ORIGINAL

Final report on

THE GEOLOGY OF THE SOREL MAP AREA

by T.H.Clark and Yvon Globensky

Front Page

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Beekmantown dolomite. Old Doucette dam on Bayonne River.

G.R. No.

Province of Quebec, Canada

Department of Natural Resources

Gilles Massé, Minister J.-G. Fredette, Deputy Minister

Geological Exploration Service

Sorel area

by

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Quebec
1972

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INTRODUCTION

Location, Boundaries, etc.

The location of the Sorel map-area within the St-Lawrence lowland, and its relationship to nearby areas, is shown on the accompanying index map (fig. 1). It is bounded by lines of longitudes 73° and 73°30', and by lines of latitudes 46° and 46°15'. It forms a quadrangle approximately 24 miles wide from east to west, and 17¼ miles high from north to south. Its area is about 414 square miles.

Natural Features

Somewhat less than the northern third of the area (124 square miles) is underlain by Precambrian rocks, and in general is an irregularly hilly region treated in a separate report by another person. The remaining 276 square miles make up a nearly featureless plain sloping downward toward the St. Lawrence river, which transects the southeastern corner of the area. This plain falls, for the most part, from about 150 along its northern margin to the level of the St.Lawrence, less than 25 feet above sea level. Inerrupting the even descent there is one escarpment, best seen between St.Viateur and Lebrun, where there is an abrupt drop of from 40' to 50' from the higher level to the lower. In the southwest croner of the area there is a low, seven-mile-long ridge running from Joliette east-northeastward with a width of approcimately one mile, and standing approximately 25 feet above the plain on either side. In this report this

is referred to as the Joliette Ridge. Adjacent to the northwestern corner of this southern, or Paleozoic, area there is the southern limit of the extensive sand and gravel delta deposited by L'Assomption river, which, within the area of the Paleozoics, rises from the plain to an elevation of 400 feet, and within the map-area itself to a high of 600 feet above sea level. There is no escarpment along the St.Lawrence shore line.

The eastern part of the boundary between the Precambrian area and the area of Paleozoic rocks is marked by a distinct and more or less abrupt escarpment, caused in part by the superior resistance to weathering of the Precambrian rocks, and in part to the presence along the boundary of a fault, which has resulted in a relative downdropping of the Paleozoic area. The western half, more or less, of the boundary is obscured by the heavy accumulation of sands which form the delta of the Assomption river.

The St.Lawrence river enters the southern margin of the area about one-third the distance from the southeast corner, and within three miles distributes its waters among half-a-dozen channels, which do not rejoin until they are well within the adjacent Yamaska map-area to the east. Along the southern border of this waterway system the Richelieu river enters from the south, and the city of Sorel is situate- at its mouth. Two other important rivers flow

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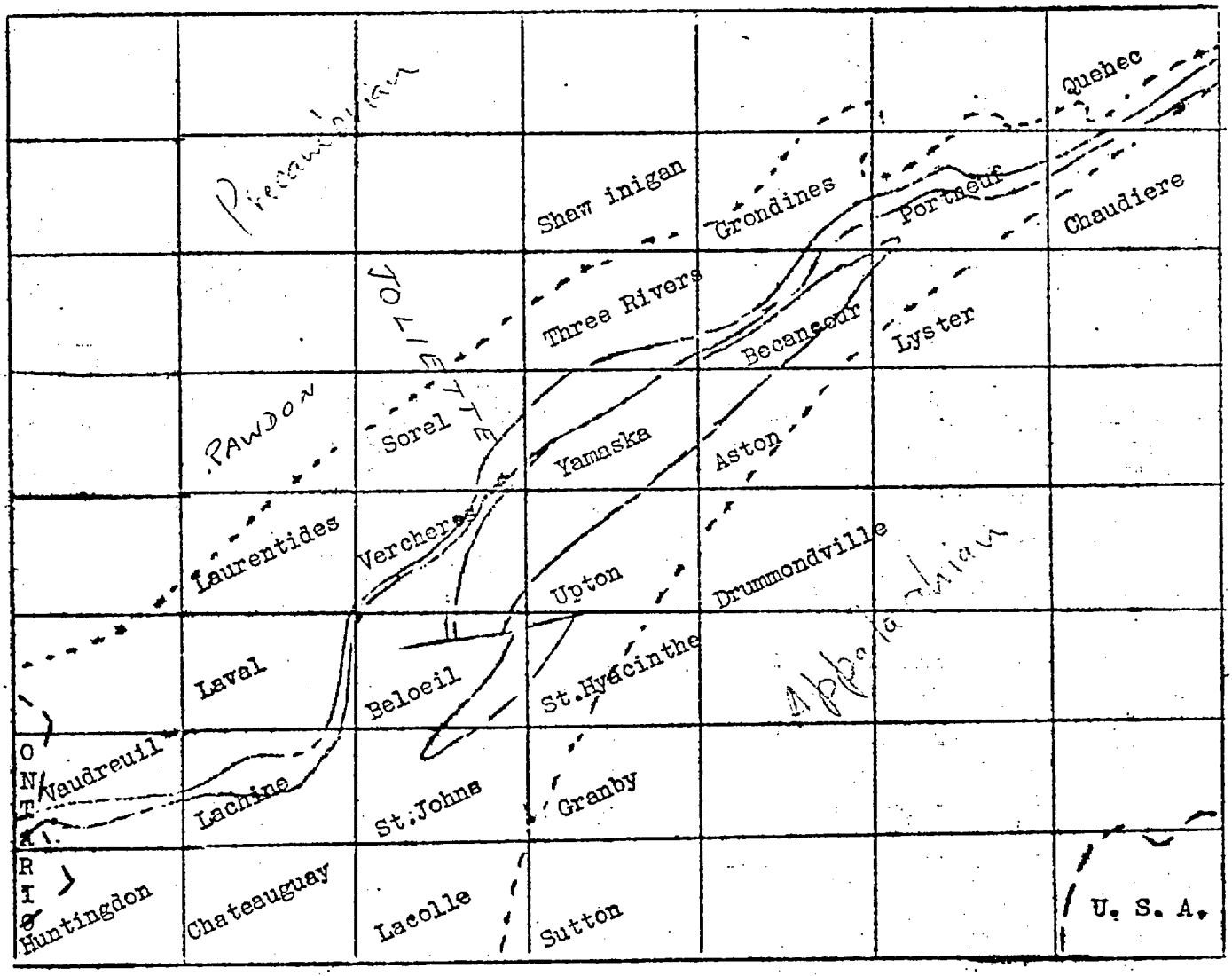

Fig.1

Index map of part of Quebec, showing the position of the Sorel map-area. Precambrian area to the northwest, the Appalachian mountain built terrane to the southeast.

over part of this area: first, L'Assomption river which winds its way southwards close to the western margin of the map, and carries on its banks the city of Joliette; and second, Maskinongé river in the northeastern corner. Other lesser streams are Bayonne, Chicot, and La Chaloupe rivers. Save for the St.Lawrence, none of these waterways is nabigable.

Access, etc.

Both Canadian Pacific and Canadian National Railways serve this area. North of the St. Lawrence the main line of the Canadian Pacific railway from Montréal to Québec passes in a nearly straight line six miles, more of less, northwest of the shore of the St. Lawrence. From a junction a few miles south of the Sorel map-area a branch line leaves this main line and runs westward to Joliette, whence it is continued due northwards to St. Félix de Valois and, beyond the limits of the area, to St.Gabriel de Brandon. The Canadian National main line from Montréal to Québec passes through Joliette, and runs thence in a nearly straight line northeastwards to Bois Blanc. On the south side of the St.Lawrence the Canadian National railway connects Sorel with both Montréal and St. Hacinthe.

The first city in importance and population is Joliette, with a population of 20,127 (1971 census), where a score of industries (Joliette was formerly known as the Village of Industry, a name still commenmorated in the city's coat of arms) have established factories, among which are the quarries and plants of Domtar Chemicals Limited, 2 miles southwest of the city and of Ciment Independant Inc. 1 mile, southwest of the City and of Ciment Independant Inc. 1 mile, northeast of the City.

Close behind Joliette comes Sorel, with a population (1973 census) of 19500. It is a prominent shipbuilding and heavy industry centre, and is the site of the newly established smelting plant for the titaniferous magnetite brought down from northern Quebec. A variety of lesser industries is located here.

Third in importance is Berthierville population 5,000 (1971 census), with two large and several small factories.

Mixed farming is the main support of the rural areas. Agricultural centers include the villages of St.Thomas, Ste.Elisabeth, St.Cuthbert, St.Barthélémy, St.Félix, and Maskinongé, together with a score of places of lesser import. Prior to the near elimination of the horse by the automobile the meadows south of Maskinongé and St.Barthélémy

were the finest hay-producing areas in the province, annually exporting huge quantities to other parts of Canada and to the United States. The abundance of barns, many of which are now no longer used, between the Maskinongé and Chicot rivers, is a silent witness to this long disused resource. For the past score of years the extensive sand delta of L'Assomption river has proved to be excellently well adapted to tobacco culture.

Quarrying is actively carried on at Joliette, east of St.Elizabeth and at St. Barthélémy. A dozen small quarries here and there were worked intermittently, in the past but the sum total of their products was insignificant.

Good roads abound. New and widered gravel roads are being provided and improved rapidly. Highway No. 2, follows the shore of the St-Lawrence in the southern part of the area, but turns inland after leaving Berthier. The main artery between Montréal and Berthierville is the to highway No. 40 which ends about three miles nord-east of Berthierville but whose northely extension towards Québec City, is under progress. Highway No. 40 is linked to Joliette by highway No. 31 which in turn is linked to highway No. 48. Access to the Laurentians can be obtained via highway No. 48 through St-Félix de Valois and via highway No. 43 through St-Norbert towards St-Gabriel. On the south shore, highway no. 3 passes through Sorel and connects Montréal with Québec City via the Quebec bridge. St-Lawrence in the southern part of the area, but turns inland after leaving Berthier. On the South Shore, highway no. 3 passes through Sorel and connects Montréal with Québec via the Québec bridge.

