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ET MINÉRALE

BECANCOUR AREA

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Final Report

on

THE GEOLOGY OF THE BECANCOUR MAP-AREA

by

T.H. Clark and Yvon Globensky

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THE GEOLOGY OF THE BÉCANCOUR MAP-AREAINTRODUCTION

In 1943, T.H. Clark originally mapped the area at a regional scale for the Québec Department of Mines. The area was revisited by Yvon Globensky during the summers of 1969 and parts of 1970, including the checking of principal outcrops and contact zones, and additional mapping, at the scale of 1:40,000, with the aid of recent aerial photographs and enlargements therefrom. Many new exposures, most revealed during recent trenchings for drainage and other works, were located and studied, and the new data were incorporated with earlier findings.

Location, Drainage and Cultural Features

The Bécancour map-area lies between parallels  $46^{\circ}15'$  and  $46^{\circ}30'$ , and between longitudes  $72^{\circ}00'$  and  $72^{\circ}30'*$ , and covers about 410 square miles. It comprises the Bécancour federal topographic map-sheet (31 I/8), and the corresponding aeromagnetic sheet (1893G) published (1963) jointly by the Geological Services of Québec and the Geological Survey of Canada. It is divided by the St. Lawrence river into two unequal parts, that lying to the south of the river being by far the larger. One considerable river, the Bécancour, and several lesser streams, the Gentilly river, rivière aux Orignaux, Petite rivière du Chêne, rivière du Creux, Champlain River and a host of smaller streams drain the area.

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\*Its position relative to the contiguous map-areas is shown on the accompanying map.



A branch of the Canadian National railway crosses the southeast and again the northeast corners of the map, by Lemieux and Manseau, and by Fortierville respectively. A line of the Canadian Pacific railway also crosses the northwest corner of the area by Champlain and Red Mill stations. The Trans-Canada highway (No. 20) between Quebec and Montreal traverses the extreme southeast corner of the area. Highways Nos. 2 and 3, respectively, following closely the north and south shores of the Saint Lawrence. A network of secondary roads makes access to all parts of the area easy. There is no ferry across the St. Lawrence within the limits of this map but the Laviolette bridge is accessible 4 miles to the west.

Mixed farming is the main occupation of the population, with lumbering prominent in the southeastern part. Manseau is the largest settlement, and is a farming and lumbering center. Other towns and villages, such as Gentilly, Bécancour, Ste. Gertrude, Ste. Sophie, and Fortierville, are mainly centers for the surrounding farming population, but some also support minor industrial establishments.

It is worth noting that near Gentilly, Hydro-Québec, with cooperation from the Atomic Energy Commission of Canada, is presently constructing a nuclear powered, electric generating station, the first of its kind in Québec.

## PHYSIOGRAPHY

The trenches cut by the prominent rivers are the most marked variation in the topography, which, otherwise, is an irregular, nearly flat plane, sloping gently towards the St. Lawrence. Several escarpments facing the river are evidences of the earlier higher level of the latter. The lowest such escarpment diverges from the river cliff shore just north of Gentilly, at the mouth of Mill river, and passes southeasterly approximately parallel to Highway # 3. A physiographic extension of the southern part of this escarpment passes around the land area lying between the St. Lawrence river and Lake St. Paul, west of Bécancour. A higher escarpment, irregularly developed, can be seen four or five miles southeast of Gentilly.

Most of the surface is sandy, though below a few feet, or at the most a few tens of feet, clay is encountered in wells. Rock exposures are rare, occurring without exception either along the stream beds or along the face of the lower escarpment described above. More are present in the area lying north of the St. Lawrence River.

Very little of the territory lies more than 325 feet above sea-level. The highest point is slightly more than 400 feet, and is to be found in the group of small sand and gravel hills in the southeast corner of the area.

## GENERAL GEOLOGY

The rocks of the area are entirely sedimentary and belong to the Ordovician and Cambrian Systems. They are part of two provinces: the Saint-Laurent Lowlands and the Appalachians. In the Saint-Laurent Lowlands the rocks belong to the Trenton, Utica, Lorraine and Richmond Groups. Except for the Bécancour River Formation of the Richmond Group they are all marine in origin and consist of shales, limestones and sandstones, in that order of abundance. In the Appalachian Province the rocks belong to two groups: The Sillery Group and the Laurier Group which are mainly composed of sandstone, shale and limestone beds.

The gross structure of the rocks of the Bécancour area is a syncline striking more or less northeast-southwest, with a belt of complications along its southern flank, which latter belt is in turn followed by the belt of folded rocks of the Appalachian mountain built province, though there is only one indication of this within the limits of this map. No igneous rocks have been reported from this region.

Table 1. Table of Formations.

PERIOD	GROUP	FORMATION	LITHOLOGY	APPROXIMATIVE THICKNESS	N.A. EQUIVALENT
O R D O V I C A N	RICHMOND	<u>Saint-Laurent Lowlands Province</u>			
		Bécancour River (Queenston) Carmel River Member	Red and green shale and sandstone. Greenish-grey shale. Non-marine.	600' + 5'-25' +	Queenston
		Pontgravé River (Waynesville)	Crystalline limestone with some shale. Marine, fossils abundants.	415' +	Waynesville
	LORRAINE	Nicolet River Upper (Pulaski)	Shale and fine grained sandstone with limestone. Shale becoming calcareous toward the top.	3000' +	Pulaski
		Lower (Frankfort Eden)	Shale and fine grained sandstone.		Frankfort Eden.
	UTICA	Lotbinière	Shale and minor limestone Granwache silstone and shale.	Non exposed in the area.	
	STRENTON	Neuville Grondines Member St-Casimir Member	Grey semi-lithographic limestone and shale.	Non-exposed in the area.	Cobourg Sherman Fall Kirkfield.
Deschambault		Light grey crystalline limestone			
LAURIER	<u>Appalachian Province</u>				
	Bourret	Black slate <sup>s</sup> , argillaceous limestones, dolomite and sandstones.	Non-exposed in the area.		
C A M B R I A N	SILLERY	Sillery	Red, green and grey shale and green sandstone.	-	

APPALACHIAN PROVINCE

As mentioned above the rocks of the Appalachian Province belong to the Sillery and Laurier Groups of Cambrian and Ordovician age and occupy the extreme southeast corner of the map-area. The Appalachian Province is separated from the Saint-Laurent Lowlands by a thrust fault.

CAMBRIAN

Sillery Group.

Sillery Formation. The only exposure of rocks of the Appalachian Province in the map-area consists of an outcrop of Sillery shale and sandstone. It is situated in an old sand pit about 3 miles south east of Lemieux. The bottom of this sand pit is composed of red and green shale with interbeds of greenish grey pea-size to medium grained sandstone. Even if it is the only outcrop available, the presence of Sillery rocks beneath is betrayed by the red coloring of the soil and of the road starting more or less in the vicinity of the County limit line. No fossils were found.

The rocks of the Sillery Group are shown separated from the rocks of Laurier Group by a thrust fault as it is the case in the next area to the east, the Lyster area.

ORDOVICIANLaurier Group.

Bourret Formation. In the Lyster area to the east, the Laurier Group is in great part, composed of the Bourret Formation consisting mainly of black slates with interbeds of buff-weathered bituminous, argillaceous limestones; ochre-weathering dolomite and sandstones and local beds of limestone conglomerate considerably deformed. No outcrops of this formation were found in the Bécancour map-area but they are present not more than 2 miles away from the limit of the map, in the Lyster area. This is the reason why it was extended into the Bécancour area bounded on the northwest by a thrust fault which is the continuation of the one existing in the Lyster map-area.

SAINT-LAURENT LOWLANDS PROVINCE

The rocks of the Saint-Laurent Lowlands Province are grouped into the following: Trenton Group, Utica Group, Lorraine Group and Richmond Group. However no exposures of Trenton or Utica rocks are present in this map-area but their distribution on the Grondines and Three-Rivers map-area demands their presence in the northwestern corner of the Bécancour map-area. The same is true for the Utica in the southeast corner. The Lorraine and Richmond Groups are the two most important Groups and all the outcrops of the area belong to these two groups.

ORDOVICIANTrenton Group.

In the extreme northwestern corner of the area, the Lower Trenton Deschambault Formation is seen separated from the Upper Trenton Grondines Member of the Neuville Formation by the St-Prosper Thrust fault. The tracing of this fault in this map-area is justified by accurate data on the Grondines map-area to the north and most of all by very accurate wells data on the Three River map, immediately adjacent to the west. The Middle Trenton Saint-Casimir Member of the Neuville Formation is completely absent from the Bécancour area being illiminated by the Saint-Prosper fault.

Utica Group.

As for the Trenton Group, the Utica Group is not represented by any exposures in the area but its presence in the Grondines area to the north and in the beds of the Saint-Maurice River and also in wells in the Three Rivers map-area, require their presence on this map. Moreover, numerous wells (see appendix I) to the south of the assumed southern limit of the Utica band, have encountered Lorraine and Utica rocks implying a surface contact approximately were drawn.

