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GYPSUM DEPOSITS OF THE MAGDALEN ISLANDS

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SPECIAL PAPER 7

GYPSUM DEPOSITS

of the

MAGDALEN ISLANDS

by

Marcel Tiphane

MINERAL DEPOSITS SERVICE

QUÉBEC
1970

QUEBEC DEPARTMENT OF NATURAL RESOURCES

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INTRODUCTION

General Remarks

The gypsum of the Magdalen Islands has been known for a very long time. In his report of 1881, Richardson[1] mentions that "the owners of vessels who do business on the islands have sometimes loaded gypsum for the return trip". It seems, however, that, because of careless exploitation, this gypsum acquired a poor reputation on the market, with the result that no one since then has had a real interest in these deposits, although favorable recommendations were made from time to time by, among others, W.F. Jennison[2] in 1911 and G.W. Waddington[3] in 1947.

Recently, the report (1966) of the BAEQ (Office for the Development of Eastern Quebec) emphasized the presence of this gypsum and requested a feasibility report on the various deposits. Hence, the possibility of exploiting these deposits is the object of this report.

Location and Means of Access

The Magdalen Islands form an archipelago composed of 15 islands located in the middle of the Gulf of St. Lawrence. Most of the 13,000 residents (1967) live on the three islands of Havre Aubert (Amherst), Cap aux Meules (Grindstone) and Havre aux Maisons (Alright). The other settled islands are Entrée (Entry), Loup (Wolf), Grosse Ile, and Coffin.

The Magdalen Islands are accessible by boat, or aircraft. A boat of Magdalen Island Transportation Company sails three times a week (four times in July and August) between either Pictou (N.S.), Charlottetown or Souris (P.E.I.) and Amherst or Cap aux Meules. A boat of La Coopérative de Transport Maritime et Aérien (C.T.M.A.) sails every two weeks between Montreal and the Magdalen Islands, passing by Quebec and the Gaspé peninsula. Eastern Provincial Airways has daily schedules (two flights a day during the summer) between the islands and Charlottetown (P.E.I.) and Moncton (N.B.). Moreover, air transportation between Gaspé and the islands is provided by Air Gaspé. The airport on the islands (House Harbour) is at the northern extremity of Havre aux Maisons island.

All the islands except Entrée are joined by tombolos, locally called dunes; the roads follow these sand barriers. Entrée island is reached by ferry-boat from Havre Aubert or Cap aux Meules (Grindstone).

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(1) RICHARDSON, J. (1881), Report of a geological exploration of the Magdalen Islands: G.S.C., Rept. Prog., 1879-1880, G 1-11.

(2) JENNISON, W.F. (1911), Report on the gypsum deposits of the Maritime Provinces; Ottawa Dept. of Mines, Mines Branch No. 84, pp. 98-102.

(3) WADDINGTON, G.W. (1947), Gypsum Deposits of the Magdalen Islands; Que. Dept. of Nat. Resources, Manuscript G.M. 10456.

Field Work

During the summer of 1967, the author made a survey of all the outcrops of gypsum of the islands of Havre Aubert, Cap aux Meules, Havre aux Maisons and Entrée. The associated rocks were mapped and, in some cases, the topography was established. A few holes were drilled during the month of August with the equipment of the Hydrogeology Service of the Quebec Department of Natural Resources.

Aerial photographs (1963) of 1:15,840 scale and also a base map of the same scale were used in this work; these were supplied by the Photogrammetry Branch of the Department of Lands and Forests. For detailed work, a transit and level were used.

Acknowledgements

The author was assisted in his work by a local student, Hilaire Thériault. His knowledge of the area saved precious time, especially in obtaining permissions to drill. The author is also grateful to the party of Raynald Dessureault of the Hydrogeology Service of the Quebec Department of Natural Resources for cooperation when the drilling was done in the month of August.

GEOLOGY

The geology of the Magdalen Islands has been studied several times since 1880. The most recent geological study was made by Sanschagrin[1] in 1960.

The rocks of the Magdalen Islands belong to two formations: that of Havre aux Maisons of Mississippian age and that of Cap aux Meules of Permo-Carboniferous age, which lies unconformably on the Mississippian. The rocks of the Havre aux Maisons Formation outcrop principally in the eastern part of Entrée island and in the axial zone of the open anticlines which cross Havre Aubert island in an east-west direction and the islands of Cap aux Meules and Havre aux Maisons in a N.80° E. direction.

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(1) SANSCHAGRIN, R. The Magdalen Islands, G.R. No. 106, Department of Natural Resources, Quebec, 1964.

PLATE I

A) Coarse-grained agglomerate, porous matrix with secondary carbonate, Havre-Aubert.

B) Gypsum outcrop, Bassin, Map B-927, Havre Aubert island.

The gypsum deposits studied are confined to the lower member (Cap Adèle) of the Havre aux Maisons Formation. Gypsum is also noted in the upper member of the same formation, which outcrops only in the southern part of Entrée island.

The rocks of the Cap Adèle Member are predominantly of volcanic origin. The lavas are principally basalts but rhyolites are also found. The pyroclastic rocks, tuffs and agglomerates are as abundant as the lavas. They are composed of fragments of various sizes up to one foot in diameter (Plate IA).

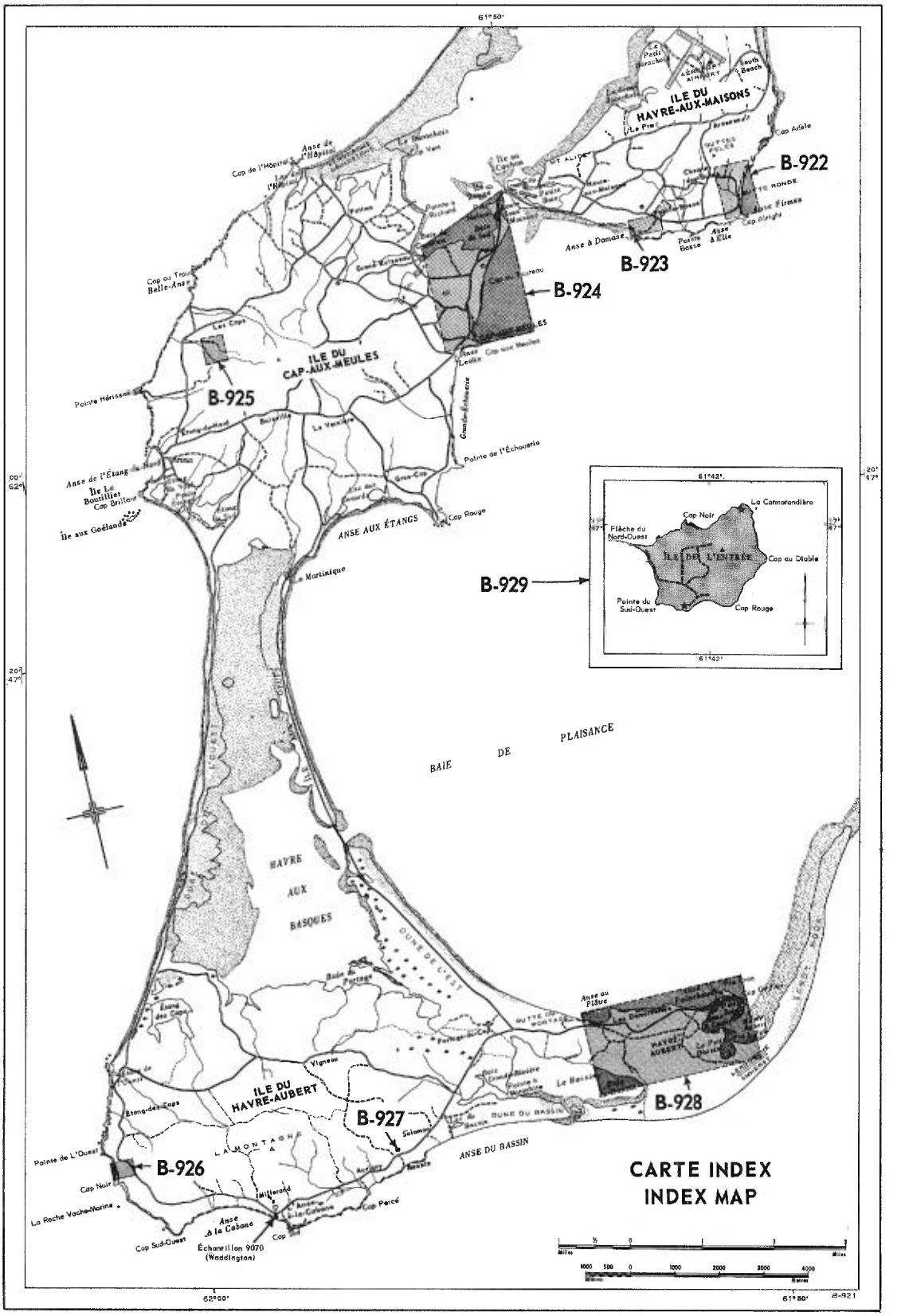
The lavas are usually brecciated and intensely altered. The disintegration of these rocks is characteristic; many small quarries, worked especially for road building, have been excavated with a mechanical shovel without the use of crushers. However, the material has very sharp angles and is hard on tires.