General Geology

Precambrian rocks occupy only the northwestern corner of the area. Potsdam sandstone, Beekmantown dolomite, calcareous sandstones of the Chazy Group, Black River, and Trenton limestones are the sedimentary rocks exposed in the rest of the area. From the known distribution of the above formations one would expect that the Utica and the Lorraine beds, and possibly the Richmond also, would be found distributed over the southeastern part of the map-area. In fact, the Utica and Lorraine rocks have been recognized in the Mohr Well and in the Cartier Natural Gas No. 5 well (Belyea, 1952 p. 86. 69).

In the Verchères map-area, immediately south of the Sorel area, the sedimentary beds dip in general to the southeast, i.e. towards the axis of the Chambly-Fortierville syncline, with dips ranging as a rule from 1° to 4°. They are broken by two major faults, and by numerous minor dislocations.

Trenton limestone is the chief geological resource. It yields stone for lime and for construction work. A small amount of Beekmantown dolomite has been used for building and for rough stone fill. Natural gas is fairly common, but nowhere occurs in sufficiently large quantities to supply more than the house to which the active well belongs. In fact, very few house-holders make use of this resource. Sand occurs in great quantities north of Joliette along L'Assomption river, but though gravel is common there also, it is too 'clean' to be a first-class road-building resource.

Methods of work, and Acknowledgments

The Paleozoic rocks of the Sorel map-area were mapped by T.H. Clark during the summers of 1950, 1951, and 1952. The area was revisited by Yvon Globensky during the summer of 1972 and exposures mainly from new by dug quarries, road cuts and agricultural ditches, were added to the original map. The original mapping was done for the most part using the Sorel Sheet No.31-1/3 issured by the Topographic Survey of Canada, on a scale of one mile to an inch. Enlargements to double scale were also used throughout the original works. Aerial photographs, at a scale of ¼ mile to an inch, were available for the 1972 field work and allowed detailed mapping of importants parts of the area. The plotting of outcrops was subsequently done on a plenimetric map at a scale of ½ mile to an inch. The available aeromagnetic map has contributed to the recoquition of the normal faults in the area.

The cooperation of scares of individuals in furnishing information concerning quarries and wells is gratefully acknowledged.

PRECAMBRIAN

Precambrian rocks of the Grenville Province in the area (see plate 1, A, B) are composed of paragneisses of the Grenville Group and foliated intrusives consisting of mangerite and gabbro of the Morin Series.

Fine-grained charnockitic gneisses are also present as well as pink, medium-grained granitic gneisses.

On the accompanying map the precambrian rocks are not differentiated into the different consituants mentioned above and are generally refered to as precambrian gneisses. The outcrops are however well localised and could be used firectly by a specialist.

Plate 1

A- Outcrop of Precambrian rock on Bayonne River at St-Félix Station

B- Outcrop of Precambrian rock on Bayonne river, 3/4 of a mile south-east of St-Félix Station

STRATIGRAPHY

POTSDAM GROUP

General Distribution

Rocks of this group occurs within the Sorel map-area in two localities only. First, along L'Assomption river a few miles above the Canadian National railway bridge crossing the river in the northern part of Joliette, there are four exposures occuring between Precambrian biotite gneiss which is found six miles and a half, straight line, above the same bridge, and Beekmantown dolomite which outcrops as far as three miles and a quarter above the bridge. Assuming an average strike hereabouts of about 60°, the breadth of outcrop between the limiting formations is about three miles and three quarters (see page 76). Seconds, half a mile above the highway bridge over Chicot river at St.Cuthbert, Potsdam sandstone and conglomerate occur in the bed and the banks of the river.

Covey Hill and Châteauguay Formations

In the Montréal area, the Covey Hill Formation which rests unconformably on the Precambrian is composed of heterogeneous fluviatile sandstones with abundant trough cross-stratifications. The Châteauguay Formation is transitional but is mostly marine and is composed of orthoquartzite deposited by wave-action, (Schmerbers and Morizet, 1971). These definitions can be applied to the Sorel area but the delimitation of the two formation is less obvious than in the Montréal area.

L'Assomption River Exposures.

There are four separate exposures, as shown on the map. The two uppermost (riverwise) are small and show nothing but white sandstone on both banks of the river. The more northerly of these, and therefore the one nearest the Precambrian, is limited to about 50 feet in length along the river, so that with dips of 4^{o} and 8^{o} there is probably less than 5 feet of beds exposed here. The more southerly of these is more extensive, an occurs on both sides of the river where it bends towards the west. The attitude of the beds is 115^{o} 8^{o} south, so that in a riverwise length of 200 feet there are probably between 20 and 25 feet of sandstone exposed.

Farther downstream, at the end of the ¾ mile long road going south from a secondary east-west road, there occurs the third exposure (see plate II). This is more extensive than the others, and occupies both banks and the bed of L'Assomption river for about 800 feet, including the upper half of a small island at that locality. It consists mostly of a fairly coarse, friable, white sandstone, with beds of rusty conglomerate bearing pebbles up to 6" in diameter.

Through cross-stratification are abundant thoughout. The friableness may well be due to weathering and not to any original weakness. Pyrite crystals abound in some layers, though where they have been exposed they are now represented by limonitic patches. Numerous small crater-like pits (see fig. 2) an inch or so across are common midway along the exposure; these have a floor about ¼" thick of sandstone somewhat more whitish than the remainder of

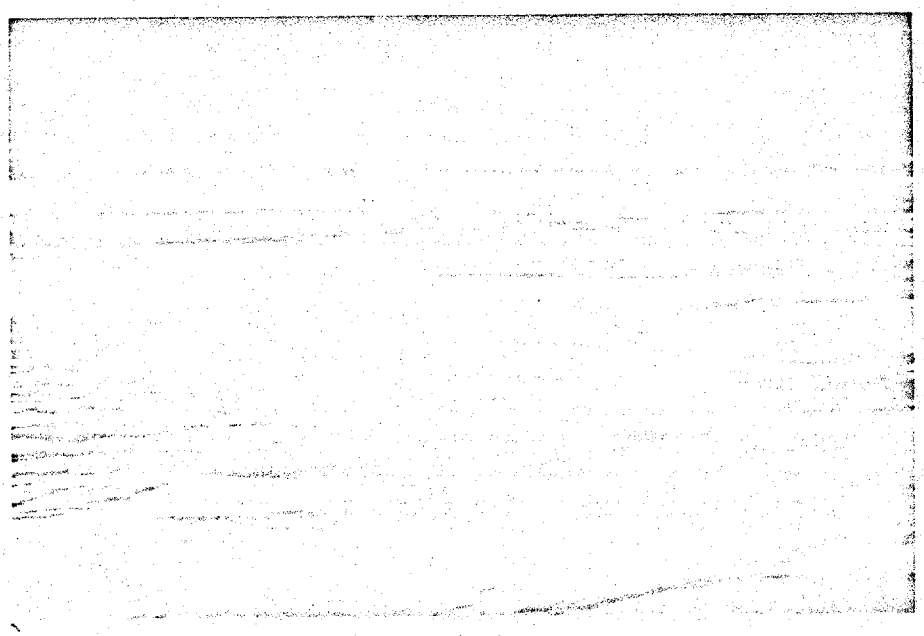

Plate II . Exposure of Potsdam sandstone in L'Assomption River showing trough cross-stratification.

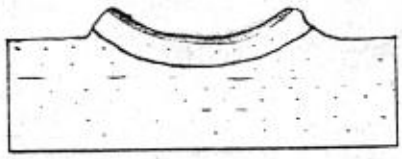

Figure 2. Craters in Potsdam sandstone, L'Assomption river.
See p. 26.
Natural scale

bed, but otherwise indistinguishable therefrom. The craters are lined with about 1/16" of brown sand. Whether or not these have any connection with the pyrite crystals which occur nearby has not been established.

The sand grains range from ¼mm. to ½mm. in diameter for the most part, but, though there is a great uniformity within narrow limits, almost every layer has coarser units, even pebbles up to 10mm. across. The sand grains are all bright and angular, whereas the small pebbles are all rounded and dull. A white kaolin-like material partially fills the spaces between the grains in some beds,but no cement or matrix is visible as a rule. Clear quartz makes up almost the entire rock, though some of the pebbles are of a darker, bluish quartz. One grain of garnet, and a few unidentified black grains, were noted.

This is a typical orthoquartzite (Pettijohn, p. 237), currently considered to be an indication of long continued weathering of a granitic land mass, and a sorting of the weathered products by the waves of an advancing sea. This theoretical outlook corresponds exactly with the view developed concerning the local sandstones from field observations, i.e. that this sandstone is a basal sandstone developed upon the Precambrian terrane now exposed to the north.

The fourth outcrop (most southern one) is as long as the third one, exposing on both sides of the river a buff and white colored, medium to coarse grained sandstone which displays numerous ripple-marks.

The exposures are better on the right bank of the stream than on the left side. Starting from the upstream and there are, for about 100 feet, beds of white sandstone poorly exposed along the shore, and dipping towards the south at about 2°. There follows a gap of about 250 feet, but within this gap there are large blocks of dolomite up to 10 feet in thickness. It is supposed that this dolomite underlies the gap, downstream from which sandstone appears again and continues to be exposed for more than 500 feet. Though all beds seen to outcrop are sandstone, save for one a few inches thick of quartz conglomerate, many show solution pits, and react sluggishly with weak dilute cold HCl. Presumably, therefore, they have a carbonate cement. Large ripple mark, with an amplitude of 12 inches, show on some beds, are Scolithus-like burrows, both vertical and horizontal, are common here and there. Lecanospira a gastropod characteristic of the Canadian (Beekmantown) series, is present, though rare and poorly preserved. Probably not more than 10 feet in continuous section is exposed here in the stretch of 500 feet, and probably less than 20 feet in the entire locality.

Description of Rock Types.

The lowest bed is a fairly uniform sandstone, with angular grains of clear quartz ranging up to .5mm. in diameter. Practically no clay-like matrix exists, and the interstices between the grains are filled with smaller grains. Effervescence with cold, dilute HCl is brisk.