In the southeast corner of the area a band of rocks bounded by thrust faults is shown but no outcrop of this rock is present in this area but its tracing is justified by its presence in the adjacent map-area to the east. This band of rock is composed of graywacke, silstone and shale for the most part affected

by the thrusting. These rocks are unlike the normal Utica lithology of the Lotbinière Formation but they contain however graptolites of Utica age. It is believed that these rocks were deposited, at the same time than that of the normal Utica sequence but much closer the Appalachian front.

LORRAINE GROUP

The rocks of the Lorraine Group occupy a good part of the area on both flanks of the Chambly-Fortierville syncline. On the north shore of the Saint-Laurent they were encountered in many wells but no outcrops are present. However on the south shore, exposures are abundant and were studied in details.

Lithologically, the Lorraine Group consists of grey to grey-green shales, sandy shales and fine grained sandstones and limestones. The Upper part being more clacareous, more fossiliferous and more thickly bedded than the hower part, however an accurate boundary line is difficult to draw between these two parts.

Traditionnaly these rocks are considered to belong to the Nicolet River Formation, the name being derived from the magnificent section of Lorraine beds exposed along the Nicolet River which is considered to be the Lorraine type section for Québec.



Nicolet River Formation

In previous report (Clark and Globensky, 1969) on the Saint-Raymond, Portneuf and Lyster area, the Nicolet River Formation was subdivided into three members this subdivision was based on lithology and thickness of the beds as follows:

St-Hilaire Member= Calcareous shale, sandstone and limestone  
 Chambly Member = Sandy shale and thick sandstone beds  
 Breault Member = Sandy shale and thin sandstone beds.

However in the present area these subdivisions don't seem to hold, especially in regards to the thickness of the sandstone beds. The most difficult unit to recognise lithologically is the Chambly Member. It seems that we are dealing here with a section in which a gradual passage take place from the base to the top and then through the Pontgravé River Formation. The basal part of the section is not thick and is composed of grey siltz sandy and micaceous shales with some thin interbeds of fine grained quartzone sandstone. As we approach the Upper part of the Lorraine section, sandy limestone beds start to appear grading into both shale and thick beds of sandstone. Most of the time these sandy limestone beds are present as a coquinoid in between the sandstone beds and the shale beds but grading into the sandstone. We have then generally rythmic repetition of with no sharp boundary between the sandstone

- Shale
- Coquinoidal sandy limestone
- Sandstone

and the limestone (see fig. 2). Sometimes the coquinoidal limestone is missing the we have the sandstone resting directly on the shale. It was also noticed that the limestone beds are often non-continuous in thickness and in extent (see plate 1). Sometimes they appear as lenses (see plate 2). The coquinoidal limestone is a detrital rock representing the beginning of the sedimentary cycle.

The width of the Lorraine sequence in this area is not as wide as in the St-Raymond, Portneuf and Lyster area as a result, probably, of a more severe Appalachian thrusting and most of the Lower Lorraine has been severely compressed and deformed by the thrusting (see plate

### Upper Lorraine

#### Northwest flank of the Chambly-Fortierville Syncline.

On the northwest flank of the Chambly-Fortierville syncline, there is only one exposure of Upper Lorraine rocks; the rivière du Moulin exposure.

#### Rivière du Moulin Exposure.

The outcrop is situated, mostly on the northeast side of the river in front of an old mill, a mile and a half (see plate 1) north of Gentilly where highway # 3 crosses the river. Good exposures occur between the road crossing and the dam a few hundred feet upstream and also for a short distance below the road crossing. The rocks are argillaceous sandy shales with abundant limestone lenses and sandstone interbeds. Fossils are not abundant (see table ) but the presence of Leptaena, Catazyga, Zygospira and Pterinea is indicative of a high horizon in the Lorraine.

Southeast flank of the Chambly-Fortierville Syncline.

On the southeast flank of the Chambly-Fortierville syncline two exposures of Upper Lorraine rocks are present; first on rivière des Crignaux and second on Petite rivière du Chêne.

Rivière des Crignaux Exposures

Along Rivière des Crignaux at a road crossing 1/2 miles southeast of Sainte-Sophie de Lévrard, calcareous shales and greenish grey laminated often cross-bedded sandstone beds are exposed on both sides of the road, the main part of the exposure being on the downstream side. Coquinoïdal limestone beds are also present and the most characteristic fossils found were Proetus, chambliensis, Zygospira kentuckyensis, Catozyga headi and Cymatonata recta.

Petite Rivière du Chêne Exposures.

Along Petite Rivière du Chêne starting at about 1/4 mile downstream from a road crossing situated at about 3 miles southeast of Sainte-Sophie de Lévrard, exposure of grey sandy shale finely bedded and a coquinoïdal limestone bed is present at the beginning of the exposed section. As we proceed downstream the exposures become more important with greenish grey hard sandstone interbeds up to 2 inches thick, sticking out of the grey argillaceous shale. Still further downstream (see plate 2) exposures become more consistent and consist of one foot thick shale beds with interbeds up to 4 inches of hard greenish grey medium grained, homogeneous sandstone (see plate 3) and grading into it at its base coquinoïdal limestone beds of about 3 inches thick are present.

These 3 lithological are repeated in seven cycles of which three are complete. A typical sequence is as shown in fig. 2 14

There is however no consistency in the thicknesses or extent of the different units. The sandstone beds vary from 1 inch to 4 inches, the coquinoïdal limestone from 1 to 4 inches and the shale from inch to 12 inches.

The greenish-gray sandstone beds are in places up to one foot thick and shaly (see plate 4) e.g. they weathered down in sheets which resemble shaly partings, a situation not observed in the Pontgravé River Formation.

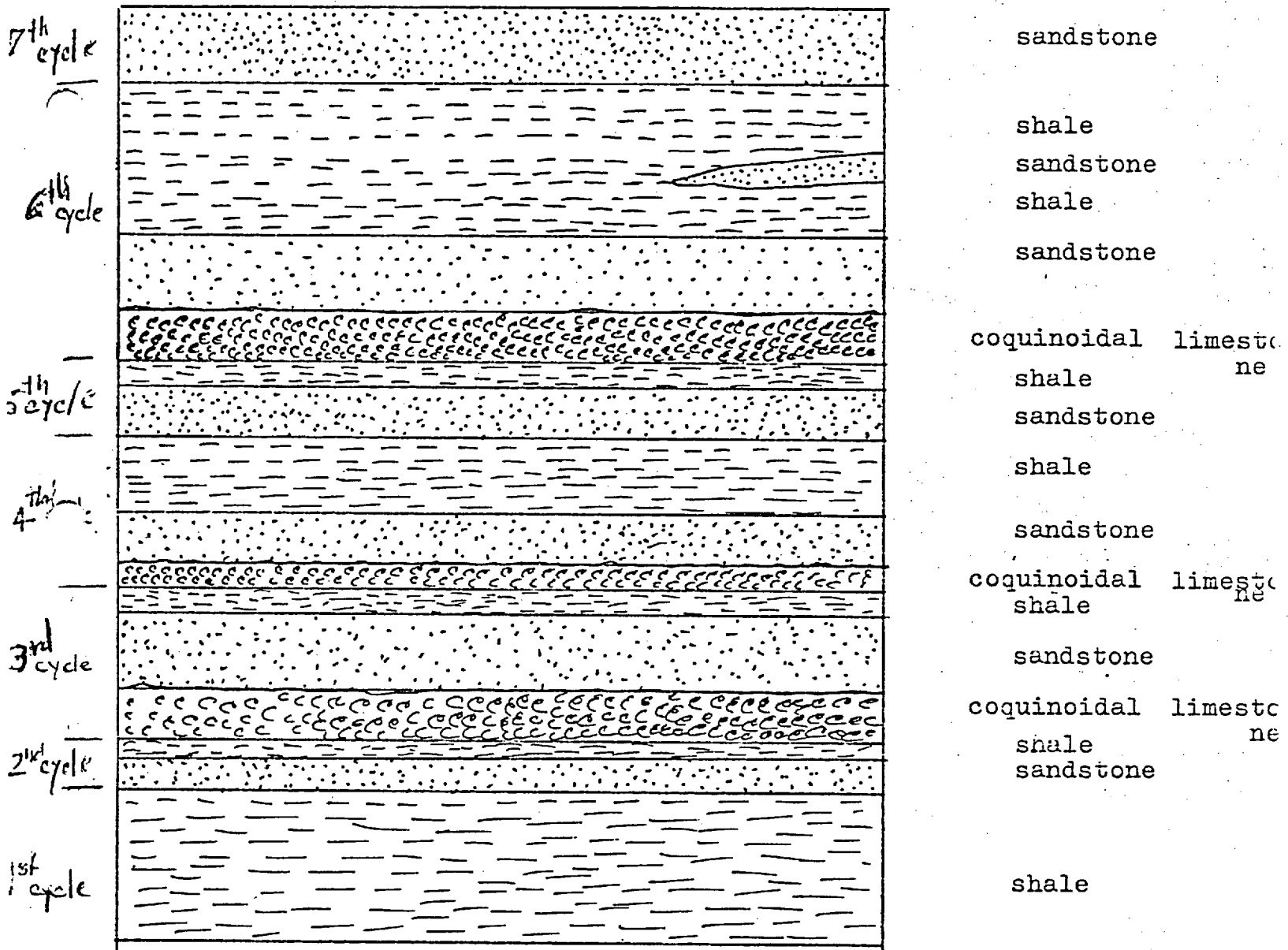
The coquinoïdal limestone is at few places present as isolated lenses surrounded by shale in between two sandstone beds (see plate 5). There is a gap downstream and the exposures of the Pontgravé River Formation start few hundreds feet further.