When present, the tuffs, which are generally very light colored, facilitate the interpretation of structure. The agglomerates, as seen on Plate IA, are more or less disintegrated according to the size of the fragments. The cement is porous, and carbonates of secondary origin have been introduced.

The sedimentary rocks are interbedded with volcanic rocks. They are mainly red or gray-green argillites or shales. The gypsum deposits are generally associated with the argillites which, nearby, are veined with fibrous gypsum. These argillites disintegrate readily and, when they are veined, a network of projection veins occurs.

Gypsum

Three main forms of gypsum were found. The granular variety, in white or slightly tinted, strongly deformed, stratified layers, is the most common; these layers are in the upper part of the Cap Adèle Member and are apparently a few feet thick. The fibrous variety (satin spar), generally also white, is seen on the sides of the granular gypsum strata in a red to gray argillite; it forms veins which cross one another in all directions and which may reach 6 inches in width, although they are generally not more than 1 or 2 inches wide. Finally, the variety selenite, in colorless and transparent sheets, was found in druses and more rarely within the gypsum strata themselves. These two latter varieties in fibers and sheets were seen only on the cliffs near the seashore. The object of this study will be the granular variety with saccharoid or compact texture in beds apparently several feet thick.


61°50'
ÎLE DU HAVRE-AUX-MAISONS
B-922
B-923
B-924
ÎLE DU CAP-AUX-MEULES
B-925
B-929
61°42'
Cap Noir
La Commandrie
Flèche du Nord-Ouest
ÎLE DE L'ENTRÉE
Cap au Diable
Pointe du Sud-Ouest
Cap Rouge
ANSE AUX ÉTANGS
BAIE DE PLAISANCE
HAVRE AUX BASQUES
ÎLE DU HAVRE-AUBERT
B-926
B-927
B-928
ANSE DU BASSIN
CARTE INDEX
INDEX MAP
62°00'
61°50'
8-921

Because of deformation, the gypsum deposits studied are seen in masses of variable size from 25 feet to a few hundred feet. The form may vary, but usually the exterior flanks are vertical or almost so. In some cases, there is downward convergence as in a diapir fold. The strata within these deposits are apparent and, in many places, illustrate a very complex structure as a salt dome. All kinds of small folds and displacements can be seen, which fact demonstrates the mobility of this rock. On the other hand, the structure is relatively simple at some locations. Needless to say, these structures are only visible on the outcrop with strong inclinations, as in shore cliffs.

Gypsum deposits have been followed in the interior of the island along funnels more or less aligned and easily found on the surface; these funnels result from the great solubility of gypsum. The horizontal outcrops illustrate this phenomenon rather well. They contain numerous cylindric holes several feet in diameter.

Analyses of the gypsum of the Magdalen Islands have already demonstrated the absence of anhydrite[1]. The almost complete absence of carbonates was readily determined by the lack of effervescence in hydrochloric acid. There are, nevertheless, a few impurities which make the stratification stand out: they are very thin beds of red of grayish green argillite of the order of 1 or 2%, according to locations. Chemical analyses reported by Waddington[1] follow.

The absence of anhydrite in the deposits of the Magdalen Islands distinguishes them from the deposits already being mined in the Maritime Provinces[2] where the anhydrite is present in extremely variable proportions, resulting in a decrease in value of these deposits. On the other hand, the structure of the Magdalen Islands deposits is very complex, whereas it is quite simple in the Maritimes deposits.

Even though the deposits of the islands are found in formations of the same age and seem to be of the same origin, they are very different because of modifications which occurred since their formation. The deposits of the Maritimes are remarkably continuous compared with the deposits of the Magdalen Islands. A few drill-holes have proved this point; vertical holes, 100 feet deep, around two of these deposits were unproductive, as were two holes near a well where gypsum had been noted. It would appear that these deposits are lenticular and have a very limited extension, which leads to the assumption that, in most cases, what is seen at the surface is about all that is left in the Magdalen Islands.

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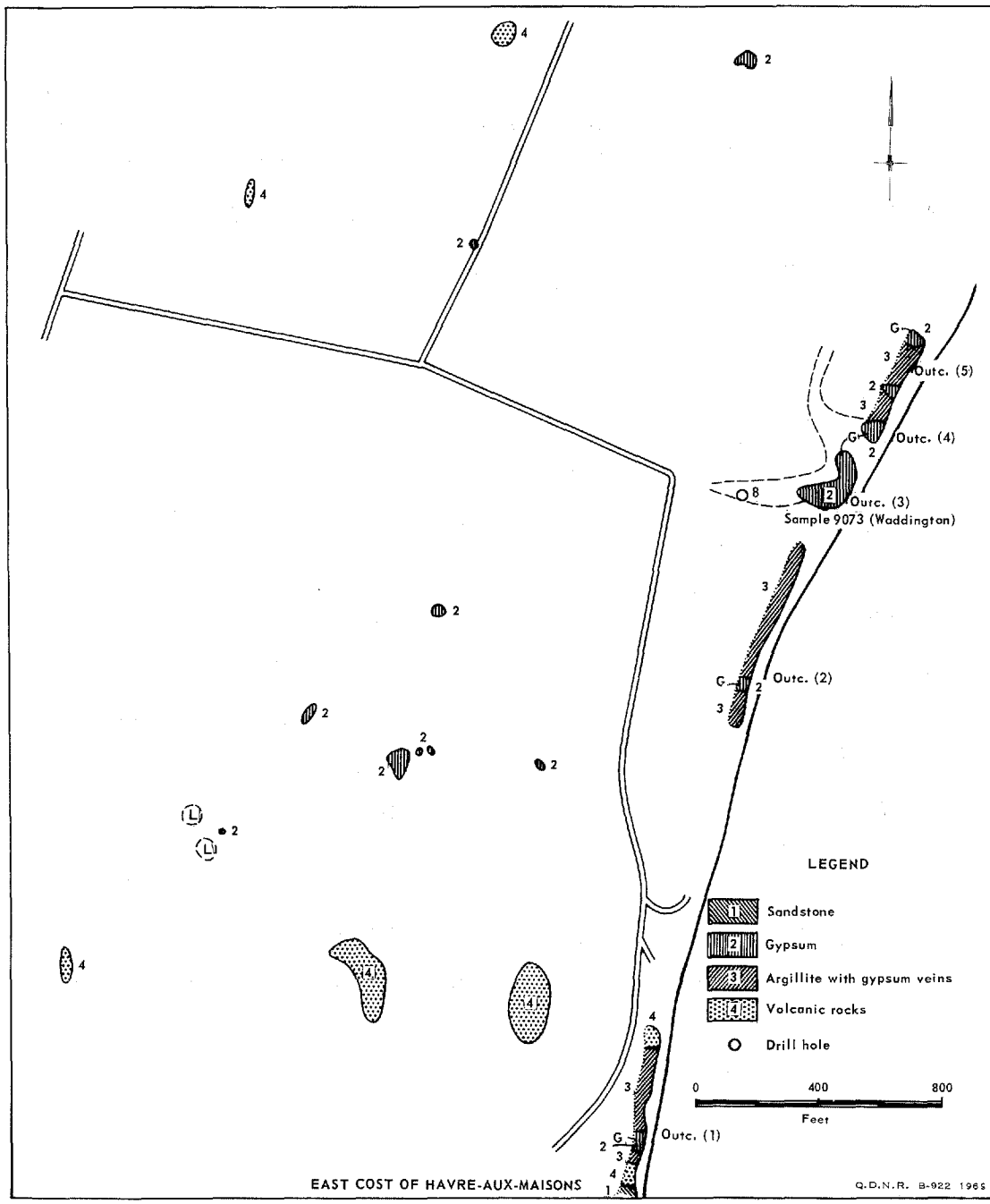
(1) WADDINGTON, G.W. Op. cit.