In another type from the upper part of the section very well rounded grains up to 1mm. in diameter make up somewhat more than half of the rock, with practically the entire inter-grain space filled with crystalline calcite, in optical continuity over areas of half a square inch or more, so that cleavage glints are common over the entire surface of the freshly broken rock. Clear quartz predominates, but gray and blue quartz also occur, and one pebble of milky quartz 6mm. in diameter was seen. A few flakes of brown mica were identified in thin sections of the rock. Effervescence strong.

A third type, from the highest bed in the section, is made up of very fine-grained dolomite, which makes up more than one half of the rock, the remainder being grains of quartz ranging up to .5mm. in diameter, but with the majority close to .1mm. Those grains more then .3mm. across are well rounded, those below .1mm. are angular. There were also a few small grains of feldspar seen in thin sections. One bed holds a few pebbles ranging up to 5mm. across. There are also fragmesnts of fossils, but the only recognizable pieces belong to an unidentifiable inarticulate brachiopod. Thin shaly flakes, or possibly thin original muddy layers, are common in this rock. It weathers dark orange. Effervescence slight.

A fourth type is a fine-grained light gray sandstone weathering dark brown, and bearing numerous Scolithus-like burrows. The fillings of the burrows contain numerous bits of broken brachiopod shells. Effervesces freely.

The thin conglomerate bed contains a fair mixture of material. Quartz masses of all sizes up to 12mm., and of many varieties, make up the bulk of this rock, but there are also present small grains of a black mineral, probably magnetite, a pink mineral, probably garnet, and thin slabs up to 20 mm. across of shaly or fine sandy beds. Calcite cleavage sheens common. Effervesces freely.

Age and Correlation.

No fossils were found here. Inclusion of these rocks with the Potsdam Group of Montréal is made because of lithological similarity and near-continuity, and by their position as the basal member of the early Paleozoic transgressive series. Most of the section is however composed of the fluviatile Covey Hill Formation with its conglomeratic elements but the fourth outcrop on L'Assomption river belongs to be Châteauguay Formation.

Thickness.

As developed beyond, on page 76, the thickness of the Potsdam sandstone may well be in the vicinity of 317 feet. Though there is no direct field evidence substantiating this figure, it is entirely realistic.

Chicot River Exposures

About half a mile above the highway bridge over Chicot river St.Cuthbert a wide exposure of Potsdam sandstoen is present (see fig. 3 and plate III -A) along both banks of the river, and at low water in the bed of the stream. The exposures continue line the banks, and at low water one may walk across the river almost dry shod.

Three kinds of rocks occur here. 1. Quartz conglomerate: pebbles up to 3" in length are not uncommon (see plate III-B) though for the most part they are somewhat less than an inch in diameter. They are mostly well rounded, though a few angular ones may be found. The larger pebbles are elongate, about twice as long as thick. The pebbles make up about 50% of the rock, the rest consists of quartz débris, or of a mixture that looks like a subgraywacke. 2. Subgraywacke (Pettijohn, p.255): sometimes grading into the conglomerate vertically is a dark gray sandstone consisting of a mixture of ingredients which, however, could not be easily identified. Even in thin section little but quartz (most of the grains of which are sut-angular and lie between .1mm. and .2mm., a few grains reaching 1mm. in diameter), occasional feldspars, and a fairly abundant matrix of brownish, unidentifiable material could be seen.

3. Pure white quartz sandstone: The grains are rarely more than 1mm. in diameter. In thin section the grains are sub-angular, mostly .2mm. to .4mm. across. All are of quartz, and are held a part by a web of matrix material, probably clay.

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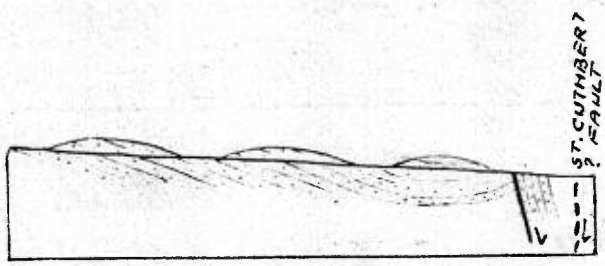


Figure 3. Potsdam sandstone exposures along left bank of Chicot river above St. Cuthbert. See page [illegible].

Horizontal scale / 250 feet /

These three kinds of beds do not seem to have any definite stratigraphic pattern. The lowest bed exposed is conglomerate but upstream from -- and contiguous to -- the fault there is also a conglomerate bed. White sandstone occurs near the upper and the lower ends of the outcrop, and the rock is exposed downstream from and contiguous to the fault. No distributional pattern could be discerned for the subgraywacke.

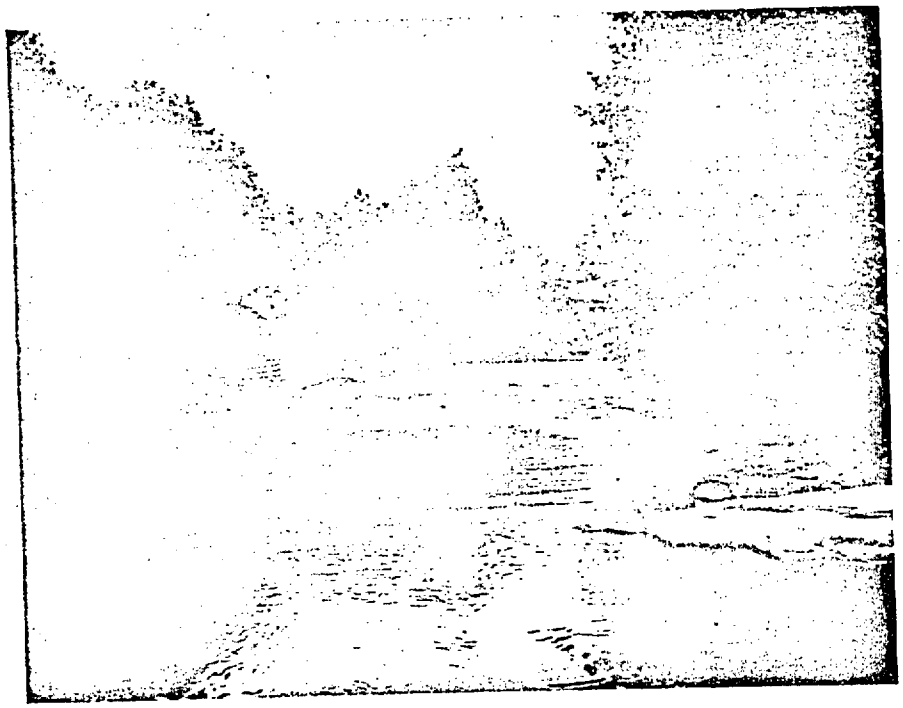
Most of the pebbles are of clear quartz, a few are of milky quartz, of chert, or of quartzite. The large size of the quartz pebbles suggest a gneiss as the parent rock.

A fourth type is a fine-grained light gray sandstone weathering dark brown, and bearing numerous Scolithus-like burrows. The fillings of the burrows contain numerous bits of broken brachiopod shells. Effervesces freely.

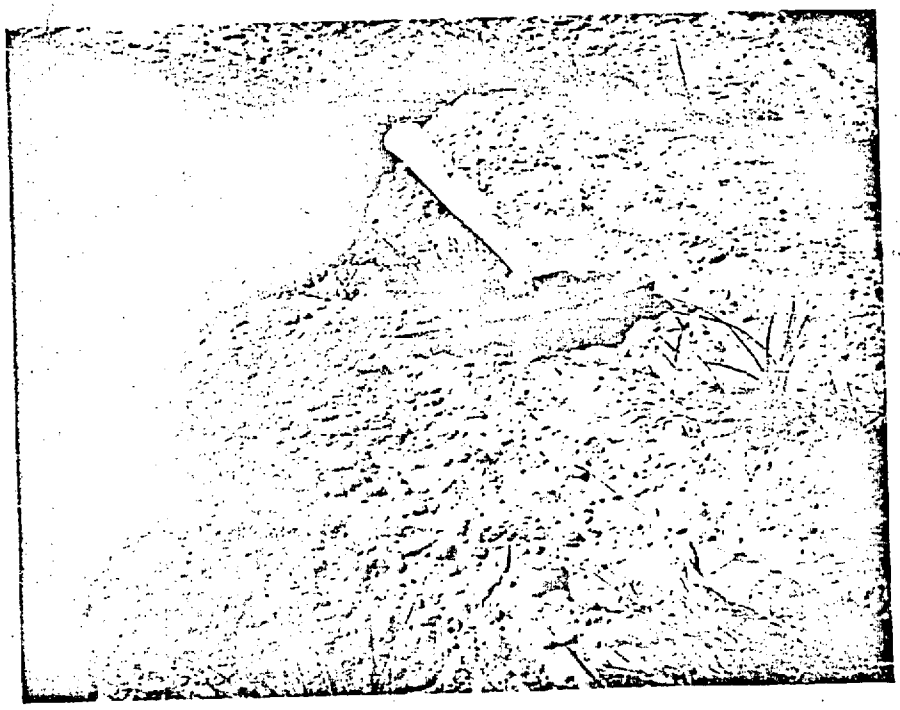
The thin conglomerate bed contains a fair mixture of material. Quartz masses of all sizes up to 12mm. and of many varieties, make up the bulk of this rock, but there are also present small grains of a black mineral, probably magnetite, a pink mineral, probably garnet, and thin slabs up to 20mm. across of shaly or fine sandy beds. Calcite cleavage sheens common. Effervesces frelly.

Logan (1863, p. 95) recorded Protichnites from this locality which would definitely serve to correlate the rock with the Châteauguay Formation of the Châteauguay area (Clark, 1966) and the Montréal area (Clark, 1972). No fossils at all were found during the prosecution of the present work.

Plate III



A- Chicot River Rotsdam exposure.



B- Clos

Thickness

At the extreme downstream end of the outcrop there is a fault, transverse to the river, which brings strongly tilted sandstone against gently tilted conglomerate (fig. 3). Immediately above the fault the sandstone beds have been deformed so as to form a structural basin. Between the upper end and the fault, assuming an average dip of 2^{o}, a thickness of 22 feet is indicated. However, the suddenly increased dip as the section approaches the pool probably increases the thickness somewhat. It is probably safe to say that there is a maximum of 25 feet exposed here.