#### Lower Lorraine

The rocks of the Lower Lorraine consist generally of sandy grey shale with interbeds of fine grained quartzose sandstone lighter in color. The thickness of the sandstone beds rarely exceeds 4 inches and usually it is less. The shale is much less calcareous than in the Upper Lorraine. Fossils are scarce in the basal portion. Primary sedimentary structures (flute casts, convolute bedding etc.) are also less abundant than in the Upper Lorraine.

Fig. 2

Repetition in the cycle of sedimentation of Upper Lorraine sediments: coquinoïdal limestone sandstone and shale on the Petite Rivière du Chêne exposures.



As mentioned earlier, it is difficult lithologically, to draw a line separating, the Lower Lorraine from the Upper Lorraine since in the upper part of the Lower Lorraine the sandstone beds get thicker, more calcereous and contains more fossils. The contrast is then not so obvious. The Upper Lorraine grey to grey-green sandy shales, sandstones and limestones are however quite different from the sandy grey shales and sandstone of the basal part of the Lower Lorraine.

Oil companies that have worked in the area have generally used a similar Upper Lorraine - Lower Lorraine subdivision and moreover Imperial Oil Ltd for instance as used the fossil Leptaena as index fossil for the Upper Lorraine.

#### Northwest flank of the Chambly-Fortierville Syncline.

On the northwest flank of the Chambly-Fortierville syncline the Lower Lorraine is exposed only in a narrow band close to the Saint-Laurent river, from Sainte-Angèle to the new wharf of the Industrial Park of Bécancour. It is mostly exposed along an escarpment running parallel to the shore, southeast of highway #3 and along road ditches in the Industrial Park, and also at few places along the shore especially at the site of an old lighthouse a mile and a half northwest of Bécancour where an abundance of concretion or nodules of grey limestone containing almost invariably a graptolite Orthographus quadrimucronatus (Hall) in three dimensions. The rocks are composed mainly of grey shale and interbeds of sandstone. At places thin sandy limestone beds containing of abundance of crinoid stems and also the lattice-like Dictyonema and the tribolite Cryptolithus.

This band of Lower Lorraine is bounded on its southeast side by a normal fault which strikes northeast and separates it from the Pontgravé River Formation. This can be well seen where the above mentioned escarpment turns towards the southeast where two exposures, close together, the first of which composed mainly of shale and sandstone and carrying Cryptolithus bellulus, and the next composed of shale with hard limestone beds carrying an abundance of Catazyga headi which is common only in the Richmond. The close juxtaposition of Lower Lorraine and Pontgravé River Formation demands a fault separating the two outcrops. Along the northeastermost part of the escarpment there is a gully in which thirty feet of limestones, sandstones, and shales can be seen, all bearing an abundant and characteristic fauna of the Pontgravé River Formation.

#### Southeast flank of the Chambly-Fortierville Syncline.

On the southeast flank of the Chambly-Fortierville syncline, Lower Lorraine rocks are exposed in two places: first along the Gentilly River south of the road leading from Sainte-Gertrude to Sainte-Marie-Blandford and second along Petite Rivière du Chêne north-east of Manseau.

#### Gentilly River Exposures

The most easily accessible exposure of Lower Lorraine on the Gentilly River is situated just beneath the bridge on the N.W.- S.E. gravel, road leading from Lavergne to Sainte-Gertrude.

The rocks are composed of medium grey argillaceous shale with interbeds of pale grey sandstone in beds of  $\frac{1}{2}$  inch in thickness. The beds are strongly inclined as a result of the thrusting a few miles to the south.

At about  $\frac{1}{2}$  mile downstream, recent excavation of the stream bed has uncovered new exposures (see plate 6A) of the same rocks except for the thicker interbeds of sandstone up to 3 inches and a graptolite fauna (see table 2).

The beds are here also steeply inclined and at some places drag folds were observed (see plate 6B). Another isolated outcrop is present in the stream bed at about 1 mile downstream from the previous one and it is completely covered with water in mid-summer. It is composed mainly of a greenish-grey sandstone bed.

#### Petite Rivière du Chêne Exposures

Along the Petite rivière du Chêne, exposures begin at about  $\frac{1}{2}$  mile from Manseau and are present with interruptions downstream. From Manseau the first outcrops encountered are composed of folded (see plate 7) greenish sandstone and siltstone beds, at places the beds are vertical and in the shale, which is also present, graptolites were found. The interbeds of sandstone and siltstone are not thick not exceeding  $\frac{1}{2}$  mile.



As we proceed downstream the greenish sandstone beds become thicker up to 4 inches and they are interbedded in thick sequence of grey argillaceous shale. The beds are steeply inclined until we reach the first bridge. Downstream from this bridge dips are much less severe.

The upper limit of the Lower Lorraine rocks is difficult to trace accurately. From a lithology point of view we would be tempted to trace it before the next road crossing the Petite Rivière du Chêne and after the last outcrop upstream. This mainly because of the great thickness of the greenish-gray sandstone beds (up to 1 foot, see plate 8) in the next exposure downstream containing ripple marks and a lesser content of shale which seem to indicate higher horizon. However, this exposure 200 feet downstream from the bridge lack the limestone content typical of the Upper Lorraine but could represent the basal part of this unit.

It is worth noticing also that the part of the section that belongs to the Lower Lorraine is more steeply inclined than the beds downstream that would be more likely considered as Upper Lorraine. This reflects in a way, the fact that the rocks of the Upper Lorraine are more competent because of the presence of the thick sandstone beds. This is due of course also to the greater distance from the thrusting front, but nevertheless we think that it stress the change in composition in the section.

Unfortunately even if the Petite Rivière du Chêne section is the most complete Lorraine section of the area, the exposures are not continuous and the gaps in the section preclude a more detailed study of the passage zone between the Lower and Upper Lorraine. This is the reason why no limit was traced on the map between these two divisions.

### Lorraine Fauna

The Lorraine Fauna of the Nicolet River Formation has been subdivided by Foerste, (1916, 1924) into three faunal zones at the type locality on the Nicolet River. These three faunal zones are the following:

Pholadomorpha

Proetus-Leptaena

Cryptolithus

However in the Bécancour map-area no continuous section of the Lorraine exists as it is the case along the Nicolet River and it seems difficult to use these three zones as such in this area. In regard to the Lower Lorraine it is best determined faunally by the presence of the trilolite Cryptolithus bellulus which is also present below in the Utica. It is also determined by graptolites especially Climacograptus typicalis Hall and Glyptograptus lorrainensis Ruedemann, the latter being abundant. (Identified by John Riva 1971). It should be also noted that the Lower Lorraine contains an abundance of varied crinoid stems. The Upper Lorraine is usually identified by the presence of Leptaena which at the base of the Upper Lorraine is found to coexist with Cryptolithus.

Upper Lorraine is also characterized faunally by a more abundant pelecypod fauna especially Whitella, Byssonychia, Pholadomorpha, Pterinea, and Modiolopsis.

The most abundant brachiopods are Catazyga, Zygospira, Leptaena, Rafinesquina, Strophomena and Sowerbyella. A complete list of the fossils found is given in table 2.

#### Thickness.

In the three deepest wells in the area: Husky Gentilly 1, Husky Bruyères and St-Angèle 1, (see appendix I) up to over 3000 feet of Lorraine rocks have been encountered. The Precambrian has been reached in the St-Angèle well 1 at 5260' but the thickness of the section is increasing towards the center of the basin since in the Husky Gentilly 1 well, the last unit drilled was the Potsdam at 7445'. In this well, 5737 feet of Lorraine-Utica rocks were penetrated which is the greatest development of these two formation in the area.

table 2

FOSSILS OF THE LORRAINE GROUP

PHYLUM and SPECIES	Locality		
	Rivière Gentilly and fields to the west Bécancour <sup>N.W.</sup> (près faille)	Rivière du Moulin (Gentilly)	Petite rivière du Chêne <sup>N.W.</sup> (près Manseau) Bécancour (N.W. in the field) Rivière des Orignaux (Ste-Sophie) Petite rivière du Chêne ( N.W. of Manseau)
<u>Graptozoa</u>			
Orthograptus quadrimucronatus (Hall)	X	X	X
Orthograptus quadrimucronatus var. inequispinosus	X		
Dictyonema sp.	X	X	
Glyptograptus cf. G. lorrainensis	X		
Climacograptus typicalis posterus (Ruedemann)	X		X
Mastigograptus sp.	X		
Pseudoclimacogratus sp.		X	
Pseudoclimacogratus clevensis			X
<u>Trilobita</u>			
Triarthrus rougensis Parks			X
Cryptolithus bellulus	X	X	
Cryptolithus bellulus	X		X

*Cryptolithus bellulus*  
*Isotelus* sp. *gigas*  
*Proetus chamblensis*  
*Calymene* sp.