(2) COLE, L.H. Gypsum in Canada: Canada Department of Mines, Mines Br. No. 245, 1913, Ottawa.


Outc. (5)
Outc. (4)
Outc. (3)
Sample 9073 (Waddington)
Outc. (2)
Outc. (1)
LEGEND
1 Sandstone
2 Gypsum
3 Argillite with gypsum veins
4 Volcanic rocks
Drill hole
0 400 800
Feet
EAST COST OF HAVRE-AUX-MAISONS
Q.D.N.R. B-922 1965

CHEMICAL ANALYSES OF GYPSUM SAMPLES FROM THE MAGDALEN ISLANDS (WADDINGTON, 1947)

	Sample 9070	*Sample 9071*	*Sample 9072*	*Sample 9073*	*Sample 9074*
Water (free)	0.21	0.14	0.12	0.23	0.10
Water (combined)	18.25	19.55	20.18	18.76	19.82
Carbon dioxide (CO_2)	0.61	1.00	0.36	0.64	0.85
Silica and solubles (SiO_2)	2.37	0.80	0.38	0.34	0.67
Sesquioxides* (R_2O_3)	0.50	0.29	0.23	0.23	0.36
Lime (CaO)	32.44	33.16	32.63	33.02	32.69
Magnesia (MgO)	0.00	0.00	0.00	0.00	0.00
Sulfur trioxide (SO_3)	45.63	45.05	45.86	46.62	45.62
Sodium chloride (NaCl)	0.11	0.01	0.03	0.02	0.03

* Nitric oxide, precipitated ferric oxide, alumina, titania, phosphoric pentoxide, manganic oxide, etc.

NOTE: Sample locations are shown on maps B-921, B-922, B-924, B-925 and B-927.

DETAILS OF THE DEPOSITS

I- Havre aux Maisons Island

EAST SIDE: The map of this zone (Map B-922) shows six outcrops of gypsum near the shore. Five of these outcrops are worthy of mention. The outcrops are 20 to 80 feet wide and 25 to 100 feet high and have depths of 50 to more than 100 feet. It was never possible to prove with certainty their extension into the interior. However, the funnels, which seem to be the result of dissolution of the gypsum base, allowed for near-certain tracing of some of these outcrops. Experience acquired on this region has shown that, where there are no funnels, gypsum does not exist, at least near the surface. The only outcrop on this shore showing a dip of the formation toward the interior is located north of the limits of map B-922. A drill-hole sunk on the supposed extension of outcrop (3) has shown that the dip is toward the sea.

The gypsum of these outcrops contains almost no impurities and could be of interest to a company requiring a few thousand tons. At present (1967), beach gravel is being transported from this area. The trucks can move quite easily, so that gypsum could be recovered without any expense of drilling or exploration. Blasting would be the only expense before loading and transporting by truck to the wharf at Cap-aux-Meules, a distance of seven miles.

An estimate of tonnage of gypsum on each of these outcrops can only be very approximate. The author used the value of 14 cubic feet per ton in his calculations.

Outcrop (1), the most southerly, with an estimated depth of 25 feet, would have a volume of 75 by 25 by 25 feet and could then supply a minimum of 3,000 tons.

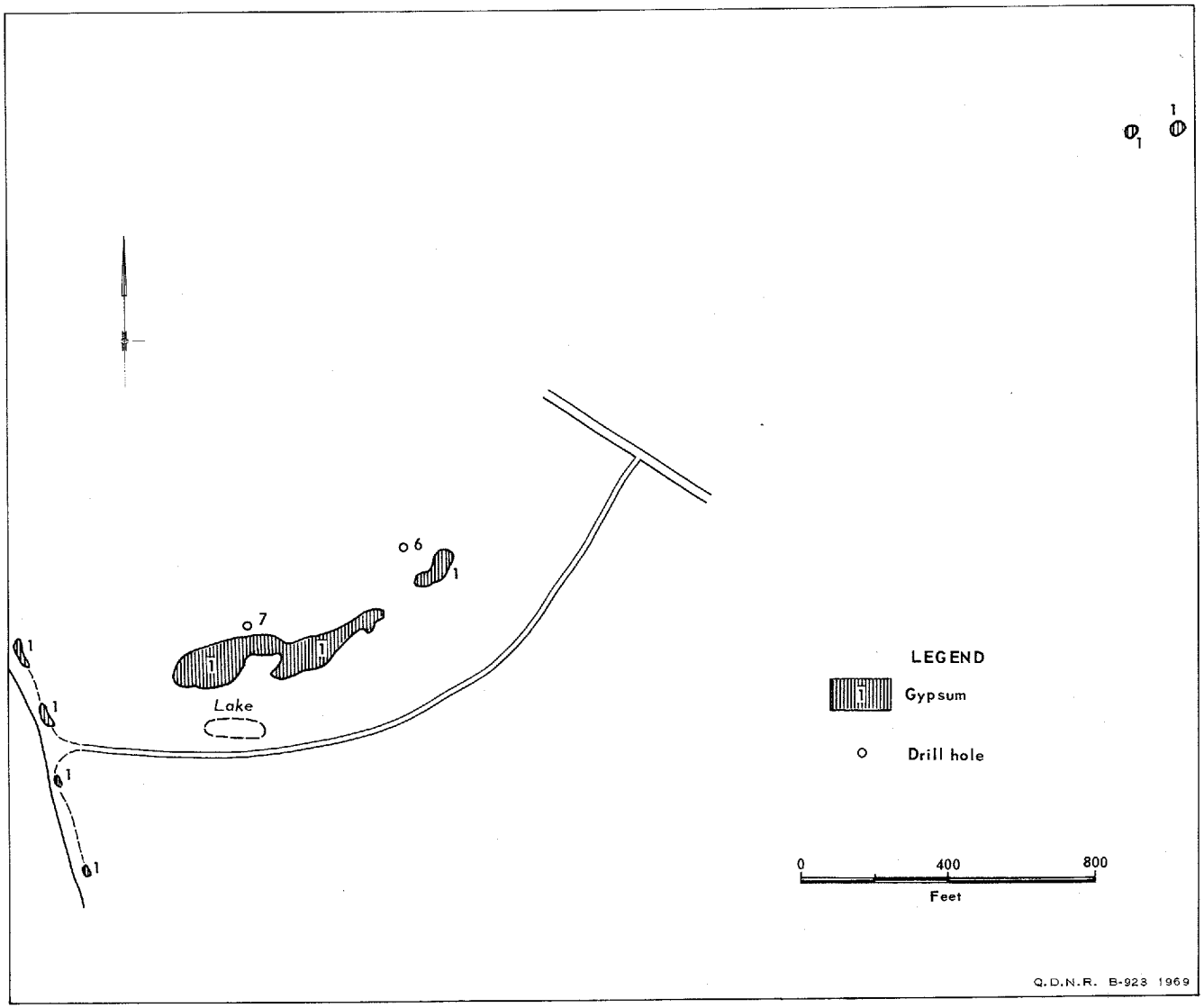
Outcrop (2), under the same conditions, would have a volume of 50 by 25 by 25 feet and could yield 2,000 tons.