BEEKMANTOWN GROUP

General Distribution

If a straight line be drawn from the southwestern corner of the Sorel map-area to the intersection of the Berthier--Joliette county line with Bayonne river, then upstream from that line exposures of Beauharnois dolomite occur along L'Assomption river to within a quarter of a mile of the lowest Potsdam sandstone outcrop; on Chaloupe river up to a few hundred feet above the railway bridge; and on Bayonne river for a mile and a half above Doucette's dam, 1,000 feet east of the county line. Beyond Bayonne river to the northeast no Beekmantown beds are known to outcrop in this map-area, though in the southeastern corner of the northern half of the Joliette map-area Beauharnois dolomite occurs at the foot of St.Ursule falls on Maskinongé river. The lack of exposures in the northeastern part of the Sorel area is, of course, occasioned by the St.Cuthbert fault.

Beauharnois Formation

In the Montréal as in the Sorel area, the Beauharnois Formation is composed of a light, medium, or dark gray dolomite with many variations of the dolomitic parts as described below.

L'Assomption River Exposures

The stratigraphically lowest beds of the Beekmantown Group, as exposed along L'Assomption river, (see plate IV) are to be found 2¼ miles, straight line, from highway no. 42-48 bridge across the river at Joliette, and are three-quarter of a mile from the extensive exposures of Potsdam sandstone upstream. This Beekmantown exposure and the other ones on L'Assomption river the passing through can easily be reached by taking road Notre-Dame-des-Prairies and following the north shore of L'Assomption River where a series of secondary roads leads to summer houses on the river shore.

This exposure is a long one and is situated on the site of an old dam and mill, the ruins of which are built upon the outcrop. The latter is in excess of 1,000 feet long, and is well exposed on both sides of the river. The dip ranges from 1^{o} to 2^{o} towards the southeast, and probably not more than 25 feet of beds are exposed here. A great variety of rock types common within the Beekmantown Group occurs here, from pure limestone (rare) to pure dolomite, and from sand-free rock to one composed almost wholly of sand. The common type is a granular medium gray dolomite. Fossils are common near the top of the section and include Lecanospira (see plate IV B) cystid plates, algae or burrows, and several indeterminate forms. One bed of very fine-grained dark dolomite contains both glauconite and pyrite.

Plate IV

A- Beekmantown Group, Beaunarnois Formation exposed on the left bank of L'Assomption river.

B- Close-up view of A, showing numerous Lecanospira

From 2 to 2¼ miles, straight line, across the Canadian National railway bridge across L'Assomption river at Joliette there is a 1,300 feet long exposure of many kinds of dolomite. Several varieties of burrows can be found, but actual fossils are rare, and are restricted to Lecanospira and cystid plates. The rock throughout is a medium gray, finely crystalline dolomite with a very few sand grains. Only one bed shows the cavernous nature common in dolomites, and in this case the pores are filled with calcite stained yellowish to brownish red.

Thickness.

In general, along L'Assomption river Beekmantown dolomite is exposed over a breadth of a little less than two miles. This is a minimum, for there are no exposures until the highway bridge (highway 41-42) over the river near the municipal pumping station is reached. This space, if occupied by Beekmantown rocks, would about double the breadth of outcrop of the latter. With dips of 2° the thickness is calculated to be-- maximum 700 feet, minimum 350 feet. In a general treatment of thickness of the entire sedimentary column (p.116) the thickness Beekmantown is estimated to be 553 feet. This latter figure is reasonable in view of the known thickness of 814 feet in the Mallet well (Clark, 1972, p.45) in the Montréal area, and its diminution northeastwards with total disppearance before the St.Maurice river is reached.

La Chaloupe River Exposures

From just above the Canadian National railway crossing over Chaloupe river -- about 4 miles northeast of Joliette-- exposures of Beekmantown dolomite are common for half a mile downstream. The uppermost (streamwise) exposure is immediately above a private bridge 100 feet above the railway bridge. Here, on the right bank, dolomite is exposed for 150 feet upstream. It is for the most part a dark gray, nearly black, very fine-grained to almost dense crystalline rock, weathered dull pale brownish orange. Bedding is well marked in some layers, but appears to be indicated by different grades of crystallinity. No fossils were seen. Black calcite fills veins and their enlargements. There are a few shaly partings. Interference ripples with polygons up to 10 inches across occur upon one surface, the ridges of the polygons being raised about 2 inches above the basins thereof.

From here downstream exposures are small but frequent, though most of them are below the surface of the water, even in midsummer. No attitudes could be taken. Below the railway bridge the rock is a very, very fine-grained dolomite (crystals less than .05mm. across) effervescing scarcely at all in cold dilute HCl. It weathers yellow to deep orange.

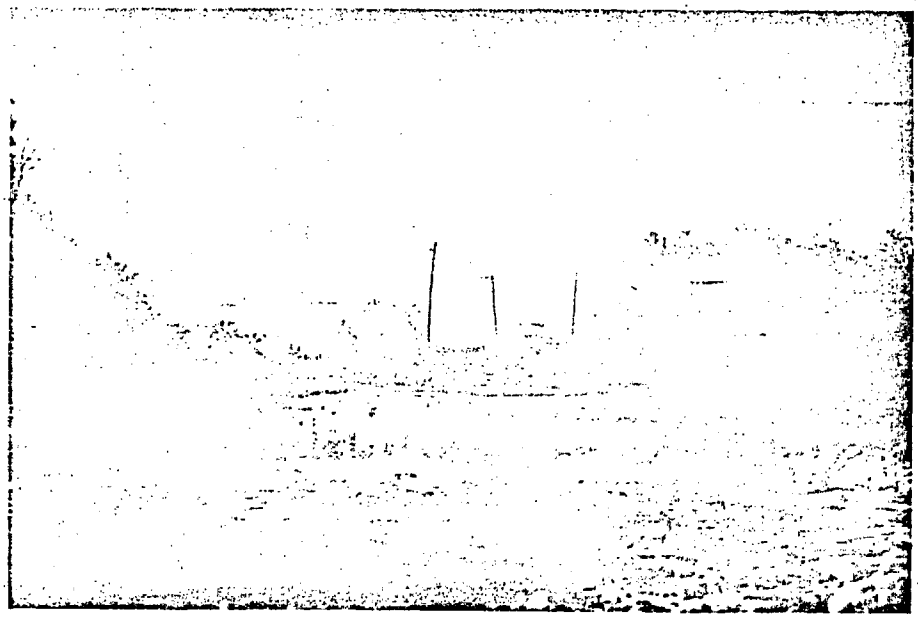
The attitude of the highest (streamwise) beds would carry them to a position along L'Assomption river stratigraphically above the Beekmantown exposures to be seen along that stream.

Intermediate in stratigraphic position between Chaloupe and L'Assomption rivers exposures, as determined by projection along the strike, is an outrop one mile north-northeast of the railway bridge over Chaloupe river. There, on the southeastern part of a small copse there are a few showings of this formation, which, in fact, have been worked in a preliminary way to provide foundation blocks for local barns. There are half a dozen low openings, non larger than 10' x 5' x 2'. The attitude of the bedding is in harmony with attitudes elsewhere. The rock is a dark, calcite-impregnated dolomite, fine-grained, and orange weathering.

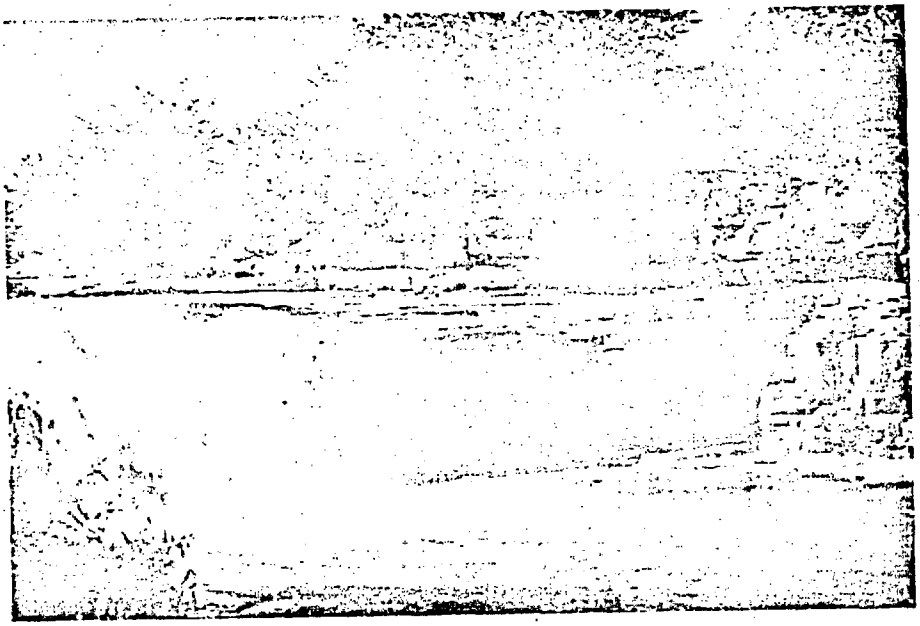
Bayonne River Fxposrues.

Exposures of Beekmantown dolomite begin at a ford across Bayonne river nearly two miles, straight line, below the railway bridge at Ste. Elisabeth, and continue for a mile and a half as far as Doucette's dam just (see plate V A, B) east of the county line (fig. 23). Throughout these exposures the dominant rock type is a light gray fine-grained crystalline dolomite, well bedded (see plate V, B), in a few places cavernous, with yellow calcite filling the once open spaces. Quartz grains are rare, and nowhere make up the bulk of any layer. Some of the rock, particularly downstream, is exceedingly well and finely banded. A great variety of burrows decorate many bedding planes some are 2mm. in diameter, more or less geometrically disposed; others are 10mm. across and are much more apt to be developed into wide curving ares; intermediate sized burrows show a peculiar method of branching.

Plate V



A- Beekmantown Group, Beauharnois Formation. Waterfall just below the old, almost completely destroyed, Doucette's dam on Bayonne river.



B- Close-up view of waterfall in A.

These types of burrows are illustrated in Figure 4. Most of them weather down into the rock, and appear as grooves, but the largest type stands out in relief upon the weathered surface. At one place, three quarters of a mile west of the highway bridge, there is a wide triangular flat of rock exposed within the band of the river. Lecanospira occurs in nearly every exposure, but is everywhere poorly preserved.