X X  
 X  
 X X  
 X  
 X

Brachiopoda

*Orbertella sinuata*  
*Occidentalis*  
*Schizocrania filosa*  
*Leptaena* cf. *L. moniquensis*  
*Rafinesquina alternata*  
*Catazyga headi*  
*Clyptorthis crispata*  
*Dalmanella rogata*  
*Orphomena* sp.  
*Sowerbyella sericea*  
*Zygospira Kentuckyensis*  
*Lingula rectilateralis*

X  
 X  
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 X  
 X  
 X X X X X  
 X X  
 X  
 X  
 X

Pelecypoda

*Byssonychia radiata*  
*B.* cf. *B. hyacinthensis*  
*Cymatonata recta*  
*Modiolopsis concentrica*  
*Modiolopsis borealis*  
*Modiolopsis manitouensis*  
*Whitella complanata*  
*Pterinea demissa*

X X X X  
 X  
 X X  
 X  
 X  
 X  
 X  
 X

Gastropoda

*Linuities cancellatus*

X X

Pelocyppoda

Byssonychia radiata

X X X X

B. cf. B. hyacinthensis

X

Cymatonata recta

X

X

Modiolopsis concentrica

X

Modiolopsis borealis

X

Modiolopsis manitoulensis

X

Whitella complanata

X

Perinea demissa

X

Gastropoda

Sinuities cancellatus

X

X

Oxydiscus subacutus

X

Hormotoma sp.

X

Bryozoa

Rhombotrypa quadrata

X

Cirripectida

Lepidocoleus jamesi

X

Incertae sedis

Cornulites cf. <sup>c</sup>d. flexuosus

X

## RICHMOND GROUP

In the center of the Chambly-Fortierville syncline is the Bécancour River Formation composed mainly of red shale, and on either side, are exposures of the gray clay-shales, limestones and minor sandstones of the Pontgravé River Formation. These two formations are part of the Richmond Group. They cover a large area of about  $8\frac{1}{2}$  miles wide along the Bécancour River valley narrowing down to about 4 miles in its northeastern extension towards Fortierville.

### Pontgravé River Formation

The Pontgravé River Formation is composed of alternating dense, platy, silty limestone beds interbedded with shale and thinner and fewer beds of coquinoïdal limestone (see plate 9) and sandstone beds. The coque<sup>inci</sup>idal limestone has a buff to light brown weathering color which contrasts with the greenish-grey color of the platy limestone. These platy limestone are dense, semi-lithographic, to silty and break with conchoïdal fractures. The shale is usually argillaceous, greenish-grey in color and it is often silty and sandy but it is somewhat more calcareous than the Upper Lorraine shale. It has a high content of kaolin and easily break (see plate 10) down upon exposure to mud, a characteristic seen also in the Bécancour River Formation. The sandstone beds are greenish grey in color and are mostly finegrained and contain numerous flute casts.

The distinction between the Pontgravé River Formation and the underlying Upper Lorraine is in some cases difficult to make because of the gradation existing between these two formations but the main general differences between these two units are:

The Pontgravé River Formation is more calcareous, and rather than containing the heavy beds of sandstone of the Upper Lorraine, it contains dense, platy, sandy limestone beds.

The Pontgravé River Formation lacks the rhythmic repetition of coquinoidal limestone sandstone, and shale seen in the Upper Lorraine. Instead the coquinoidal limestone is mostly present as discrete beds separated by shale or rarely as beds grading upwards into fine-grained limestone.

The sandstone beds of the Upper Lorraine are thicker shalier and less resistant to erosion (see plate 10) than the one from the Pontgravé River Formation.

As mentioned above the Pontgravé River Formation stratigraphically underlies and areally flanks the red and green Bécancour River shale.

#### Northwest flank of the Chambly-Fortierville Syncline

The well stratified Pontgravé River shales, limestones and sandstones can be seen at several widely separated localities between Ste-Angèle and Bécancour, and at a locality two miles southwest of Gentilly on land of Alcide Tourigny (see plate 10) where an attempt was once made to utilize these rocks for road material.



### Petite Rivière du Chêne Exposures

Rocks of the Fontgravé River Formation are exposed discontinuously along Petite Rivière du Chêne starting at about one hundred feet upstream from the small bridge (the most upstream one) and continuing to appear over a distance of about 1 mile.

The outcrops are composed of greenish-gray shale with 1 inch to 2 inches thick interbeds of dense, hard argillaceous limestone and fine grained, laminated with brown weathered surface sandstone. Some ripple marks, were observed in some sandstone beds. Fossils are numerous especially Catazyga headi, Bissonychia radiata and several other pelecypods (see table 3). The outcrops ceased to be present in the second big turn of the river ½ mile downstream from the second bridge (the most downstream one).

Numerous exposures were made while excavating for building (see plate 13) or for road purposes in the new Bécancour Industrial Park. Numerous outcrops of the Pontgravé River Formation became available (see plate 9) while digging for road, sour or drainage purposes. From Gentilly no more outcrops occur on the northwest flank of the until, Chambly-Fortierville. The Petite Rivière du Chêne is reached where the shales, limestones and sandstones appear again (see plate 11).

#### Southwest flank of the Chambly-Fortierville Syncline.

On the southeast flank of the Chambly-Fortierville syncline, exposures occur along the Gentilly River, along Des Orignaux River and again along the Petite Rivière du Chêne.

#### Gentilly River Exposures

On the Gentilly River, the senior author has mapped in 1943, three exposures of the Pontgravé River Formation. The most northerly outcrop is composed of 4 feet of soft shale with hard 6 inches thick sandstone and 3 inches thick limestone interbeds. The limestone beds contain abundant crustacean fragments. The second exposure downstream consists mostly of dark micaceous shale and a bed of lenticular cross-bedded sandstone bed. Only one fossil, a pelecypod was seen. The most, southerly outcrop along the Gentilly River is again composed of shale and heavy sandstone and no fossil was observed. However, these three exposures of the Pontgravé River Formation on the Gentilly River are now completely covered by sand and clay coming down from the river cliff and it is impossible to see them now. The recording of these three exposures in the past

by the senior author reveals itself to be very important today.

#### Rivière des Orignaux Exposures

On Rivière des Orignaux, about  $\frac{1}{4}$  of a mile northwest of the village of Sainte-Sophie de Lévrard, exposures of the Pontgravé River Formation occur above the bridge and can be followed for about  $\frac{1}{2}$  mile. These exposures are mainly composed of thick greenish-grey silty limestone and sandstone in fresh surfaces, brownish in weathered surface in beds up to 6 inches. Thick numerous ripple marks have been noticed.

#### Petite Rivière du Chêne Exposures

On Petite Rivière du Chêne,  $2\frac{1}{2}$  miles west of Sainte-Sophie de Lévrard, good exposures mostly under water can be observed (see plate 12). The outcrop is mostly composed of thick (up to 3 feet) of greenish-grey sandy, massive limestone with some cross-bedded sandstone also greenish-grey in color. The sandy limestone or calcarenite is hard, thickly bedded but the greenish-grey sandstone is more thinly bedded and soft. This zone of outcrops has been gently folded in a small anticline being visible at the northern end of the exposure.

No fossils were found except for few fragments of brachiopods.

### Thickness

According to the wells drilled in the area the thickness of the Pontgravé River Formation varies from 110' to 415' feet. The former thickness was encountered in the Husky Gentilly # 1 well and a later was disclosed by the Husky Bruyères # 1 well. There is, however, no way of knowing how much of the original section was in the latter section eroded away since it is covered by overburden.

### Fauna

The Pontgravé River Formation is the most fossiliferous formation of the area. It contains great amount of specimens of many species. However the most characteristics fossils generally present in every exposures of the Pontgravé River Formation are the followings:

The brachiopods Catazyga headi, and the coral Streptelasma rusticum. Along with these two fossils, we usually find the following brachiopods Rafinesquina alternata, Strophemena neglecta, Sowerbyella sericea, Zygospira kentuskiensis, Platystrophia clarkvillensis. The gastropods Lophospira beatricea and Clathrospira subconica are also usually present. The pelecypod fauna is also generally well represent with species such as Whitella complanata, Byssonichia suberecta, Pholadomorpha pholadiformis, Cuneanya neglecta and Modiolopsis vera.