Outcrop (3) has two branches. The south branch, as far as hole (8), is 300 feet long and could yield 10,000 tons. In this case, however, there is danger of dilution by the argillaceous cover, as one approaches the drill-hole. At this latter point, there is a cover thickness of 15 feet. The extension of the north branch could not be verified. If the north branch has a depth of 50 feet, it should contain about 3,000 tons. Outcrop (4) is smaller and should yield about 1,500 tons under the same conditions.

PLATE II

A) Gypsum, outcrop (1), Map B-925, Cap aux Meules island.

B) Gypsum, outcrop (2), Map B-925, Cap aux Meules island.


1
1
1
6
1
7
1
1
1
1
1
Lake
LEGEND
Gypsum
Drill hole
0
400
800
Feet
Q.D.N.R. B-923 1969

Outcrop (5) could yield only a few hundred tons and, moreover, it would be very difficult to reach. It has not, therefore, been added to the readily recoverable tonnage.

Finally, the outcrop located north of the map limit would also contain a few hundred tons of gypsum. There also, access is difficult and this deposit will not be included in the calculations.

In summary, this cliff contains more than 18,000 tons of good gypsum that could be freed by gravity with little blasting. This estimate includes only the gypsum above sealevel. Trucks have easy access to each of the outcrops.

The gypsum outcrops located in the interior, with the exception of a small one near the road, are not easily accessible. The initial expenses for mining a small quantity of ore would probably be too high.

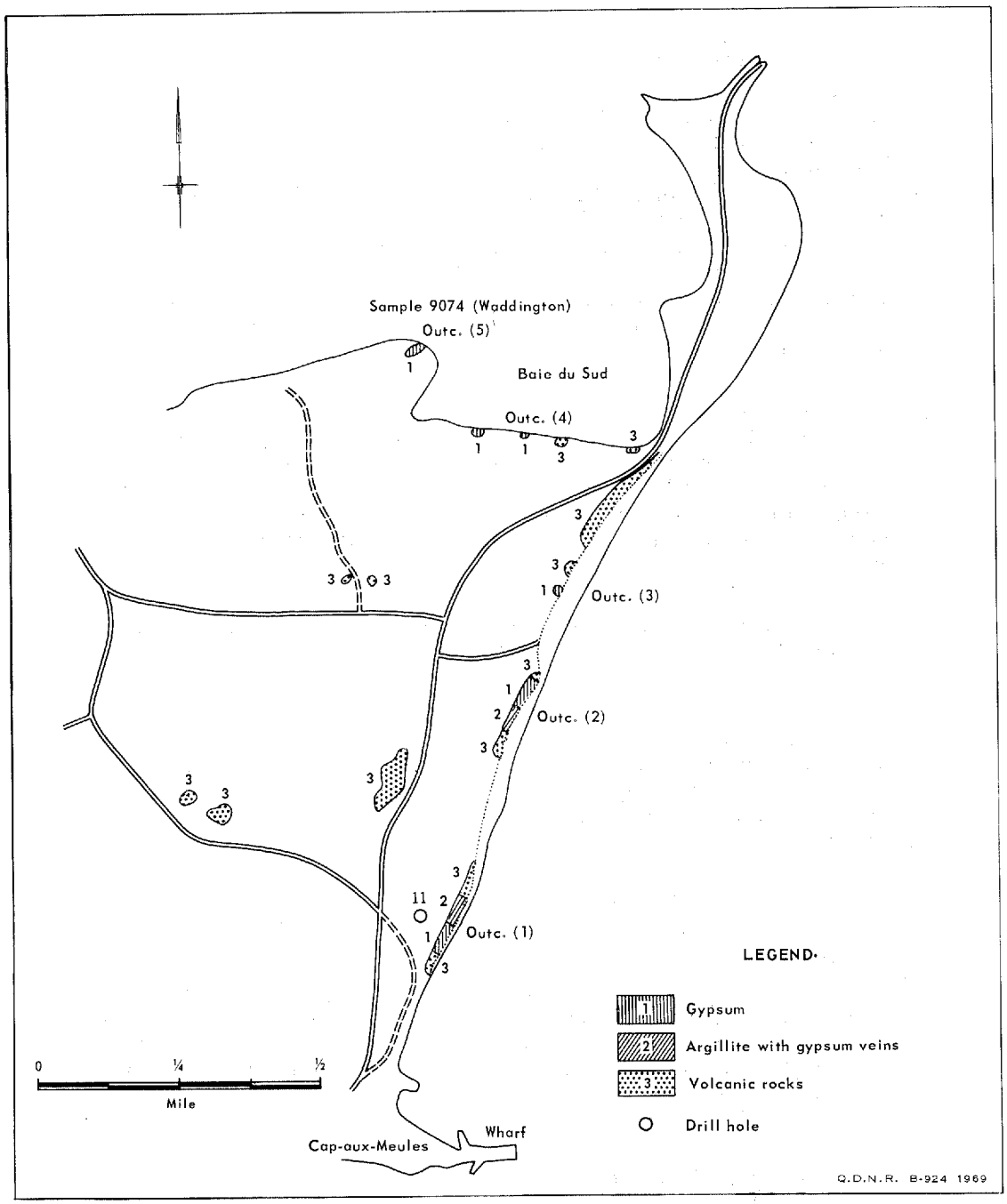
Mention here has been made only of the locations and the respective tonnages where the gypsum is visible and ready for mining. The author does not wish to imply by any means that there are no other gypsum deposits in this part of the area. On the contrary, it would be normal to trace the extension of the formation at depth with drill-holes near the outcropping gypsum.

SOUTH SIDE: Map B-923 shows four small outcrops of gypsum near the shore. The cliffs in this part of the cost are low and none of the outcrops arouse any interest because of their small size. However, for 1,200 feet from the coast in a N.60° E. direction, other outcrops of the same unit are found at an elevation of less than 50 feet above sealevel. Because of the extent of these outcrops, they have been given special attention. The structure is difficult to interpret. Along the coast there appears to be a series of anticlines and synclines. To confirm this interpretation, two holes were drilled near the main outcrop. These holes led to the supposition that these outcrops are remnants of erosion, the remainder of the gypsum having been dissolved as the funnel-shaped topography indicated. There would thus be only a few hundred tons of gypsum at this locality.

The other outcrops of gypsum in the interior of Havre aux Maisons island may be considered as relics of a formation now gone; however, no drilling was done in these vicinities and the extension of this formation could very well be traced.

II- Cap aux Meules Island

Cap aux Meules island has two groups of outcrops (Index Map): along the east shore and in the western part.


Sample 9074 (Waddington)
Outc. (5)
Baie du Sud
Outc. (4)
Outc. (3)
Outc. (2)
Outc. (1)
Wharf
Cap-aux-Meules
0
¼
½
Mile
LEGEND
1 Gypsum
2 Argillite with gypsum veins
3 Volcanic rocks
Drill hole
Q.D.N.R. B-924 1969

a) **East shore**: Map B-924 shows three outcrops of gypsum on the shore from the wharf at Cap-aux-Meules northward and two others on the shores of Sud bay.

Outcrop (1) is 250 feet long and 25 feet high; toward the interior, funnels are seen which are the result of dissolution of the gypsum. In order to check the extension of the formation toward the interior, one hole was drilled at 250 feet from the shore and 31 feet above sealevel. The gypsum formation was found from the depth of 58 feet to 85 feet, that is 27 to 54 feet below sealevel. Assuming a triangular deposit which has a thickness of 25 feet and apexes at the extremities of the outcrop and at the drill-hole, one could expect to find, at this location, more than 50,000 tons of gypsum. Recovery would be more costly than on Havre aux Maisons island, because of the low elevation and the slope of the deposit toward the interior. The problem of mining below sealevel must also be taken into account.