The attitude throughout, though varying somewhat, is generally south-southeast at about 2^{o}.

South of the road paralleling Bayonne river and to the south of it there are several exposures as mapped. Two deserve especial mention. First, there is an old abandoned quarry (Doucette quarry) a few hundred feet southwest of Doucette's dam, the Olivier quarry of Goudge (1935, p.77). Slightly southeastward dipping beds of dark and light gray granular dolomite are exposed here, the lighter colored beds showing the characteristic calcite cleavage glints. There is also a fair development of dark, almost black, calcite which appears to have replaced some of the dolomite beds completely, and now occurs as a coarsely crystalline mass with cleavage surfaces up to two inches across.

Opposite and south of the bridge is Philip Lambert's house, which was built in 1870 of stone from the old Doucette's quarry. Several other houses along the road to Ste. Elisabeth are similarly constructed, though in all cases the corner trim is made of Trenton limestone, probably local Deschambault.

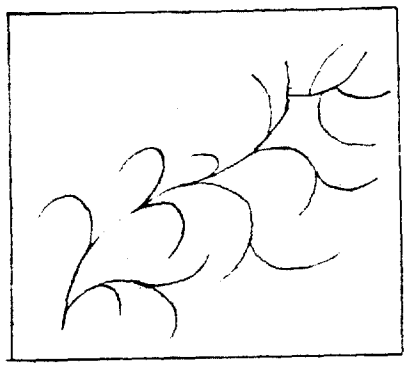


Figure 4. Burrows of unknown organism in Beekmantown dolomite. Bayonne river. See page 17. 26

One quarter natural scale.

Emile Coutu Quarry. Half a mile (straight line) west of Doucette's dam, a side road goes southward for a couple of miles. In the southwest angle between this road and the river road a long abandoned quarry was reopened, in the past, by Page Construction Company of Three Rivers to provide rough stone for construction (fill, etc.) at Sorel. This is the Richard quarry of Goudge (1935, p.77). The rock outcrops on the north-south road itself, and for a quarter of a mile to the west along the base of a low escarpment. It is in most respects similar to the rock of the old Doucette's quarry. It consists of light bluish gray dolomite in grain ranging from exceedingly fine to very fine. The former type is exceedingly finely banded, in some beds the laminae are less than 1mm. thick, and the bedding in detail is remarkably unifrom, though over a width of several feet it shows a marked tendency towards lenticularity. About 10 feet of this type of rock occurs here, and this is the rock which has been quarried.

The lowest part exposed, forming the floor of the quarry, is a darker gray, fine-grained dolomite which shows all gradations between possessing occasional calcite cleavage glints, through a rock half original dolomite and half dark calcite crystals, to a mass of almost black calcite, with cleavage surfaces up to 2 or 3 inches across. The latter represents the final stage of the calcification of the dolomite.

Other, and minor occurrences can be seen along the northwestern margin of the wooded ridge that extends from Joliette

east-northwastwards towards Bayonne river. At Doucette's dam, on the latter river, the dolomite is in faulted contact with the Trenton limestone (fig. 23). Further southwest along the ridge no contacts are to be seen. Though the areal evidence is except in one limited area opposed to the development of a normal stratigraphic succession from Beekmantown to the younger rocks of the ridge, there is definitely a fault between the Chazy and the Trenton within the city of Joliette, though whether that fault is continued all the way along the base of the ridge as far as the north-south road at Doucette's dam is very doubtful.

CHAZY GROUP

General Distribution

Rocks of Chazy age have long been recognized in the Joliette area. Ells published (1896, p. 20,46,120,121) a list of fossils and brief references to the exposures in the bed of L'Assomption river at Joliette. Well developed between Ottawa and Montréal, and to the south and east of the latter place, Chazy rocks seem to be exposed at but one locality within the Sorel map-area, and outcrops are unknown northeast of Joliette. At Montréal, Chazy rocks have a measured thickness of 280 feet. At Joliette the thickness is not know with certainty, but there are at least 30 feet exposed, with the top and base of the section not seen. The thicknesses of 260 feet credited to the Chazy in the log of the Experimental Farm Well at L'Assomption (Belyea,1952,p.35,36)and (348 feet measured in the Bald Mountain Berthierville No.1 well C.Q.D.N.R. Publ. S-75 part 2,p.8).betoken a considerably greater thickness of

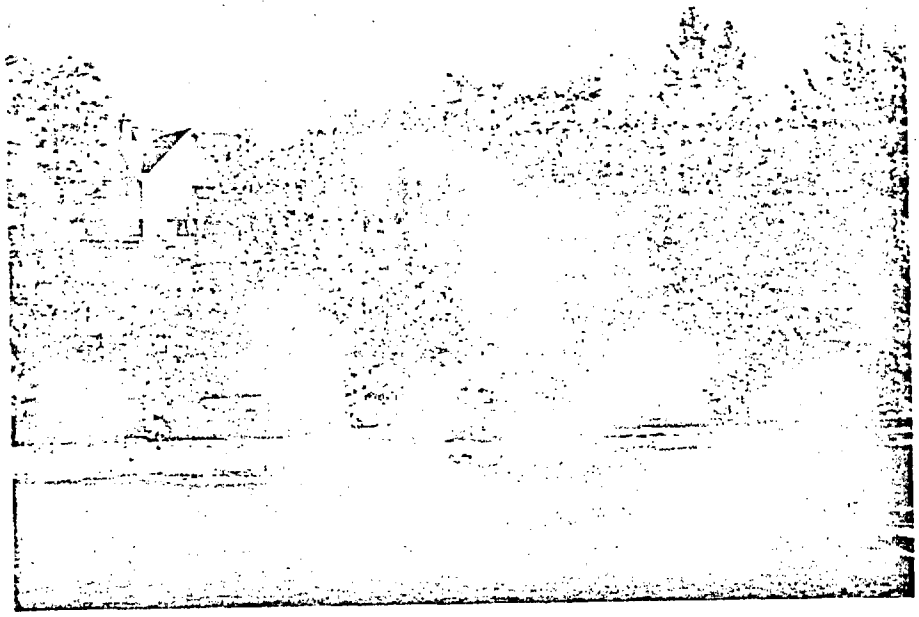
the Chazy at Joliette, than the limited exposures indicate. The limited exposures at Joliette are doubtless due to the remainder of the beds being eliminated at the surface by the Joliette fault.

Laval Formation, Joliette Member.

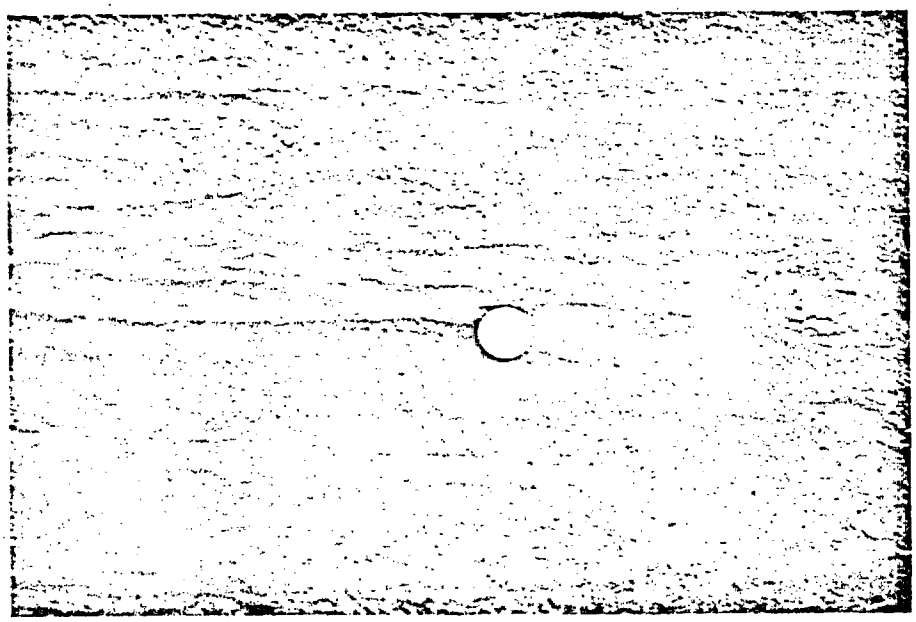
L'Assomption river passes through the eastern part of the city of Joliette. After passing over the dam opposite mid-part of the city it flows southeastwards for a quarter of a mile and then turns abruptly to flow towards the southwest. Almost immediately after making the latter turn it passes under highway 41-42 bridge. For 1,000 feet above and 400 feet below this bridge sandstones of Chazy age are well exposed (see plate VI-A) at mid and at late summer's water level. Though the rock must be considered a sandstone, (see plate VI-B) there is a very great deal of yellowish intersitial calcareous matter and a fair admixture of fossil and fossil fragments. Practically all of the quartz grains are rounded, and range in diameter from .5mm. to 5mm. A few feldspar grains, up to 2mm. across, can be found in some beds.

One block, loose but probably only a few feet away from its proper place, is composed largely of limestone, with quartz grains mostly about 1mm. across, but ranging up to 3mm. Fossils are abundant in this block, especially Zygospira and Eurychilina. Limestone beds are distributed lenticularly throughout the sandstone, and are rarely more than 6 inches thick. Such a thickness may peter out within 10 feet to nothing.

Plate VI



A- Chazy Group. Laval Formation - Joliette Member exposed on L'Assomption river immediately below the highway 41-42 bridge.



B- Close-up view of the Chazy sandstoen exposed in A. Note the bryozoans on the left.