One head (6 inches in diameter) of the coral Favistella alveolata was also found in one of the ditches of the new Bécancour Industrial Park.

Table 3

FOSSILS OF THE PONTGRAVE RIVER FORMATION

PHYLUM and SPECIES	Locality				
	Gentilly ( 2 1/2 S.W. ) old quarry ancienne carrière	Rivière Gentilly (21/8 miles from the road to Ste-Marie) 21/8 de la route de Ste- Marie.	Rivière du Chêne (south belt) ( bande sud )	Rivière du Chêne (flanc nord) (north flank)	Bécancour ( 2 milles au N.E. ) ( 2 milles N.E. )
<u>Brachiopoda</u>					
Dalmanella sp.	X			X	
Herbertella occidentalis	X				
Rafinesquina aternata	X			X	
Strophomena neglecta	X				
Leptaena sp.	X				
Catazyga headi	X		X	X	X
Platystrophia clarksvillensis	X				
Rafinesquina sp.		X			X
Zygospira modesta		X			X
Sowerbyella sp.			X		X
Lingula rectilaris				X	
Zygospira sp.				X	
Zygospira kentuckyensis				X	X
<u>Trilobita</u>					

*Pygospira* sp.

*Pygospira kentuckyensis*

X X

Trilobita

*Calymene meeki*

X

*Cryptolithus recruris*

X

Pelecypoda

*Pterinea demissa*

X

X

*Byssonychia radiata*

X

X

X

*Whitella complanata*

X

X

*W. complanata*

X

X

*Pholadomorpha pholadoformis*

X

X

*Gastropoda* *fissicostata*

X

*Whitella cf. complanata moniquensis*

X

*Byssonychia suberecta*

X

*Modiolodon poststriatum*

X

*Cuneanya* sp.

X

X

*Cuneanya neglecta*

X

*Modiolopsis vera*

X

*Pholadomorpha chlambulensis*

X

Gastropoda

*Lophospira beatrice*

X

*Clathrospira subconica*

X

*Melicotoma* sp.

X

*Sinuities cancellatus*

X

*Lophospira* sp.

X

Echinoidea

X

Helicotoma sp.	X		
Sinuities cancellatus	X		
Lophospira sp.		X	
<u>Echinoidea</u>			
Taeniaster mefordensis		X	
<u>Cephalopoda</u>			
Straight cephalopods	X		
<u>Incertae sedis</u>			
Cornulites cf C. flexuosus		X	
<u>Coelenterata</u>			
Streptelasma rusticum	X		X
Favistella alveolata			X
<u>Bryozoa</u>			
Rhombotrypa quadrata		X	
<u>Stromatoporoidea</u>			
Beatricea indulata	X		
Beatricea sp.	X		
<u>Ostracoda</u>			
Bythocypris cylindrica	X		X
<u>Cirripedia</u>			
Lepidocoleus jamesi	X		

A small horn-like fossils is also present in abundance in this formation is the Incertae sedis genus Cornulites cf. *C. flexuosus* which however is also found in the Lorraine.

For a complete list of the fossils found see table 3.

#### BÉCANCOUR RIVER FORMATION

The Bécancour River Formation the highest formation exposed in the Chambly-Fortierville syncline consists of a few tens of feet of gray shales in the lower part (the Carmel River Member see plate 13), followed upward by red shales and sandstones and few lens-like gypsum beds, veins and molds of crystal groups up to 7" across. With the latter minor amounts of green and gray shales and sandstones are interbedded. Save for the places where the relatively few beds of sandstone show up, stratification is obscure.

These rocks can be seen to good advantage along the banks of the Petite Rivière du Chêne, the Gentilly river, and the Bécancour River.

#### Petite Rivière du Chêne Exposures

On the Petite Rivière du Chêne they are intermittently exposed as mapped, for a distance of a mile and a quarter with dips, constantly to the south, of 2 to 7 degrees. If we assign an average dip of four degrees the calculated thickness would be 442 feet. This is likely to be somewhat higher than the actual figure, because the flatter dips all occur in the southern part of the section, that is, toward the center of the syncline. Hence it appears better to assume that a thickness of about 400 feet of



Bécancour River Formation is exposed here. Inasmuch as the southwestward plunge of the fold can scarcely be assumed to be as much as half the amount of the dip on the flanks, the area of outcrop of the folded Bécancour River beds northeastward from Petite rivière du Chêne should, by calculation, be extended two or two and a quarter miles to the northeast. This would carry the extension of the Bécancour River Formation just beyond the boundary of the map into the Portneuf area where it terminates in the nose of the syncline.

#### Gentilly River Exposures

Along the Gentilly river exposures, almost wholly of red shales and sandstones, (see plate 14) occur with a constant strike of  $30^{\circ}$  and with dips ranging from 2 and 3 degrees to 6 and 7 degrees. The latter are probably exceptionally high, but, inasmuch as the exposures are developed over a width of a little less than a mile -- say, 5000 feet -- the calculated thickness, based upon assumed dips of  $3^{\circ}$  and  $4^{\circ}$  are, respectively, 262 and 349 feet. The syncline is here five miles wide, and these exposures occur only near its southeast border.

#### Bécancour River Exposures

Compared with what can be seen along the Petite Rivière du Chêne there is a relatively greater breadth of outcrop of the Bécancour River Formation beds along the Bécancour river. There is a very simple explanation for this. At two localities, first, 600 feet below the mouth of Rivière Saint-Wenceslas, and, second, a few hundred feet above the old railroad bridge a mile or more above Bécancour, anticlinal axes of southwestward plunging anticlines

can be plotted from among the exposures on both banks of the river. The main syncline is here thus complicated by these secondary wrinkles. Its width of outcrop is there by doubled, or possibly trebled. On the basis of  $2^{\circ}$  dips, 273 feet of are exposed Bécancour River on that limb of the anticline whose axis can be seen close to the mouth of Rivière Saint-wenceslas. The three thicknesses given above are those of measured sections only. It is likely that the total thickness of the whole formation as developed in this map-area is more than 600 feet. For instance, the 273 feet calculated from the exposures on the Bécancour is for only that part involved in the anticlinal dome; and is not concerned with those beds outcropping between the limits of that dome and the outer boundary of the Bécancour River. Formation.

#### Other separated exposures of the Bécancour River Formation

Exposures of the Bécancour River Formation are also present in a small river entering the center side of Lake Saint-Paul about 3 miles southwest of Bécancour. Again here, red shales contain few interbeds of greenish-grey sandstone from 1" to 4 inches thick.

While driving from Gentilly to Bécancour, one can right away noticed a small terrace-like hills which is composed near Gentilly of the Pontgravé River Formation but as one approaches Bécancour and beyond along the south side of Lake Saint-Paul, this hill gets a reddish tint revealing the presence of the Bécancour River Formation. The Carmel River Member can be readily observed below this hill in some of the drainage ditches as mentioned above it is composed solely of non-fossiliferous greenish-grey shale. This thin

member is also well seen in some of the new ditches or building excavation (see plate 13) made in the Bécancour Industrial Park.

Fauna

The Bécancour River Formation does not contain, for the most part any fossils but at its base near the contact with the Pontgravé River Formation on the Gentilly River, fossils were found especially the pelecypods Byssonichia radiata and Zygospira kentuckyensis. However, this could be interpreted by considering the fact that the change from marine to non-marine sedimentation was not everywhere abrupt and an alternation of red Bécancour River Formation and grey Pontgravé River Formation is present at the base of the section.

Thickness

As mentioned above, it is likely that the total thickness of the whole formation in this map-area is more than 600 pieds.

In the Husky Gentilly # 1 well in the center of the basin, a thickness of at least 343 feet was encountered under the overburden. There is of course, no way of knowing how much of the original section was eroded away.

As far as the thin Mont Carmel Member is concerned a thickness of 5 feet was recorded from Imperial Lowlands # 3 well near Précieux Sang Station. In the other wells it was not differentiated from the rest of the Bécancour River Formation. At the type locality

on Mont Carmel River a tributary of the Pontgravé River it is 40 feet thick. In the Bécancour map-area it surely does not exceed this figure and it is in the order of 25 feet thick, <sup>as</sup> measured in subcontinuous exposures.

### STRUCTURAL GEOLOGY

Only one major structural unit can be made out on this map-area, the Fortierville syncline. However, by comparison with contiguous areas it appears that the southeast corner of the map is cut off by thrust faults and that a part of the folded Appalachians is brought to lie against the southeast flank of the aforesaid syncline. Two normal faults have also affected the rocks of the area; the Saint-Prosper fault cutting through the N.W.- Corner of the area and the Sainte-Angèle fault passing close to the southshore of the Saint-Laurent River near Saint-Angèle.

