to the west, there are no sandstones, but the strata consist of shale and limestone in which are layers containing pebbles of limestone. Rather exact correlation is possible for all three sections, because of the occurrence in each section of a nodular shale of which the large gastropod *Hormotoma gigantea* is characteristic. On the south side and in the Vauréal River section, the *Hormotoma gigantea* shale is continued upward in a coral reef which is represented in the north coast by impure limestone ~~of a very fossiliferous~~ shale and sandstone containing coral heads. Considered as a whole, the rocks of this formation are not markedly calcareous, the limestone as a rule occurring as thin bands separating thicker bands of shale (South coast) or sandstone (North coast). Ripple-marking is not uncommon in all three sections, and some of the ripples are of large dimension.

The formation varies considerably in thickness. It is about 200 feet thick at Ellis bay and vicinity. On Vauréal river 124 feet are assigned to the formation, with the possibility that part of the 200-foot zone below the falls may belong thereto. The thickness of the north shore section is about 300 feet.

(L) Read the following after the period: Limestone pebbles and boulders also occur in the sandstones of cape James. On the south coast the sandstones of the north find their equivalent in highly calcareous shale (L) and thin limestone. Rather.....

On the west end of the island this formation begins with the lowest beds exposed at the base of Junction cliff, the first prominent headland east of West point. The highest beds form the lower part of cape Henry, the west horn of Ellis bay. The indentation of Ellis bay gives a second excellent exposure of the upper six zones of the formation, extending its outcrops to Bear cliff, the east horn of the bay. The northern exposures are best developed about Prinista bay, but begin at the base of the cross-bedded sandstones of point Joseph and extend southeastward to the east side of Lousy cove, forming Grindstone cliff, cape James, and Table head. The extent of the exposures is about 12 miles. On Vauréal river the formation is thought to form the rock making the upper part of the canyon at the falls, and thence included nearly all the strata exposed in the upper part of the river.

The line between the Ordovician and Silurian is drawn at the top of this formation. A break in deposition is thought to have occurred, as succeeding deposits begin with conglomerates, and ripple-marks and other features of the surfaces of the strata show that there was a decided shallowing of the water; and if there was not exposure, it seems very probable that the bottom was brought to a depth above the profile of equilibrium for the conditions and was eroded. There were sufficient changes in the environment to bring about the extinction, modification, or migration of most of the Ellis Bay fauna.

(1) An analysis of the calcareous shales of Ellis bay gave the following:

	1	2
SiO ₂	'20.700	'20.800
Al ₂ O ₃	'12.279	' 7.345
Fe ₂ O ₃	' 2.771	' 2.355
CaO.....	'33.200	'34.600
MgO.....	' trace	' trace
I't'n loss.....	'31.500	'32.600
SO ₃	' 0.800	' 1.300
Total.....	'100.250	'100.000

Made at the School of mines of Paris from specimens taken from White cliff, Ellis bay, and kindly furnished by Mr. George Martin-Zédé.

Becsacie Formation

On both sides of the island the deposition of compact and granular limestone initiated the Becsacie formation, which with progress upward largely becomes a shell breccia, but grades near the top into shales and impure limestones holding many coral heads and masses. Limestone pebble conglomerates enter into the record on both sides of the island, and ripple-marking is common.

The type section of the formation is in Becscie River bay, in the vicinity of which almost the entire section can be seen. Its base and most western exposure are found at Bear cliff and cape Henry whence, with some interruptions due to the appearance of beds of the succeeding formation, it makes the shore to the mouth of Otter river, a total distance of about 25 miles. On the north shore the line of separation between this and the preceding formation is placed just west of Fox point, and its upper limit is placed on the east end of Wreck beach on Innommé bay. The length of the outcrop is about 12 miles. Concealed areas and inaccessible cliffs do not favour collecting in parts of the formation on the north side of the island. The thickness is around 200 feet.