Table 1. Fossiles du Chazy / Fossils in the Chazy Group		
Espèces/Species	Symboles/Symbols	
PORIFERA	Abundant	C H A Z Y Lower Middle Upper
?Hinda fibrosa		
Lamottia sp.		
L. heroensis		U
CYSTOIDEA		
Paleocystites tenuiradiatus		L M U (Ells' list)
BRACHIPODA		
Orthis ignicula		U
Hebertella borealis		U (Ells' List)
Camarella longirostris		L M U
Camarotoechia plena		U
Zygospira acutirostris	A	L
Holopea sp.		
CASTROPODA		
Raphistoma stamineum	A	M U
Bucania sulcatina		L U (Ells' List)
TRILOBITA		
Vodgesia bearsi		M
Illaenus sp. cf. I. bayfieldi		
OSTRACODA		
Eurychilina latimarginatus	AA	L M U
E. crassimarginata		
Apatochilina dimorpha	A	
Briartina modesta		
Conchoprimitia sp. cf. C. tolli		

It is easily seen from the above list of fossils, which includes three species taken from Ells' (1896, p. 120,121) that the Joliette beds have a predominantly Upper Chazy aspect. Only two species so far identified do not occur within the Upper part of the Chazy known elsewhere. The identification of Zygospira acutirostrata, which is very common and well preserved, is not attended by any doubt. Vogdesia bearsi is represented by one fragment showing the characteristic eye stalk, and insofar as the fragment goes the identification is certain. Hence we have here a record of the persistence of these two species into the Upper Chazy.

With the exception, perhaps, of Vogdesia bearsi, all specimens are much smaller than their correlatives in the Montreal and Lake Champlain areas. This may possibly be attributed to the difficult conditions attendant upon life upon a sand-strewn sea floor, or it may well be due to accumulation in a sea which had probably reached its expansional limit, and was at the time that these sands were being accumulated actually retrogressing. We have reason to suppose that this sea occupied an embayment which spread westward from the Appalachian geosyncline so that the marginal position of this exposure is reasonably assumed.

Curiously enough, this faunule, though collected no more than 30 miles from the typical St.Martin Limestone as developed in the quarries at St. François de Salles and in the Montréal district (Clark, 1952, p. 46), bears little relationship to the St.Martin fauna. Camarotoechia plena, characteristic of and extremely abundant in the

St.Martin Limestone, is represented in our collection from Joliette by but one specimen. Raphistomina stamineum is not common around Montréal, but in the Joliette beds it is second only to the ostracods in abundance. So distinctive are both the lithology and the fauna of these sandstone beds that it is appropriate and wise to designate them by a separate stratigraphic name. Temporarily, we shall assume that they belong within the Laval Formation, but that they constitute a separate basal development therein which we propose to call the Joliette member of that formation. Though it is unlikely that this may later be elevated to formational rank, it is within the realm of possibility that it may prove to be a synonym of the Ste.Thérèse Sandstone Member described from the Montréal area (Clark, 1952, p.43).

In all, some 30 feet of these sandstones occur in this locality. The attitudes are somewhat varied, as the following measurements taken above the bridge show:

55°	5°E
55°	4°E
35°	3°E
70°	5°E
45°	4°E

At both the highest and the lowest (riverwise) limits extreme variations from these attitudes occur, but they are due to the effects of large scale cut-and-fill cross-bedding structures. Looking across to the practically inaccessible left bank of the river, especially above the bridge, the inclinations of the beds of the overhanging bank show undulations which may be inherent or may be due to disturbances close to a supposed fault which separates the Chazy beds from the uppermost Black River downstream. There is not sufficient room between these two developments for the rest of the Black River

(45 feet, probably, see p. 34,, which includes the normal Leray, the Lowville, and the Pamelia.

BLACK RIVER GROUP

Limestones of the Black River Group outcrop within and about half a mile east of the city of Joliette, and occur discontinuously along the northwestern margin of the Joliette ridge. Along this ridge the lower members of the Trenton beds are pretty continuously exposed, but only here and there do the Black River beds appear from beneath them.

The determination of the age of the Black River beds in this region must depend largely upon the section worked out by Okulitch (1939, p. 82) from the exposures on the Ouareau river (Laurentides map-area) as follows:

Lower Trenton - Deschambault Formation

Transition beds of Okulitch - Ouareau Formation

28'	Leray Formation
9'	Lowville Formation
8'+	Pamelia Formation, base not exposed.
45'	Total Black River beds exposed

In the Sorel map-area Pamelia rocks can be observed in the Ciment Independent Quarry. They are composed of greenish colored dolomite, on fresh surface, buff on weathered surface, and containing a high

percentage of quartz grains. The beds are quite thick, up to one foot (see plate VII). They are followed up section by Lowville, Leray (which makes a small edge) and Ouareau limestones (a small recession). Lowville limestone, impure and pure semi-lithographic limestone, white to light brown weathering, shaly in places, thinly bedded and containing abundant Tétradium, has been found also in the Turnbull construction Co Quarry and again-on the northwestern edge of the Joliette ridge, and is apparently in faulted contact with what has been has been identified as the Beekmantown dolomite (figure 25). Leray (dark colored, semi-cristalline limestone) and Ouareau (argilaceous, fine-grained dark grey limestone) beds are with difficulty differentiated unless a few characteristic fossils can be found, or unless they occur in an unbroken succession as in Ciment Independant Quarry and as in Turnbull Construction Co. Quarry (see plate VIII). One obvious difference between them is that the Leray is poorly provided with small gastropods, whereas the Ouareau limestone of the Trenton Group is crowded with several species of them. Colonies of Foerstephyllym and Stromatocerium occur in great profusion in the Leray (see plate IX-B but few specimens have been observed as high as the basal Deschambault. The Leray is usually thickly bedded (see plate IX-A) and the Ouareau is more thinly bedded with more shale interbeds (see plate VII). In Ciment Independant Quarry, the section can be worked out, tentatively, as follows:

Trenton Group	22.70'+	Deschambault Formation
	4.75'	Ouareau Formation
Black River Group	16.40'	Leray Formation
	16.90'	Lowville Formation
	13.45'	Pamélia Formation
	74.20'+	

A layer of bentonite (1 inch thick) has been observed at the top of the Leray Formation, mainly on the northwestern face of the quarry. Large, black colored ostracods are abundant in an argilaceous shaly horizon (1 foot thick) stratigraphically situated towards the base of the Deschambault Formation.

In the Turnbull Construction Co. Quarry, Leray and Lowville Formations are well exposed occupying most of the quarry faces (see plate VIII). It is composed mainly of a dark colored, semi-lithographic limestone, buffweathered surface, containing (in the Leray) many Foerstephyllum halli as well as many big ($\frac{1}{4}$" diameter) crinoidal stems. There is a zone of about 8 feet of intraformational slumping at the top of the Leray section and a band of bentonite at the base of the Lowville Formation.

The remaining exposures are all related to the northwestern edge of the Joliette ridge. On the road to St.Thomas (route 41-42), just half a mile east of the parish church of St.Thérèse de Joliette, the gastropod-laden Ouareau beds can be seen in the bed of a small stream, deepened in 1951, a couple of hundred feet south of the highway. In the adjacent fields to the southwest fairly wide exposures of the Leray Formation bearing Foerstephyllum extend for 400 feet more.

Over the Leray Formation, there is 2 feet of thin bedded, dark colored fine-grained limestone, buff weathered surface that belong to Ouareau Formation.

The thickness of the section is less important is this quarry than in Ciment Independant Quarry. A maximum figure of 32 feet was measured for the overall thickness of the quarry it is tentatively subdivided as follows:

2'	Ouareau Formation
15'	Leray Formation.
15'	Lowville Formation
32'	

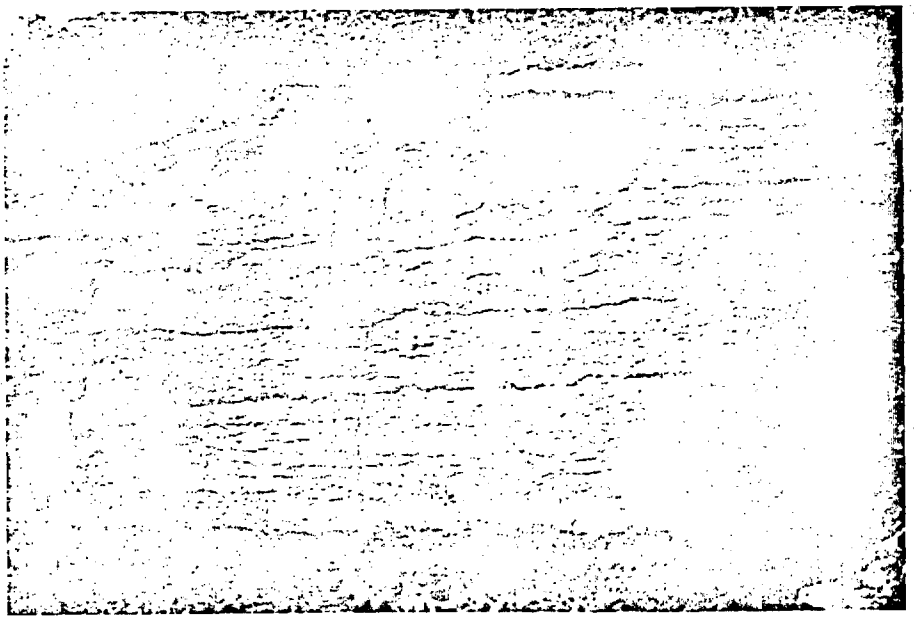
Plate VII

Black River Group. Pamelia Formation, Ciment Independant Quarry at Joliette. The pale colored thick beds at the base of the section belong to the Pamelia Formation with Lowville, Leray and Ouareau Formation above.

Plate VIII

Turnbull Construction Co. Quarry. Black, River Group (Leray and Lowville) Formations with the Trenton Group (Ouareau Formation) appearing near the top.

Plate IX



A- Leray Formation, Turnbull Construction Co. Quarry, showing thick beds and heads of Foerstephyllum halli.

B- Close-up view of the heads of Foerstephyllum halli.

From this locality Black River beds can be followed north of the road along a belt of outcrop striking about 30° for a little more than a mile. The southermost of these exposures, and probably the highest stratigraphically, carries many small gastropods, and belongs to the Trenton Ouareau formation. The other exposures, seen mostly as longitudinal outcrops, precisely bounding the ridge, do not carry gastropods in profusion. Instead, one finds large cephalopods, Tetradium, Foerstephyllum, Stromatocerium, and Lambeophyllum. The combination of these forms is generally indicative of a Leray age.