### CHAMBLY-FORTIERVILLE SYNCLINE

The gross structure of the rocks of the Bécancour area is a syncline striking more or less northeast - southwest, with probably a belt of complications along its southern flank, which latter belt is in turn followed by the belt of folded rocks of the Appalachian mountain built province, though there is only one indication of this within the limits of this map. Two main rock types are present, though presenting numerous variants. In the center of the syncline is the red Rivière Bécancour Formation shale, and on either side, and around the northern end are exposures of the gray clay-shales, limestones and sandstones of the Rivière

Pontgravé Formation of the Richmond Group and of the sandy shale and sandstone of the Lorraine Group. So, structurally, the rock units of the area have been bent downward into a long trough-shaped depression. The area of which lies entirely southeast of the Saint-Laurent River. The two flanks of this syncline are not similar the north-west of the axis, the sedimentary beds are fairly uniformly disposed, and dip is evenly southwestward toward the axis. On the south east, however, the syncline is limited by a major thrust plane (Logan's Line).

In addition to the establishment of this syncline by the areal distribution of the stratigraphic units as shown on the map, three good cross-sections are provided along the Petite Rivière du Chêne, the Gentilly and Bécancour rivers. In the first case only the red shales of the Bécancour River Formation are exposed by secondary folds. Along this section, as shown above, at least 400 feet of the Bécancour River shales can be measured. On the Gentilly river about 300 feet of beds of the same formation are exposed on the southeast limb of the fold, and are here followed outwards by beds of Pontgravé River age. There is no evidence by which the structure closer to the axis of the syncline along either of the above rivers can be deduced.

However, along the Bécancour river (see map), where exposures occur for five miles above the village of Bécancour, there is more information. The widening of the syncline southwestwards from the Gentilly river, as shown by the exposures of the Pontgravé River and the actual outcrop of the Bécancour River would ordinarily indicate a continuing plunge to the southwest, and a greater thickness of the beds involved. A careful plotting of the exposures along the Bécancour river reveals that the fold here is not simple, but is accompanied by a least two superimposed anticlinal folds with an intermediate syncline. These two anticlines and the syncline presumably disappear northeastwards, for no trace or evidence of them is to be seen on either, of the other two rivers. Southwestwards, the paucity of Bécancour River exposures makes any conclusion as to structure one of probabilities rather than certainties.

Very rarely are the dips more than 5° or 6° anywhere on this map-area. Here and there an exceptional dip of as much as 15° can be seen, but the vast majority of measured dips lie below 4°. The folds have a N.E. - S.W. strike and the plunge are towards the N.W. or the S.E. with an angle of less than 5°.

Seismic works done in the area by Lowlands Exploration Ltd (GM-4647) in 1955-56 have revealed by gravity and seismic a significant anticlinal high in the vicinity of Précieux Sang. This structure appears to be over five miles in length, one to two miles wide. Two other anticlinal structures were revealed by seismic one passing ½ mile west of Rainbault in the direction of Grand Saint-Louis and the other passing immediately west of Hushy Gentilly well \* 1 and crossing Gentilly River in its southwestern extension. These demonstrate the complicated nature of the center of

the Chambly-Fortierville syncline.

Folded Appalachians. The southeast corner of the map is shown as being cut across by the frontal thrust of the Appalachian mountain built terrane. Because there is only one rock exposures in this part of the map the establishment of such a structure depends wholly upon the logical continuation of established conditions from contiguous map-areas into this one.

As we approach the southeastern corner of the map-area we notice that the Lorraine strata become more acutely dipping. At places, especially on the Gentilly River they are vertical and accompanied by drag folds. These are the results of thrusting that went on in this part of the map-area during the taconic orogeny. Unfortunately exposures are almost absent and it is impossible to map accurately all the changes that took place in the rocks as we get closer to the Appalachian front.

#### Thrust faults

The three thrust faults that are shown in the southeastern corner of the map-area were traced by using first, the sole outcrop of Sillery rocks plus the red coloration of the soil in area nearby; this for the limit of the southern most thrust fault, secondly by extending in the area the faults that were accurately mapped in the nearby area to the east, and thirdly by considering the age of the graptolites found in the Petite Rivière du Chêne exposure closest to Manseau and also the age of the graptolites found in the Gentilly

River exposures.

Normal faults.

St. Prosper Fault. There is a discordance between the distribution of rocks in the eastern part of the Three-Rivers area and that of the northwestern corner of the Bécancour area. Harmony between the two can only be restored by the introduction of a fault passing near Saint-Prosper (whence it gets its name) southwestwards to almost reach the Saint-Maurice river six miles above Trois-Rivières. The fault which is shown to cut across the northwestern corner of the map-area is then controlled in position by the distribution of the rock formations on the Grondines map-area to the north (Clark, Globensky and Lunde 1970) and in the Trois-Rivières map-area to the southeast (Clark and Globensky 1971) where the fault was accurately traced using precise well data. Along this fault, the rocks to the south were dropped down.

Ste. Angèle Fault. The close proximity of exposures of Lower Lorraine and of Pontgravé River beds along the northeastern margin of the hill northwest of Bécancour necessitates the placing of a fault there. The fault must pass to the south of the remaining Lorraine exposures northwest of Bécancour (see fig. 3). It is drawn with a strike of about  $60^{\circ}$  partly because such a strike raises no problems concerning the known rock distribution, and partly because this direction is that of the major faults -- St. Prosper, Deschambault, and Neuville -- which cut across the Precambrian contact to the north, with which faults this one is considered to be genetically connected.



The displacement here consists of at least the thickness of the Middle and the Upper Lorraine, which in the Nicolet River section amounts to 1395 feet. This is a minimum figure, and it is unlikely that the actual displacement much exceed it.

## ECONOMIC GEOLOGY

### Petroleum and Natural Gas

In the economic field, attempts so far made to find commercial quantities of natural gas and oil have been unsuccessful (see Parks, 1929, 1931 and also Snider & Barish 1935). However, it should be pointed out that natural gas is being delivered from producing wells in the Pointe-du-Lac region, just a few miles west of the present area. In the past, only two localities in the area were reputed for occurrences of natural gas. In the southwest corner, on the land of Merille Leblanc, 2 $\frac{1}{2}$  miles south of Bécancour, a few bubbles of gas erupt from time to time in a well dug for water in the middle of a field. And near the northern end of the sheet, at a road corner 2 miles northwest of Ste-Cécile, I was told of a cheese factory, since burned to the ground, which was run by natural gas. No attempt to re-establish the flow of this fuel if it ever existed, is made today.

In 1889, a shallow well was bored on the land of E. Bergeron in the St-Grégoire parish, but without success. Later in 1933 and 1934 the Canadian Seaboard Gas & Oil Company drilled two wells one in the St-Grégoire parish and the other in the Ste-Angèle de Laval parish. In both wells some gas shows at several depths were encountered but no oil shows. In 1948, a well in Ste-Gertrude parish was bored on

land of J.A. Roy and J. Fortin with a gas show. Several years later in 1954, and for the following years started a much more intense petroleum exploration program. In the years 1954, 1955, 1956, 1957, 1959, 1961, 1962, 1971, 19 wells were bored in the area. These are listed in Quebec Department of Natural Resources Publication S-75 part II as numbers 3, 4, 5, 6, 7, 18, 27, 48, 49, 50, 66, 67, 71, 74, 118, 119, and 63, 71, 72, 141, 156, 158 in S-75 part I. Summary logs of these wells are given below in appendix I. None of the wells produced commercial amounts of gas or oil. However most of the wells, except for well #18, 66, 67, 71, 74, 119, 156, 158, in the (S-75, Part II), and #71, 72 in (S-75, Part I), have given gas and in one case well # 5 (S-75, part II) oil was recovered in small quantities. As indicated in Appendix I, gas was encountered in most formations starting from the Chazy up to the Pontgravé Formation and in the glacial drift. As for oil, it was met within the Chazy and in the Utica but as mentioned before in no commercial amounts and in only one well. If any generalization can be made it is that the rocks which has been more frequently the host of gas, in the area belong to the Lorraine Group, which 22 gas shows at various depths in the wells listed above. The next formation in importance as far as gas shows are concerned is the Trenton with 12 gas shows. After, comes the Chazy, with 7 gas shows, followed by the Utica with 6, glacial drift with 3, Black River with 2, and Pontgravé with 1.