Outcrop (2) is more than 400 feet long near the shore. Funnels are easily detected westward as far as the road. Because of the rough topography accentuated by these holes, drilling could not be carried out, and the thickness of the formation remains questionable. From the shore proper, a few thousand tons of gypsum can be recovered. However, the attitude of the formation toward the interior remains to be seen.

Outcrop (3) is small and could yield only a few hundred tons of gypsum. However, the best crystals of selenite were found at this location.

In Sud bay, two small outcrops (4), located almost at sealevel, appear to offer no economic possibility, even though they were traced toward the interior along funnels. The outcrops are too close to sealevel and each unit is too narrow, which facts would cause prohibitive dilution.

An outcrop (5) filled with dissolution kettles and near sealevel seems to be the only relic of the gypsum deposit and contains only a few tens of tons.

Among these outcrops, only (1) and (2) offer any possibility of being mined. These outcrops are easily accessible by the beach and a minimum tonnage can be extracted readily. Further mining of outcrop (1) would involve work below sealevel. Possibilities for extension inland of outcrop (2) are not known.

b) **West part**: Five gypsum outcrops at one and a half miles north of the village of Etang-du-Nord are close together and seem to be part of a single unit. Three of these have a lenght of about 200 feet. This group appeared very promising, and, therefore, a program of topographic

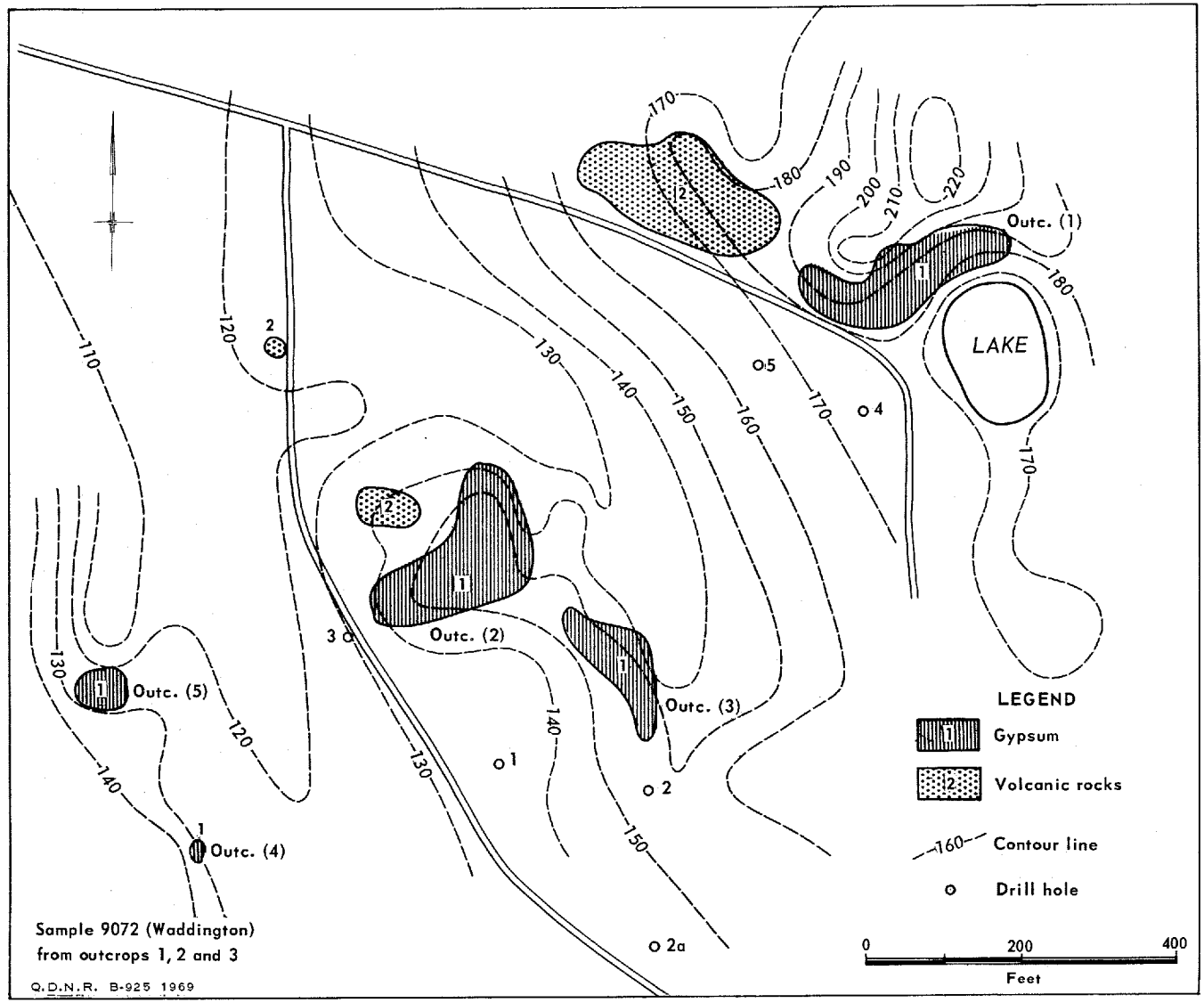
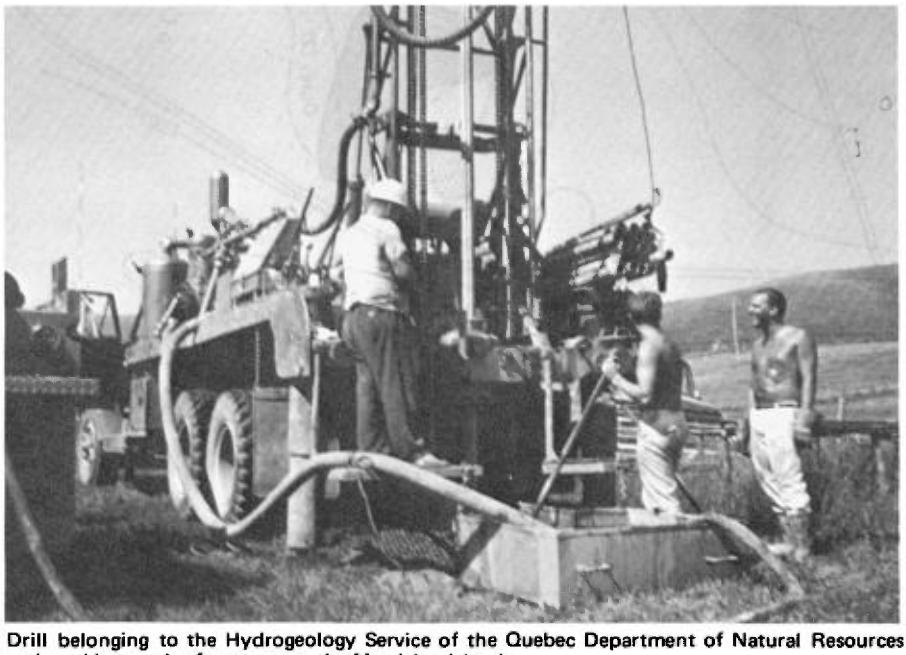

170
180
190
200
210
220
Outc. (1)
180
LAKE
170
110
120
130
140
150
160
170
2
5
4
3
Outc. (2)
Outc. (3)
Outc. (5)
130
120
140
130
140
150
1
2
2a
Outc. (4)
Sample 9072 (Waddington)
from outcrops 1, 2 and 3
Q.D.N.R. B-925 1969
LEGEND
Gypsum
Volcanic rocks
160
Contour line
Drill hole
0
200
400
Feet

PLATE III

Gypsum with green sandstone blocks; top, conglomerate; at right, red argillite. Outcrop (3), Map B-928, Entrée island.