~~Just~~ less than a mile and a half, straight line, from the point on the road mentioned above, or more exactly, 8,000 feet from Ste. Thérèse church along a line at 40°, there is a small clearing, just within the wooded ridge. The northern part of the clearing is occupied by normal Beekmantown dolomite, dipping northward at 5°. Separated by but two feet from this dolomite, and at the same level, there is Lowville limestone of the 'birdseye' type. A faulted contact is indicated here (see fig. 25).

The entire fauna so far identified from local rocks of Black River age consists of the following (listed in table 2).

Table. 2 Fossiles du Black River/Black River Fossils

BRYOZOA	
Nicholsonella multitabulata Husain.	(Husain's List)
COELENTERATA	
Stromatocerium rugosum	
Lambeophyllum profundum	
Foerstephyllum halli	
Tetradium fibratum	
T. clarki	
BRACHIOPODA	
Hormotoma gracilis	
H. wilsoni	
Lophospira bicincta	
TRILOBITA	
Isotelus gigas	
Bumastus sp.	
Otarion sp., cf. *O. wilsoni*	
OSTRACODA	
Bythocypris cylindrica	
Leperditella magnapuncta	Carter's List
Macronotella micropuncta.	Carter's List

Thence, northeastward along the wooded Joliette ridge Leray beds can be seen here and there as far as the extreme northeastern end of the ridge. There, 2½ miles east-southeast of Ste. Elisabeth, and to the north of a stream which passes the end of the ridge on its way to join La Chaloupe river, Black River beds are fairly well exposed in two small copses.

Hence from the exposures detailed above it can be seen that the Black River localy contains parts of the Lowville and Leray Formations. No reliable extimate of the thickness of the Lowville or of the Leray can be arrived at from exposures within the confines of the Sorel map-area. Nowhere is there exposed anything comparable to the 64 feet of Black River beds measured by Okulitch on the Ouareau River (Laurentides map-area).

TRENTON GROUP

General Statement.

Rocks of this group outcrop within a belt which passes across the map-area irregularly from the northesst to the southwest corners. Exposures are common toward the soutwest, rare toward the northeast. With few exceptions they are to be found only along streams, the chief exception being the Joliette ridge, which is almost entirely composed of Trenton limestone. Nowhere is there a continuous section of Trenton beds exposed within the Sorel map-area, although along l'Assomption river there is a nearly complete section of Trenton beds exposed within the Sorel map-area, although along L'Assomption river there is a nearly complete section, the upper continuation of

which lies within the Verchères map-area.

Here, as elsewhere, the Trenton Group is complex, comprising four formations (Ouareau, Deschambault, Montréal, Tétreauville) knit together by a rough faunal warp. The Lower Trenton consists of the Ouareau and Deschambault limestones, the former best seen just beyond the southwestern corner of the area in the gorge of the Ouareau river at the route 41 bridge, and the latter is particularly well exposed at St.Cuthbert, along the Joliette ridge, in the Assomption river section, and in the Domtar Chemicals Ltd quarry at Joliette. It is almost everywhere a completely crystalline rock, probably fragmental throughout, for the most part light gray with a brownish tint, and quite pure, ranging from 95% to 99% $CaCO_3$.

Both to the northeast, in the Portneuf-Grondines map-areas, and to the southwest, in the Montréal area, there are exposed Middle Trenton beds intermediate to the Deschambault and Upper Trenton Formation -- the Montréal Formation in the southwest, the St.Casimir and part of the Grondines Members of the Neuville Formation in the northeast. Within the Sorel map-area this intermediate development is chiefly displayed in the southwest corner, particularly along L'Assomption river, where its irregular thin-beddedness, lack of lithological uniformity, and obvious argillaceous content serve to set is apart from the formations above and below.

The highest of the four formations is closely allied to and probably identical with the Tétreauville Formation of the Montréal area, and is so named here. Locally, the Tétreauville Formation is far more widely distributed than is the Montréal, and consists of dark, bluish gray limestone, dense evenly bedded, with rare crystalline layers up to one or two inches thick. Shaly partings a few inches thick between limestone beds occur throughout. The almost complete contrasts of characteristics allow these four formations to be differentiated in the field with no difficulty.

Ouareau Formation

The most easily accessible section of the lowest Trenton formation is to be found on L'Assomption river between the Barrett Company dam and Pont des Dalles. Here 12 feet of Ouareau limestones are covered, just above Pont des Dalles, by the succeeding Deschambault limestone. For a couple of hundred of feet below the bridge the uppermost Black River bed makes a shelf up to 30 inches wide (see plate X). The Ouareau beds consist for the most part of muddy limestone, with a few thin beds of crystalline limestone. Many of the muddy limestones show on weathered surfaces an abundance of cross-sections of small and medium sized gastropods.

Along the northwest side of the Joliette ridge Ouareau beds are abundantly exposed, partly on wide flat karst areas, and parlty where the edges of the southeasterly dipping beds crop out along the western escarpment of the ridge. Nevertheless nowhere can a complete section be developed. Still further to the northeast the marginal rocks of the ridge are with one exception of Trenton age. Still on the margin.

Plate X

Ouareau Formation. Below Pont-des-Dalles, L'Assomption river, Joliette.

of the ridge, and 1,500 feet southwest of the road parallel to and south of la Chaloupe river, there is a clearing where discontinuous exposures of the edges of a succession of beds can be pieced together into a section of which the lowest belong to the Ouareau Formation, with an abundance of gastropods in some beds, though these are lacking in the highest Ouareau beds. The section, given below, in table 3, continues upward directly into the Deschambault limestone, which occupies all of the ridge to the southeast.

Table 3. Coupe de la formation de Ouareau, colline de Joliette/ Ouareau Formation Section Joliette ridge.

10"	Fine to medium-grained, brownish gray crystalline limestone
1'	Thin-bedded fine-grained, crystalline limestone
1' 10"	Dark gray, fine-grained, brownish limestone. Chert, Base of Deschambault Formation -- Top of Ouareau Formation
10"	Dark gray fine-grained limestone
1' 8"	Completely crystalline limestone
2'	ditto
1' 6"	Dense, semi-lithographic, faintly brownish, medium gray limestone with numerous irregular seams of crystalline calcite.
2' 9"	Not exposed
9"	Dark brownish gray, very fine-grained limestone. Gastropods in abundance. Other fossils rare. Ouareau Formation.

Throughout this thicknesssof 9'6" the assemblage of fossils can be found by referring to Locality A of the faunal list given on page 46.

At the extreme northeastern end of the Joliette ridge Ouareau beds make their last appearance. There, 2½ miles east-south east of Ste.Elisabeth, a stream which passes by the end of the ridge on its way to join La Chaloupe river, exposed, prior to its being exacavated in 1951, a flat bed 100 square feet in area on which small gastropods characteristic of the Ouareau fauna occurred in abundance. Somewhat downstream, where the river first entered the woods the contact between the Ouareau and the overlying Deschambault Formation could once be plainly seen. At the top of the Ouareau there were colonies of Foerstephyllum and Stromatocerium up to 10" across, together with Lambeophyllum. These appear to have had their upper parts worn off, and indeed, the entire upper surface of the Ouareau is irregular, with bumps and hollows giving a relief of up to 4 inches. Above this the bedding of the Deschambault is remarkably even even for the basal few inches which accommodate themselves to the irregular surface underneath (see fig. 5). These basal Deschambault beds lap up around the half worn heads of Foerstephyllum, etc. (fig. 6)

Between the Ste.Elisabeth road and La Chapelle river, in line with the northwestern edge of the Joliette ridge a section can be built up from meagre exposures seen along a poor wagon track descending to La Chaloupe river. Here 19 feet can be measured, but the top of this section- south of the road, is of unknown thickness below the top of

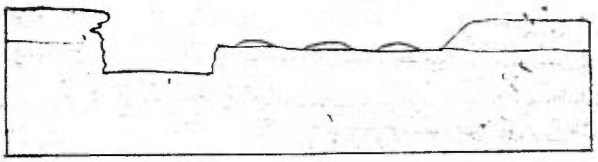


Figure 5. Contact between ~~Black River~~ (Ouareau Formation) beds below and ~~Trenton~~ (Deschambault Formation) above. Cross-section of recently excavated stream (unnamed) 2½ miles E.S.E. of Ste. Elisabeth. See page ~~30~~. ~~Horizontal~~ scale / 10 feet /

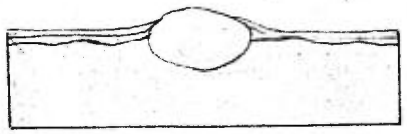


Figure ~~5a~~ 6. Detail of contact shown in Figure 5. The ~~basal~~ ~~Trenton~~ beds lap up around eroded heads of ~~Columnaria~~, etc. in the ~~Black River~~. See page ~~30~~ 31. ~~Horizontal~~ scale / 1 foot /

the Deschambault. Small gastropods and other fossils characteristic of the Ouareau Formation occur in the topmost and the lowermost layers, and it is therefore likely that the whole thickness lies within the Ouareau Formation. The section (referred to as Locality B in the faunal list on page 46) follows in table 4.

Table 4. Coupe de la formation de Ouareau Localité B / Ouareau Formation Section Locality B

	Top of section
6'	Dark, fine-grained limestone with a few large crystals of calcite. Small gastropods abundant
1'	Very fine-grained, almost sub-lithographic, white-weathereing limestone.
3'	Dark, fine-grained crystalline limestone.
1'	Dark, fine-grained crystalline limestone.
2'	Very fine-grained, dark, crystalline limestone. Chert.
4'	Dark, very fine-grained limestone, with one thin layer of very coarsely crystalline rock.
2'	Dark, fine-grained crystalline limestone, parts sublithographic.
	Abundance of small gastropods.

The meagre fauna of the Ouareau beds reported above has a Black River aspect. Yet the much more extensive collection from the complete section of the Ouareau Formation at the Ouareau river in the Laurentides map-area, not yet reported, indicates without question a Trenton age for the Ouareau beds.

The list of fossils so far identified from Ouareau beds in the Sorel area follows in table 5.