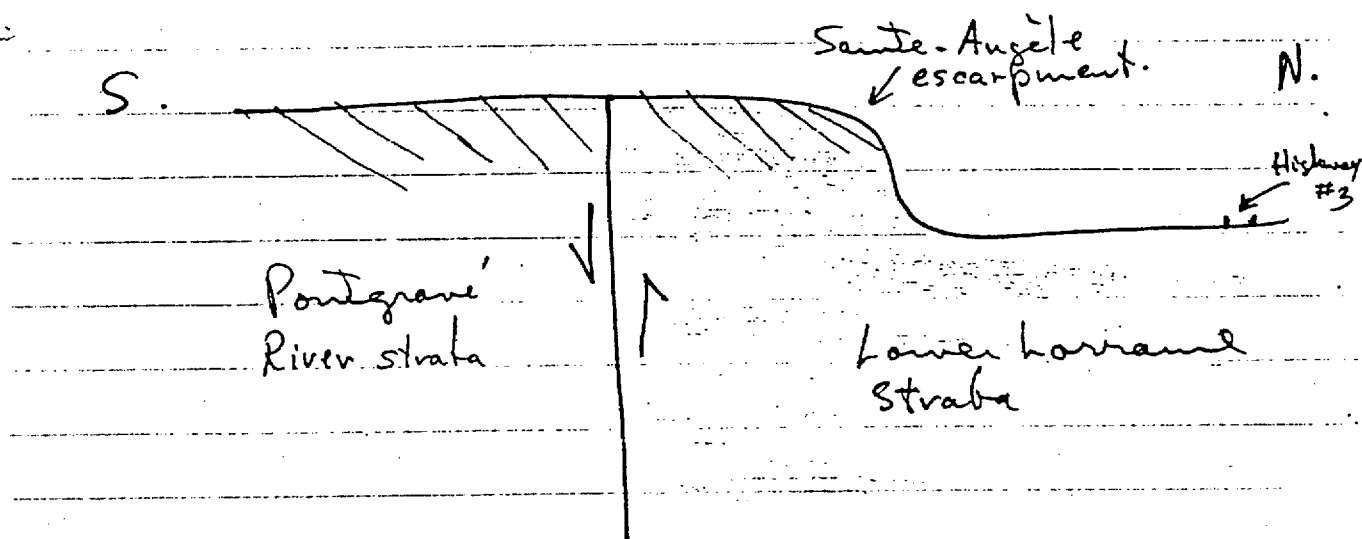


Fig. 3 Sainte-Angèle Fault

This fault is situated near the escarpment southeast of the village of Sainte-Angèle. The Lower Lorraine strata were dropped down.

However, it should be pointed out that Lorraine type of rock, is quite abundant in the area, so that the gas was not encountered at great depth. In well No. 48, gas was met in Lorraine type of rock at 48', in No. 50 at 75', in No. 6 at 172' and so far up to 1903' in No. 7. So we can observe that gas was found more frequently accumulated closer to the surface in the sandy, more porous Lorraine type of rocks.

#### Road Material

Little, if any, materials of value have have been extracted from the rocks of this area. An attempt was made to use the Pont-gravé River shale and limestone, occurring on the land of Alcide Tourigny (formerly owned by Maurice Lavigne), 2½ miles southwest of Gentilly, a few years ago for road material, but its high kaolin content was responsible for its ready crumbling upon exposure to the atmosphere. Similar attempts appear to have been elsewhere, e.g. minor excavations east of Ste-Angèle, and at the sharp road corner 3 miles northeast of Bécancour, but without success.

#### Sand and Gravel

Sand is present as a veneer a few feet thick over most of this map-area. Gravel is scarce except in a few places. Three miles southeast of Ste-Gertrude extensive deposits of sand and gravel, in the form of outwash planis lying to the south of an eastwest recessional morainal belt, have provided great quantities of road material

to date. Half way between Lemieux and Manseau gravel has been quarried in the past in a group of sand and gravel hills. Adjacent to the new highway in the southeast corner of the map there are vast quantities of sand in kame or beach like deposits, most having some gravel associated with them.

#### Economic minerals

Ochre products have been produced for many years at a small operation near Red Mill, a few miles northeast of Cap-de-la-Madeleine (Champlain). It was exploited for many years by the Sherwin-Williams Company of Canada Limited, but since 1965, it is own by the Red Mill Industries Limited, but the production was quite low in the last few years. The use, nowadays, of artificial pigments is the cause of it.

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APPENDIX

Summary of Logs of  
wells Bored in the  
Area.

(taken from Q.D.N.R. Publication S-75. The well numbers used in this summary correspond to the numbers in Publication S-75 and accompanying map).

For more detailed information on wells, the reader is asked to consult the Public Archives at the Q.D.N.R. using the GM Number given in this summary.



Well No. 3

Companie: Bald Mountain Oil Co.

Nom du puits: Bald Mountain-Batiscan No 1

GM - 16480	12192	12210	12222
GM - 12170	12193	12212	12224
12171	12206	12213	12225
12172	12208	12221	12237
			12238
			12275
			12275

FormationIntervalle de profondeur (en pied)

Mort-terrain.....	0 - 115
Lorraine Moyen.....	115 - 630
Lorraine Inférieur.....	630 - 1740
Schiste argileux Utica.....	1740 - 2070
Trenton Supérieur.....	2070 - 2198

Well No 4

Companie: Bald Mountain Oil Co.

Nom du Puits: Bald Mountain-Batiscan No 2

GM - 16480	12177	12214
GM - 5117	12180	12215
	12182	12216
	12185	12217

FormationIntervalle de profondeur (en pied)

Mort-terrain.....	0 - 135
Lorraine Moyen.....	135 - 720
Schiste argileux du	
Lorraine Inférieur.....	720 - 1750
Utica.....	1750 - 2100
Trenton Supérieur.....	2100 - 2165
Trenton Moyen.....	2165 - 2205
Trenton Inférieur (Deschambault)	2205 - 2325
Black River.....	2325 - 2420
Calcaire Chazy.....	2420 - 2720
Grès Chazy.....	2720 - 3390

Well No 5

Companie: Bald Mountain Oil Co.

Nom du Puits: Bald Mountain-Batiscan No 3

GM - 5234

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 94
Lorraine Moyen.....	94 - 650
Lorraine Inférieur.....	650 - 1720
Utica.....	1720 - 2065
Trenton Supérieur.....	2065 - 2125
Trenton Moyen.....	2125 - 2170
Trenton Inférieur (Deschambault)	2170 - 2285
Trenton Inférieur (Rockland)....	2285 - 2300
Black River.....	2300 - 2395
Calcaire Chazy.....	2395 - 2705
Grès Chazy.....	2705 - 2957

Well No 6

Companie: Bald Mountain Oil Co.

Nom du Puits: Bald Mountain-Batiscan No 4

GM - 5491

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 122
Lorraine Moyen.....	122 - 685
Lorraine Inférieur.....	685 - 1750
Utica.....	1750 - 2105
Trenton Supérieur.....	2105 - 2165
Trenton Moyen.....	2165 - 2205
Trenton Inférieur (Deschambault)	2205 - 2340
Black River.....	2340 - 2427
Calcaire Chazy.....	2427 - 2500

Well No 7

Companie: Bald Mountain Oil Co.

Nom du Puits: Bald Mountain-Batiscan No 5

GM - 5620

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 100
Lorraine Moyen.....	100 - 735
Lorraine Inférieur.....	735 - 1810
Utica.....	1810 - 2140
Trenton Supérieur.....	2140 - 2205
Trenton Moyen.....	2205 - 2245
Trenton Inférieur (Deschambault)	2245 - 2307

Well No 18

Propriétaire: E. Bergeron

Nom du Puits: Puits Bergeron

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 35
Queenston.....	35 - 600
Richmond Inférieur.....	600 - 685

\* On ne sait pas si ce puits a été obturé

Well No 25

Company: Canadian Seaboard Gas &amp; Oil

Well Name: Canadian Seaboard St. Grégoire No. 1 Well

GM - 4983

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 40
Richmond (Bécancour River)....	40 - 470
Richmond (Pontgravé River)....	470 - 690
Lorraine-Utica.....	690 - 4110
Trenton (Upper).....	4110 - 4710
Trenton (Montréal & Mile End).	4710 - 5210
Black River (Leray-Lowville)..	5210 - 5245
Black River (Pamelia).....	5245 - 5260
Chazy (Beldens).....	5260 - 5680
Beekmantown.....	5680 - 6030

Well No 27

Companie: Canadian Seaboard Oil &amp; Gas

Nom du puits: Puits Canadian Seaboard Ste. Angèle No 1

GM - 4983

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 20
Richmond (Pontgravé River).	20 - 220
Lorraine-Utica.....	220 - 4020
Trenton Supérieur.....	4020 - 4960
Trenton (Montréal).....	4960 - 5110
Précambrian.....	5110 - 5620

Well No 34

Company: Châteauguay Gas &amp; Oil Ltd

Well Name: Madeleine No. 2

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 150
Middle Lorraine.....	150 - 460
No record.....	460 - 550
Lower Lorraine.....	550 - 1510
No record.....	1510 - 1600
Utica.....	1600 - 1810
No record.....	1810 - 1900
Trenton.....	1900 - 2370
No record.....	2370 - 2429
Chazy.....	2429 - 2431
No record.....	2431 - 2452
Beekmantown.....	2452 - 2631
No record,.....	2631 - 2658
Potsdam.....	2658 - 2660
No record.....	2660 - 2672
Precambrian.....	2672 - 2687

Well not plugged

Well No 48

Propriétaire: Germain Gélinas

Nom du Puits: Gélinas No 2

GM - 5027  
GM - 5029GM - 12028  
1224012253  
12255

12273

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Mort-terrain.....	0 - 3
Lorraine Inférieur.....	3 - 810