Gun River Formation

An abundance of corals is a prominent feature of the basal Gun River formation at its western extremity. This feature is wanting in the equivalent on the north shore, which is represented by compact limestones with thin shales. The sequence is continued on both sides of the island in alternating beds of shale and limestone, in which are a great number of zones of coral in reef-like masses or isolated heads. This formation has many beds of intraformational and flat pebble conglomerate and near the middle of the formation on the south shore these are rather striking features of the cliff exposures. The roughness and irregularities of the bedding planes suggest very shallow waters.

At the western extremity this formation is excellently exposed in the many low, and a few high, headlands of the coast extending from Ste. Anne cliff to within about 6 miles west of Jupiter river. A large part of the formation can readily be seen in the cliffs in the vicinity of the mouth of Gun river, and for a short distance up the stream there are excellent exposures of the higher beds. The eastern limits of the formation are exposed from Wreck beach on Innommé bay to cape Sandtop. It is not completely known in these exposures because of inaccessibility.

In previous papers by the writer and in the paper by Schuchert and Twenhofel, beds to the west of Jupiter river with a thickness of about 60 feet were assigned to this formation. These beds are characterized by an abundance of fossils, among which are *Bilobites bilobus*, *Coelospira hemispherica*, *Triplecia insularis anti-costiensis*, *Clorinda linguifera*, *atrypa reticularis*, and others. The strata containing these fossils are unlike those of the other parts of the Gun River formation, but are like those of the overlying Jupiter formation in which are also found the same fossils. For these reasons in this paper the strata have been referred to the Jupiter formation.

Jupiter Formation

The basal strata of the Jupiter formation on the south side

consist of very fossiliferous shales and limestones, following which in the western exposures there are about 100 feet of nearly unfossiliferous shale. No similar shale zone occurs in the eastern exposures. Above the unfossiliferous shale zone are calcareous shales and soft limestones which are succeeded upward by compact limestones. Locally, these limestones have zones of shell limestone, several of which are composed of the shells of *Stricklandina* and *Atrypa*.

The type section of this formation is in the high headlands that guard the entrance of Jupiter river to the sea. The western exposures begin about 6 miles west of the mouth of Jupiter river and extend eastward to about 1 mile west of Southwest point. The formation is again exposed at the Jumpers, where a low anticlinal swell brings up the higher beds. The length of the exposures is about 7 miles; they are extremely good, and an abundance of fossils can be collected. On the east end of the island the coast is formed of Jupiter reefs in the 60 odd miles extending from cape Sandtop eastward to East cliff and westward to *rivière du Pavillon*. There are many exposures, which are separated by an equal number of concealed areas of greater length than the exposures. The strata are quite undulatory and much of the shore is on the strike, so that in following its windings, both ascent and descent are made in the section. Many fossils can be collected in these exposures, and it is no exaggeration to state that a carload of *Atrypa reticularis* could easily be obtained.

Chicotte Formation

The Chicotte crinoidal and reef limestones in their lithology are rather markedly different from any that have preceded, although there is an even but rapid transition from the limestones of the upper Jupiter. In many places the rock is a pure coral limestone; in others it is formed locally of the broken stems of crinoids. Some parts of the formation are highly crystalline. Much of it is structureless, unless the plastering of *Favolites*, *Halysites*, and *Clathrodictyon* over each other be considered structure.

This formation has its most western exposures about 1 mile west of Southwest point and with many concealed areas extends eastward almost to *rivière du Pavillon*, a distance of about 35 miles. Its base has been seen in contact with the beds of the preceding formation at the Jumpers and near *rivière du Pavillon*, and its upper horizon passes beneath the sea. The beds are extremely undulating, due to causes already described. The best exposed and most continuous section is the type section on Chicotte river. The exposed strata of the formation have a thickness of 73 feet.

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 by
 W. Warren Longley
 1945

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Table of Formations

Quaternary	Pleistocene and Recent	Till, marine sed- ments, river gravels.
Great Unconformity		
Paleozoic	Silurian and Ordovician	Limestone Shale Sandstone
Great Unconformity		
Precambrian	Post Grenville Intrusives	Pegmatite Granite Gabbro
	Intrusive contact	
	Probable recryst- allized Grenville sediments	Banded gneiss and augen gneiss
	Grenville (?)	Quartzite and quartz biotite schist