PLATE IV



Drill belonging to the Hydrogeology Service of the Quebec Department of Natural Resources and used in search of gypsum on the Magdalen Islands.

survey and drilling was undertaken. None of the five 100-foot vertical holes crossed the formation except hole (2) between depth of 25 and 26.5 feet. Although very deceiving, this result has again led to the assumption that the outcrops are remnants of an eroded formation. If such is the case, mining would be limited to the volume of each outcrop, which would give:

Outcrops	Volume	Cavities %	Tonnage
(1)	200' x 60' x 20'	25	13 000
(2)	200' x 60' x 10'	50	4 000
(3)	150' x 40' x 10'	25	3 000

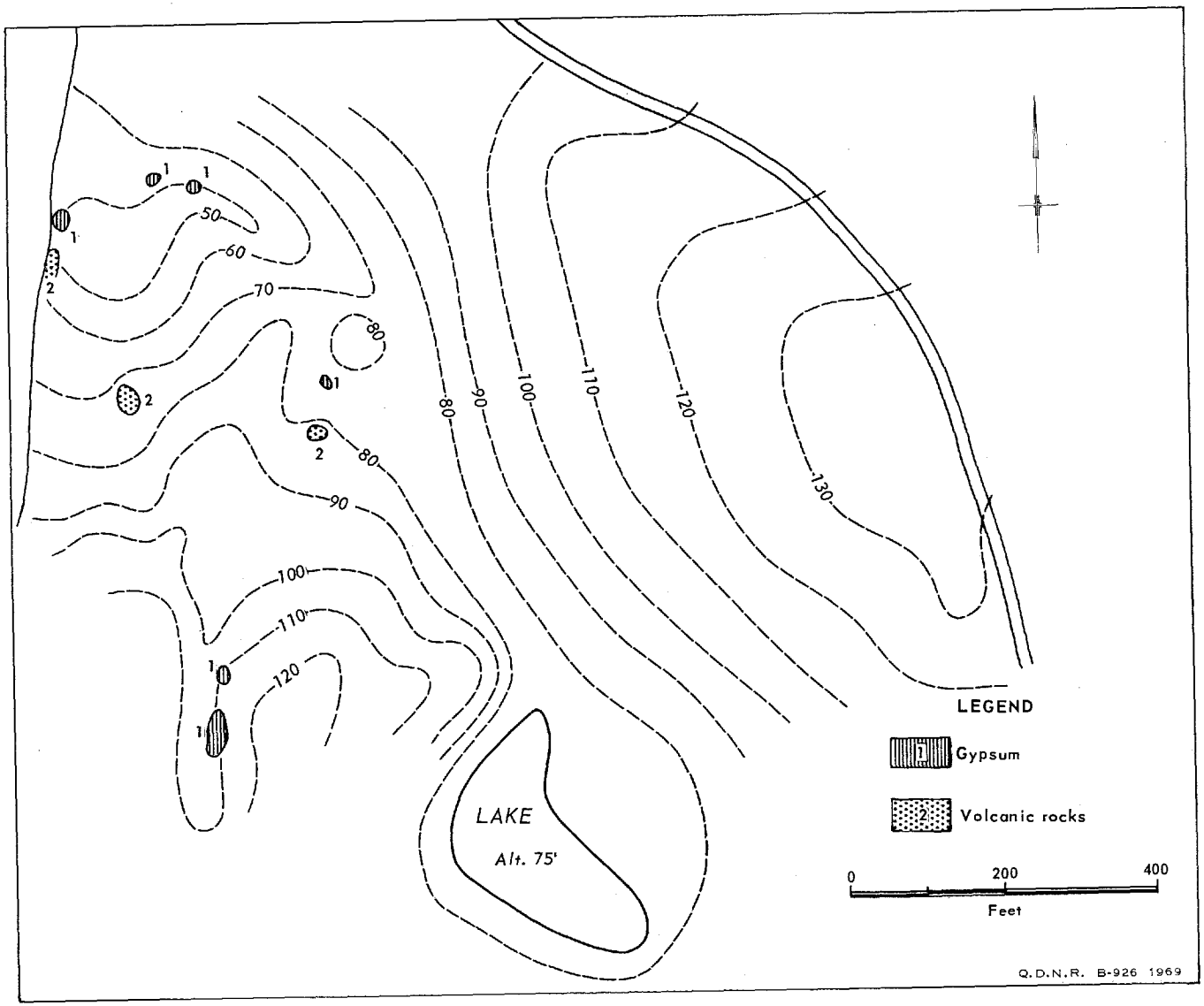
Photographs (Plate IIA; IIB) show outcrops (1) and (2). The outcrops of gypsum (4) and (5) are small and they are not considered minable. The outcrops that could be mined are near the road and access to them is easy. However, a little overburden should be removed at certain places, which fact would increase the cost of mining. The ore could be transported to the fishing boat wharf at Etang-du-Nord, that is 2 miles from the outcrops. If this wharf is not judged suitable, the wharf at Cap-aux-Meules, a little more than six miles away, would be used.

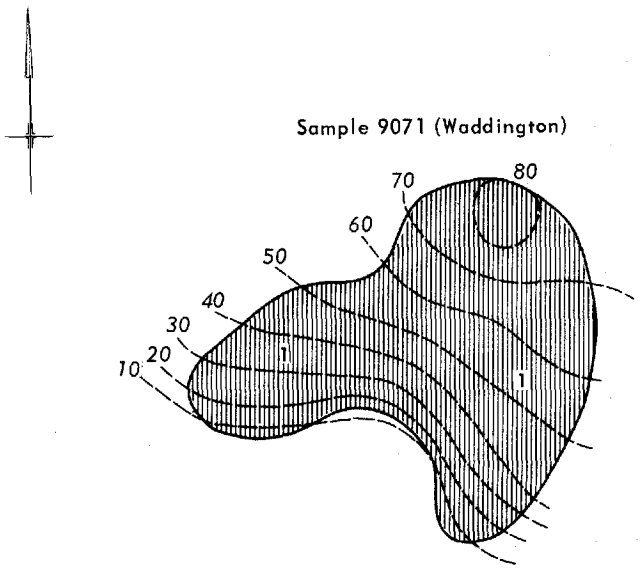
III- Havre Aubert Island

This island has gypsum formations at various locations (Index Map.) There is a group of outcrops near the shore at the western end of the island near Noir cape; an outcrop of gypsum near the shore at L'Anse-à-la-Cabane; a large outcrop north of Bassin road; and, moreover, a series of outcrops along the Demoiselles cliff at Havre-Aubert.

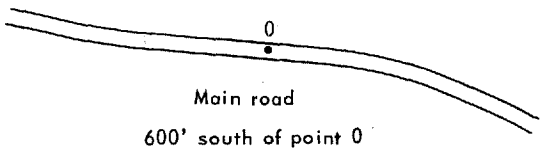
a) The group of small outcrops of Noir cape (Map B-926) extends over a distance of 700 feet; the outcrops are all small and, if judged by the topography, do not appear to be very promising. Nevertheless, the topography has been established in the hope of drilling at least one hole. Unfortunately, the topography did not allow for the transportation of the drill and this part of the project had to be abandoned. The size of outcrops does not justify the mining of the visible part. A drilling program could outline a larger deposit, but it is likely that these outcrops are again only remnants of an almost completely eroded formation.

b) A small outcrop of gypsum with impurities is found on the shore at L'Anse-à-la-Cabane. To the northwest, some ten feet of argillite contains veins of fibrous gypsum. The outcrop is small, but funnels suggest the presence of gypsum farther north. No other outcrop was


50
60
70
80
90
100
110
120
130
LAKE
Alt. 75'
LEGEND
1 Gypsum
2 Volcanic rocks
0
200
400
Feet
Q.D.N.R. B-926 1969



Altitude above point 0 (feet)



Main road

600' south of point 0

LEGEND

1 Gypsum

0 100 200

Feet

Q.D.N.R. B-927 1969

found, however. The visible part is too small to warrant mining operations; a drilling program is in order to determine the extension of the formation.

c) A large outcrop of gypsum at a few hundred feet from Bassin church (Map B-927) measures 200 feet by 150 feet in plan, and it has a height of 80 feet (Plate I-B). To the west and to the east, characteristic funnels are seen with gypsum fragments. It was not possible to evaluate the thickness. Nevertheless, even with a thickness of ten feet there would be about 10,000 tons of gypsum at this location and it could be easily mined, because of the steep incline and the proximity of the road. This outcrop is six miles from Havre-Aubert.

d) A series of gypsum outcrops borders the north shore of the island (Map B-928) from the village of Havre-Aubert westward. These outcrops, quite large in places, are only remnants of an eroded gypsum unit; extensions of the gypsum on land were observed only to the north of the church. Many local people say that there is gypsum under Havre-Aubert. To verify these statements, two 100-foot holes were drilled (12 and 13): one in the schoolyard and the other on the road leading to the old airfield of Amherst. Near these two places, old water wells appear to have crossed a layer of gypsum. The two holes that were drilled, however, did not encounter gypsum beds.