Puits non obturé

Well No 49

Propriétaire: Germain Gélinas

Nom du Puits: Gélinas No 3

22618	GM - 5029	12240
22619		12253
22620		23620

FormationIntervalle de profondeur (en pied)

Mort-terrain.....	0 - 3
Lorraine Inférieur.....	3 - 800

Puits non obturé

Well No 50

Propriétaire: Germain Gélinas

Nom du Puits: Gélinas No 4

GM - 12280	12283	23621
GM - 5029	12451	

FormationIntervalle de profondeur (en pied)

Schiste argileux (Lorraine)...	0' - 580'
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Puits non obturé

Well No 66

Compagnie: Laduboro Oil Limited

Nom du Puits: Laduboro-Seaway-Almega No 5 Champlain

<u>Formation</u>	<u>Intervalle de profondeur (en pieds)</u>
Sable fin.....	0 - 68
Argile.....	68 - 75
Gravier et schiste argileux trituré.....	75 - 96
Siltstone et schiste argileux de Lorraine.....	96 - 780

Well No 67

Compagnie: Laduboro Oil Limited

Nom du Puits: Laduboro-Seaway-Almega No 6 Champlain

<u>Formation</u>	<u>Intervalle de profondeur (en pied)</u>
Sable.....	0 - 21
Argile.....	21 - 158
Sable et gravier.....	158 - 181
Schiste argileux de Lorraine...	181 - 774

Well No 71

Compagnie: Lowlands Exploration Ltd.

Nom du Puits: Imperial Lowlands No 3

GM - 5099	23402
16499	23400

<u>Formation</u>	<u>Intervalle de profondeur (en pieds)</u>
Bécancour River.....	0 - 295
Carmel River.....	295 - 300
Pontgravé River.....	300 - 460
Lorraine Supérieur.....	460 - 1320
Lorraine Moyen.....	1320 - 3320
Lorraine Inférieur.....	3320 - 4770
Utica.....	4770 - 5500
Trenton Supérieur.....	5500 - 5531
Trenton Moyen.....	5531 - 5561
Trenton Inférieur.....	5561 - 5850
Black River.....	5850 - 6000
Chazy.....	6000 - 6514

Well No 74

Compagnie: Lowlands Exploration Limited

Nom du Puits: Imperial Lowlands Seaway Nol Champlain

GM - 8750	12453
806	12454

<u>Formation</u>	<u>Intervalle de profondeur (en pieds)</u>
Mort-terrain.....	0 - 200
Lorraine moyen.....	200 - 530
Lorraine inférieur.....	530 - 1470
Utica.....	1470 - 1750
Trenton supérieur.....	1750 - 1920
Trenton moyen.....	1920 - 2040
Trenton inférieur.....	2040 - 2190
Black River.....	2190 - 2240
Chazy (calcaire).....	2240 - 2540
Chazy (grès).....	2540 - 3020



Well No 118

Compagnie: Senneterre Metals Mines Ltd.

Nom du Puits: Senneterre Metals-Gelinas No 1 Ste-Angèle

23413

23414

FormationIntervalle de profondeur(en pieds)

Mort-terrain.....	0 - 3
Lorraine inférieur (schiste argileux, un peu de siltstone et de grès à grain fin).....	3 - 703

Well No 119

Compagnie: Senneterre Metals Mines Ltd.

Nom du Puits: Senneterre Metals-Gélinas No 2 Ste-Angèle

23418

23419

FormationIntervalle de profonseur (en pieds)

Mort-terrain.....	0 - 3
Lorraine inférieur (schiste argileux, siltstone et grès à grain fin).....	3 - 690
Aucune information.....	690 - 767

Company: Husky Oil Ltd.

Well Name: Husky Gentilly No. 1

Location:

Lot: 656

Range: 3rd concession

Parish: St-Edouard de Gentilly

County: Nicolet

Coords: Lat.: 46°21'52"

Long.: 72°16'40"

Ground Elevation: +125.95

Spudded: Dec. 10, 1970

Finished: May 18, 1971

Driller: Garnett Drilling Ltd.

Type of Rig: Rotary

Result: Dry Hole

Log: Bud Burden

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden	0' - 39'
Becancour River	39' - 382'
Pontgravé River	382' - 392'
Upper Lorraine	392' - 3465'
Utica	3465' - 5929'
Upper Trenton	5929' - 6066'
Middle Trenton	6066' - 6451'
Lower Trenton	6451' - 6621'
Chazy	6621' - 6662'
Béekmantown	6662' - 7445'
Postdam	7445'

Company: Husky Oil Limited  
 Well Name: Husky Bruyères No. 1

Location:

Lot: 83  
 Range: Rang de la Grande Rivière  
 Parish: Ste-Angèle de Laval  
 County: Nicolet  
 Coords: Lat.: 46°19'30"  
 Long.: 70°29'51"

Ground Elevation: +98.3

Spudded: June 6th, 1971

Finished: August 9th, 1971

Driller: Garnett Drilling Ltd.

Type of Rig: Rotary

Result: Dry Hole

Log: Bud Burden

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden	0' - 16'
Pontgravé River	16' - 431'
Lorraine	431' - 2138'
Utica	2138' - 2398'
Tétreauville	2398' - 2536'
Middle Trenton	2536' - 2632'
Montréal	2632' - 3109'
Black River	3109' - 3136'
Chazy	3136' - 3259'
Beekmantown	3259' - 3469'
March Formation	3469' - 3692'

Potsdam Formation

3692' - 4070'

Lower Potsdam

4070'

Well No 63

Propriétaire: Germain Gélinas

Nom du Puits: Gélinas No 1

GM - 5028  
GM - 5029

GM - 12028  
GM - 12253

Formation

Intervalle de profondeur (en pieds)

Mort-terrain.....  
Schiste argileux gris-bleu...  
Roche grise (grès?).....

0 - 3  
3 - 103  
103 - 315

Puits non obturé

Well No. 71

Compagnie: Laduboro Oil Limited

Nom du Puits: Laduboro-Seaway-Almega No 1 Champlain

Formation

Intervalle de profondeur (en pieds)

Argile.....  
Gravier.....  
Lorraine inférieur (surtout du  
siltstone gris moyen).....

0 - 145  
145 - 216  
216 - 416

Well No 72

Compagnie: Laduboro Cil Limited

Nom du Puits: Laduboro-Seaway-Almega No 2 Champlain

<u>Formation</u>	<u>Intervalle de profondeur (en pieds)</u>
Sable.....	0 - 30
Argile.....	30 - 156
Sable et gravier.....	156 - 170
Lorraine (surtout du grès à grain très fin).....	170 - 457

Well No 73

Company: Laduboro Oil Limited

Well Name: Laduboro-Seaway-Almega No. 3 Champlain

<u>Formation</u>	<u>Depth interval ( in feet)</u>
Blue clay.....	0 - 132
Fine sand and gravel.....	132 - 151
Lorraine (mainly interbedded shale and siltstone).....	151 - 457

Well No. 74

76-

Company: Laduboro Oil Ltd.

Well Name: Laduboro-Seaway-Almega No. 4 Champlain

<u>Formation</u>	<u>Depth interval (in feet)</u>
Sand.....	0 - 45
Clay.....	45 - 142
Lower Lorraine (mainly very fine grained sandstone and siltstone.....	142 - 457

Well No 141

Propriétaire: J.A. Roy & J. Fortin

Nom du Puits: Puits Roy J.A. & Fortin J.

GM - 12160	12162
12161	12285

<u>Formation</u>	<u>Intervalle de profondeur (en pieds)</u>
Les quelques échantillons disponibles indiquent que l'intervalle de profondeur 350'-485', embrasse le con- tact entre les formations Richmond et Lorraine	350 - 485

\* On ne sait pas si ce puits a été obturé

Well No 146

77-

Company: Seaway Gas and Oil Ltd.

Well Name: Seaway-Almega No. 1 Champlain

GM - 5619

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 180
Middle Lorraine....	180 - 296

Well No 147

Company: Seaway Gas and Oil Ltd.

Well Name: Seaway-Almega No. 2 Champlain

GM -5619

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 235
Middle Lorraine.....	235 - 261
Lower Lorraine.....	261 - 342



Well No 148

76-

Company: Seaway Gas and Oil Ltd.

Well Name: Seaway-Almega No. 3 Champlain

GM - 5619

GM - 5814

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 162
Middle Lorraine.....	162 - 177
Lower Lorraine.....	177 - 231

Well No 149

Company: Seaway Gas and Oil Ltd.

Well Name: Seaway-Almega No. 4 Champlain

GM - 5619

GM - 5865

<u>Formation</u>	<u>Depth interval (in feet)</u>
Overburden.....	0 - 155
Lower Lorraine.....	155 - 203

Well No 150

Company: Seaway Gas and Oil Ltd.

Well Name: Seaway-Almega No. 5 Champlain

GM - 5961

Formation

Depth interval (in feet)

Overburden.....  
Middle Lorraine.....

0 - 167  
167 - 221