Access to the outcrops on the shore is not easy, and it would be very costly to mine these remnants.

IV- Entrée Island

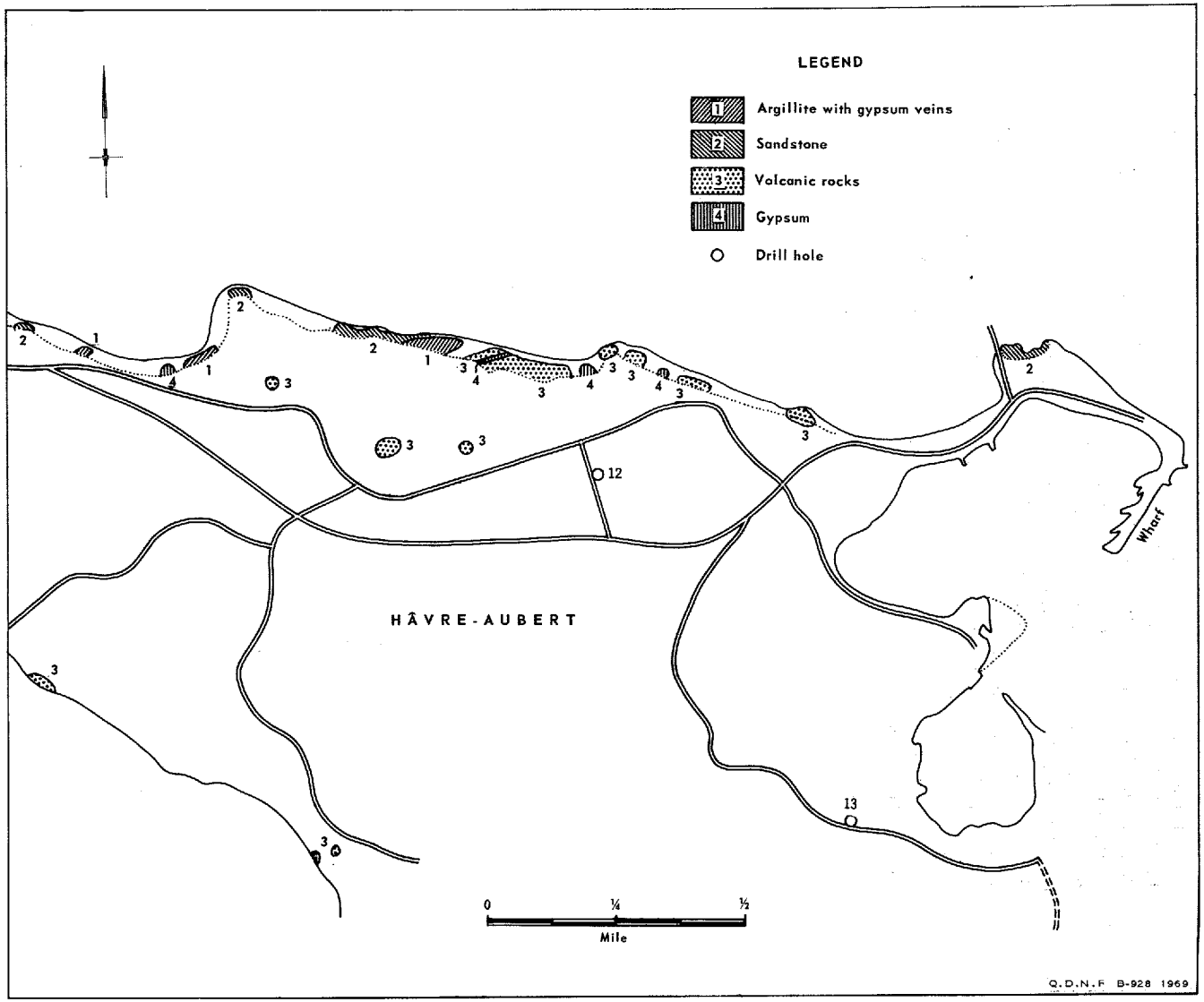
There are a number of gypsum outcrops on the south and east shores of Entrée island (Map B-929).

Outcrop (1), located in the low part of the island, is a few feet thick and is covered by red sandstone. Immediately west, the argillite is present with a few veins of fibrous gypsum. At this location, thickness is insufficient to suggest mining or even further exploration.

On outcrops (2) and (3), the gypsum formation is overlain by a conglomerate at the top of the cliff and encloses blocks and fragments of green sandstone. These outcrops well illustrate the plasticity and flowing properties of this formation (Plate III).

Outcrop (4) is composed of intensely deformed gypsum with a north contact of argillite containing veins of fibrous gypsum.

Outcrop (5), like outcrops (2) and (3), consists of a gypsum formation with fragments of green sandstone overlain by the same conglomerate at the top of the cliff.


LEGEND
1 Argillite with gypsum veins
2 Sandstone
3 Volcanic rocks
4 Gypsum
Drill hole
HÂVRE-AUBERT
12
13
Wharf
0
¼
½
Mile
Q.D.N.F B-928 1969

Finally, outcrop (6) is similar to (5). Argillite is seen to the north and, farther on, conglomerate is present.

All these outcrops of Entrée island are visible only on the shore along the cliffs. With the exception of the first one, which is too small, they would be of minable dimensions, as long as precautions are taken to minimize dilution by the argillite or conglomerate, two fragile formations. The mining possibility is reduced because of the difficulty of access. It is almost impossible to reach the shore by land. There is no wharf on this side and it would be necessary to dredge in order to reach the deposit from the sea. The project thus becomes costly and the dimensions of the deposits do not justify such an expenditure. It would thus become necessary to drill on the extensions of this formation inland to outline sufficient volume before starting exploitation operations.

CONCLUSIONS

During the present study of the gypsum deposits of the Magdalen Islands, about 10 deposits which could be mined and which could yield a minimum of about 100 000 tons of ore of very high quality were found.

These deposits are distributed as follows:

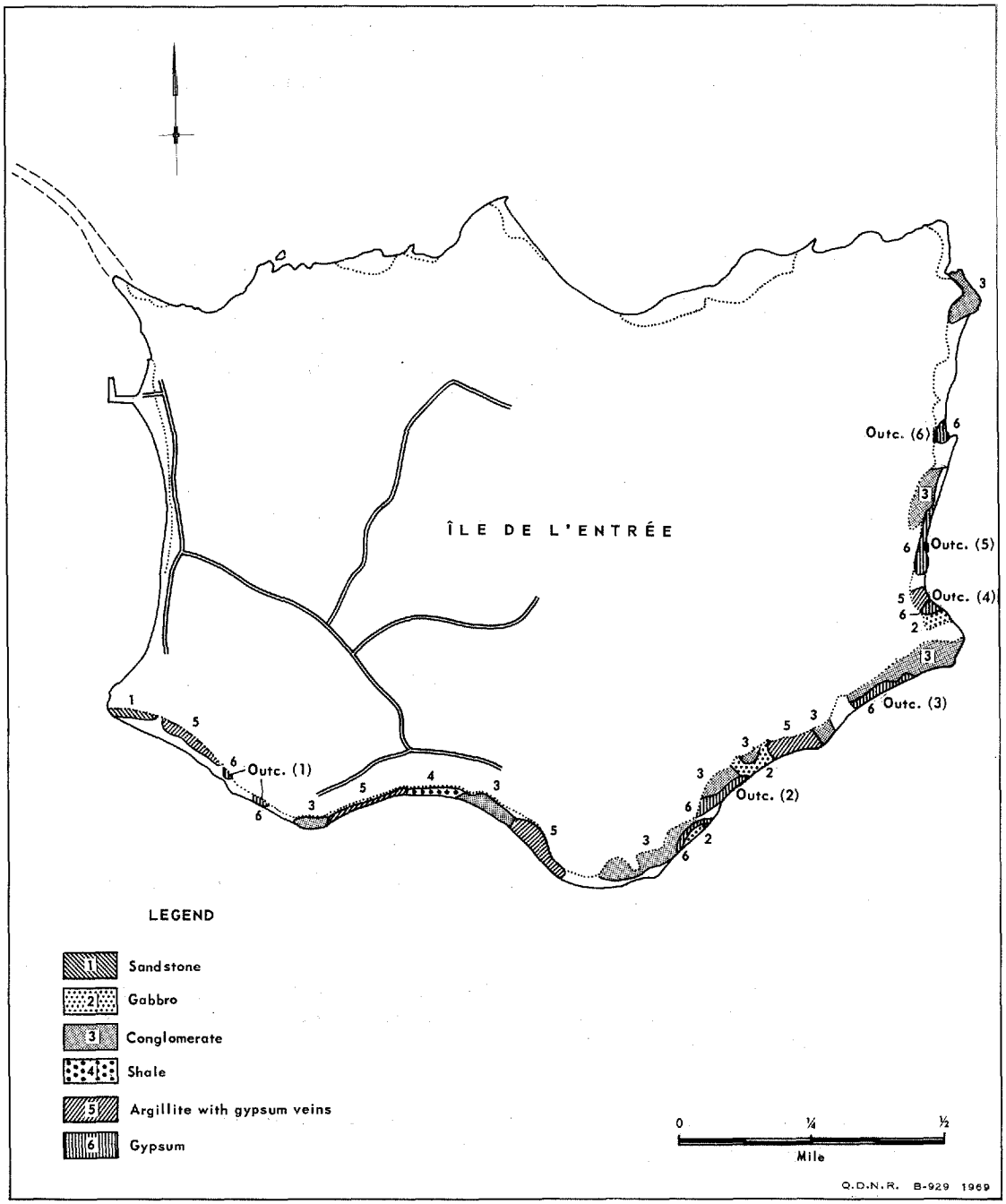
Locations	Outcrops	Tonnage	Remarks
Havre aux Maisons Is. (east side)	(1)	3,000	Depth assumed
	(2)	2,000	Depth assumed
	(3) (south)	10,000	Danger of dilution
	(3) (north)	3,000	
	(4)	1,500	
Cap aux Meules (east shore)	(1)	50,000	Below sealevel
	(2)	A few thousand tons	Thickness unknown
(west part)	(1)	13,000	
	(2)	4,000	
	(3)	3,000	
Havre Aubert Island (Bassin)		10,000	

Other deposits are not considered because of their small dimensions or the prohibitive cost of mining.

This study concludes that the deposits are discontinuous due to structural deformations, the gypsum being relatively plastic, and to the high solubility of the mineral.

It is evident that, in most cases, the outcrops of gypsum represent just about all that remains of easily minable material.

Important deposits are not excluded however, but they would be deep, and this study does not presume their existence.


ÎLE DE L'ENTRÉE
Outc. (1)
Outc. (2)
Outc. (3)
Outc. (4)
Outc. (5)
Outc. (6)
LEGEND
1 Sandstone
2 Gabbro
3 Conglomerate
4 Shale
5 Argillite with gypsum veins
6 Gypsum
0
¼
½
Mile
Q.D.N.R. B-929 1969

APPENDIX

The holes were bored with the drill of the Quebec Department of Natural Resources. Plate IV illustrates this drill mounted on a truck. It is a rotary drill, designed for water searching. It, therefore, drills only vertically and in soft material and can recover cores of 2 1/4 inches in diameter.

Drill-hole No 1

Location: Cap aux Meules island, see Map B-925.
Attitude: Vertical
Length: 100 feet

Depth in feet	Lithology
0 - 70	Clay
70 - 100	Gray argillite
100	Bottom of hole

Drill-hole No 2

Location: Cap aux Meules island, see Map B-925.
Attitude: Vertical
Length: 95 feet

Depth in feet	Lithology
0 - 25	Clay
25 - 26.5	Gypsum
26.5 - 35	Red and gray argillite, veins of fibrous gypsum 1/4 inch
35 - 42	Gray argillite
42 - 45	Red argillite
45 - 95	Mixture of red and gray argillite
95	Bottom of hole

Drill-hole No 3

Location: Cap aux Meules island, see Map B-925
Attitude: Vertical
Length: 100 feet

Depth in feet	Lithology
0 - 10	Clay
10 - 100	Gray argillite
100	Bottom of hole

Drill-hole No 4

Location: Cap aux Meules island, see Map B-925
Attitude: Vertical
Lenght: 95 feet

Depth in feet	Lithology
0 - 35	Clay
35 - 95	Gray argillite
95	Bottom of hole

Drill-hole No 5

Location: Cap aux Meules island, see Map B-925
Attitude: Vertical
Length: 95 feet

Depth in feet	Lithology
0 - 35	Clay
35 - 95	Gray argillite
95	Bottom of hole

Drill-hole No 6

Location: Havre aux Maisons island, Pointe-Basse, see Map B-923
Attitude: Vertical
Length: 34 feet

Depth in feet	Lithology
0 - 24	Gravel
24 - 28	Hole, probably druse in gypsum formation, total loss of water
28 - 29	Granular gypsum
29 - 34	Hole, probably druse in gypsum formation
34	Stoppage due to loss of water.

Drill-hole No 7

Location: Havre aux Maisons island, Pointe-Basse, see Map B-923
Attitude: Vertical
Length: 95 feet.

Depth in feet	Lithology
0 - 50	Red argillite
50 - 95	Red argillite, few narrow veins of fibrous gypsum
95	Bottom of hole

Drill-hole No 8

Location: Havre aux Maisons island, Butte Ronde, see Map B-922
Attitude: Vertical
Length: 48 feet

Depth in feet	Lithology
0 - 15	Clay
15 - 20	Powdered gypsum (disintegrated)
20 - 37.5	Solid gypsum, no cavities
37.5 - 38	Gypsum and fragments of gray argillite
38 - 48	Argillite with a few narrow veins of fibrous gypsum
48	Bottom of hole

Drill-hole No 11

Location: Cap aux Meules island, Cap-aux-Meules village, see Map B-924
Attitude: Vertical
Length: 95 feet

Depth in feet	Lithology
0 - 25	Red and gray argillite
25 - 58	Argillite and narrow veins of fibrous gypsum
58 - 85.5	Massive gypsum, argillaceous impurities from 75 to 85.5 feet, partly disintegrated from 80 to 85.5 feet.
85.5 - 95	Gray argillite
95	Bottom of hole

Drill-hole No 12

Location: Havre Aubert, island, Havre-Aubert village, see Map B-928
Schoolyard, 332 ft. south of main road, 21 ft. east of the street.
Attitude: Vertical
Length: 95 feet

Depth in feet	Lithology
0 - 75	Red and light green argillite
75 - 95	Red argillite, veinlets of fibrous gypsum
95	Bottom of hole

Drill-hole No 13

Location: Havre Aubert island, road to Havre Aubert airport, see Map B-928
Attitude: Vertical
Length: 100 feet

Depth in feet	Lithology
0 - 100	Clay and argillite
100	Bottom of hole