Table 5. Fossiles du Ouareau / Ouareau Fossils

	Localities	
ALGAE		
Solenopora compacta		B
COELENTERATE		
Stromatocerium rugosum	A	B
Tetradium cellulosum		B
T. fibratum	A	
T. clarki	A	B
Lambeophyllum profundum	A	B
Foerstephyllum halli	A	
BRACHIOPODA		
Rafinesquina sp., cf. *R. okulitchi*	A	B
GASTROPODA		
Small gastropods in abundance	A	B
TRILOBITA		
Isotelus gigas		B
BRYOZOA		
Nicholsonella multitabulata (Husain's List)		
Macronotella sp., cf. *M. schofieldi*		B
Bumastus sp.		B
OSTRACODA		
?*Bythocypris cylindrica*		B

Deschambault Formation

Overlying the Ouareau beds is the Deschambault Formation of light to medium gray, crystalline limestone, about 90 feet thick. This outcrops in a band about a mile wide starting at the southwestern corner of the map-area, and includes - A) the Domtar Company quarry and exposures along St.Pierre river; B) L'Assomption river and quarries in and around Joliette; C) practically the whole of the Joliette ridge, at the northeastern termination of which it is limited by a fault. Thence eastwards it occurs at three widely separated localities D) Doucette's dam on Bayonne river; E) St.Cuthbert on the Chicot river; and F) outcrops near St.Barthélémy Station. Each of these will be considered in turn.

A. Rivière St.Pierre and Domtar Chemicals Ltd Quarry.

No exposures of any sort occur along the rivière St.Pierre from its entrance into the Sorel map-area until it reaches a locality 1,000 feet above the old railroad track (now a truck road) serving the quarry. Thence, exposures are almost continuous to and for 1,5000 feet below the highway (NO.41) bridge (see plate XI). This gives a breadth of outcrop across the regional strike of 2,400 feet, which, with the prevailing dip of 2° gives a thickness of 84 feet, very closely in harmony with what is known from actual measurements elsewhere. Small exacavations have been made at several places along this stream, particularly just above and just below the truck road and the highway bridges. For 300 feet below highway No. 41, where the stream flows southeastwards, the rocks consists largely of a mass of bryozoan colonies. Thence normal crystalline Deschambault limestone continues for a thousand feet

or so, but where the river turns sharply from southwest to southeast the Deschambault, at low water level, is succeeded upward by the limestone of the Montréal Formation.

The quarry of ~~the~~ Domtar Chemical (see plate XIIA) has been developed into these limestone. The section is 89 feet thick and the strata dip at an angle of about 5^{o} to the southeast. The quarry is subdivided in three levels (see fig. 7). The first level at the base of the section is composed of 10 feet of thickly bedded, dark brown cristalline limestone containing up to 97% $CaCo_3$. The surface separating the 1^{st} level from the 2^{nd} is marked by giant ripple-marks (see plate XIIB). The second level consist of 29 feet of thinly bedded fine to medium grained argilaceous dense limestone, containing up to 8% of SiO_2. The limestone of the 3^{rd} level at the top of the section is thickly bedded, grey brown and coarsed grained with a total thickness of 59 feet at 23 and 35 from the top, there are two beds of chert up to 3 inches thick and in between nodules of chert are disseminated throughout the limestone. The percentage of $CaCO_3$ is aldo high 96%.

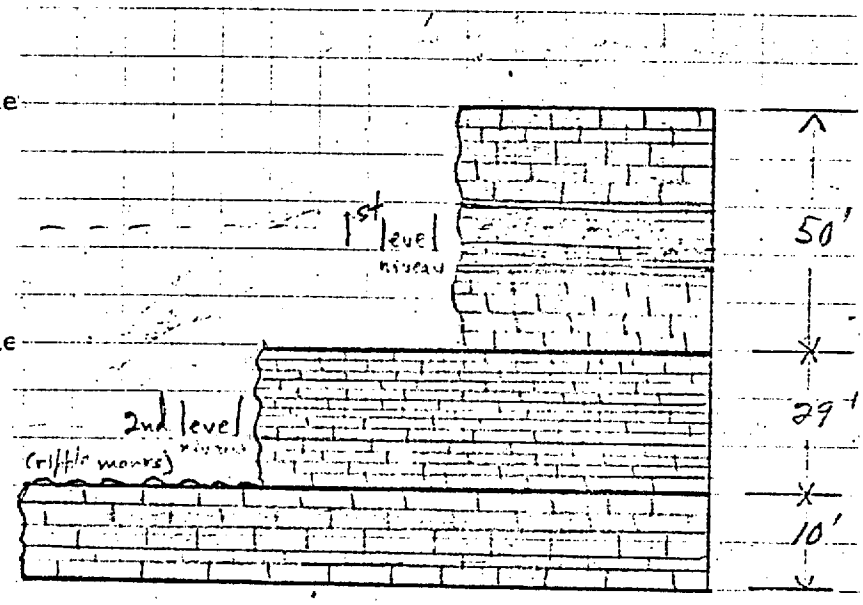
Plate XI

Deschambault Formation. Exposure on the west side of highway (No. 41) bridge, in the extreme S.W. corner of the map-area.

Sommet de la coupe

Top of section

Si	CaO	$CaCO_3$	MgO	
2.2%	54%	96%	.60%	1st level
7-8%	45-50%	85-90%	.55%	2nd level
1.7%	55%	97%	.50%	3rd level



Base of section

Base de la coupe

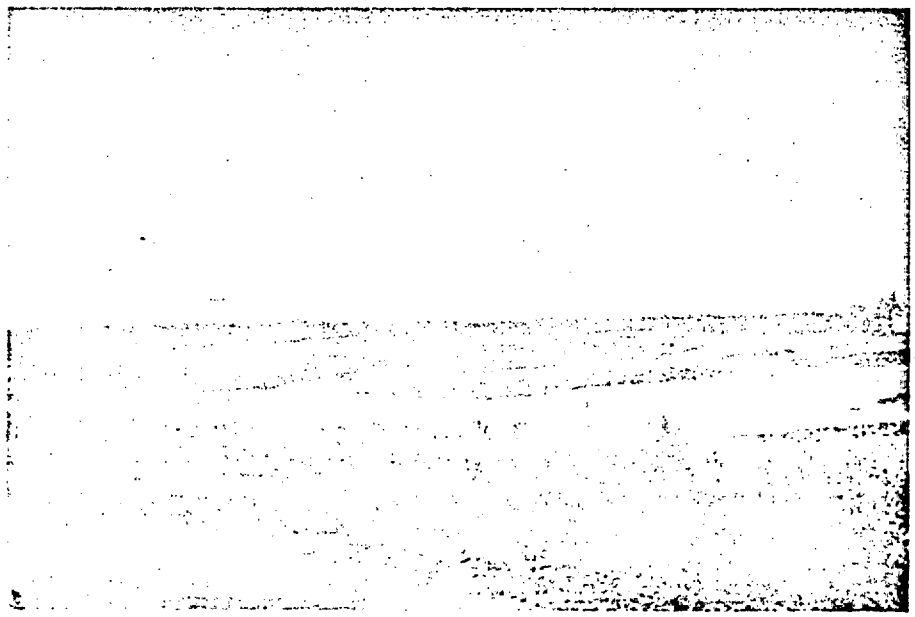
Fig.7. Deschambault Formation. Domtar Chemicals Ltd quarry at Joliette.

Calcaire — Limestone

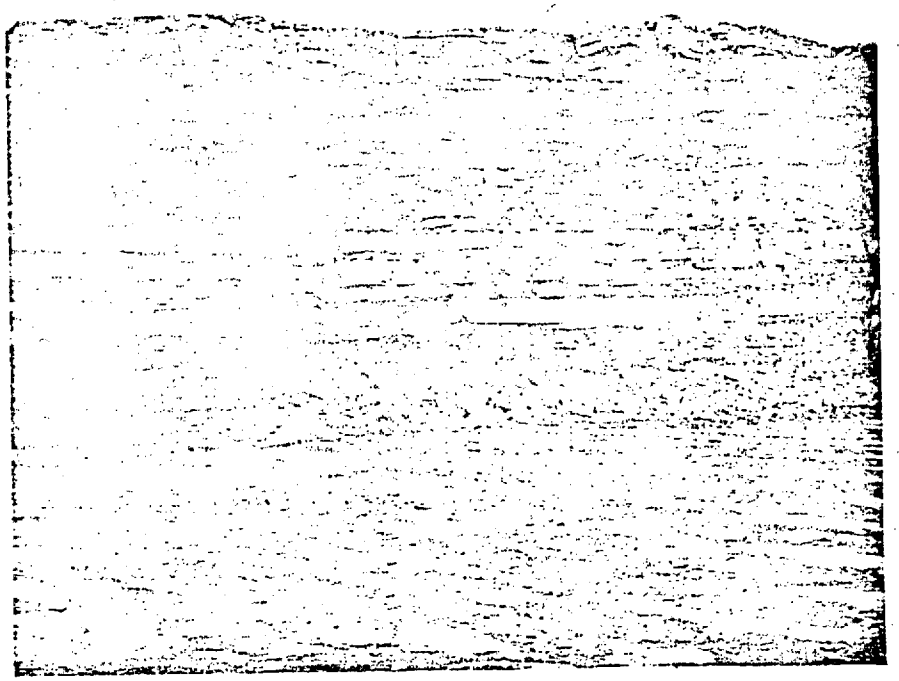
calcaire à nodules de chert — Limestone with chert nodules

lits de chert — Chert beds

Plate XII



A- Deschambault Formation, Domtar Chemicals Ltd quarry at Joliette.



B- Close-up view of the ripple-marked floor of the 1st level and the face of the 2nd level.

Goudge (1935, p. 72) described the section mentioning with reason that: "the deposit consists of alternate bands of pure and rather impur stone. The bands do not maintain their relative thicknesses around the face of the extensive quarry, but thicken and thin in an irregular manner."

Further details concerning the rock of this quarry are given below under Economic Geology.

B. L'Assomption River Section and quarries in and around Joliette.

An uninterrupted section of the Deschambault Formation can be seen along the banks of L'Assomption river from Pont des Dalles (southeastern part of Joliette) downstream. With this section there should be included the two displays of the beds of this formation in two quarries, both close to the left bank of the river, the abandoned and half filled Beaudry quarry above the bridge (Pont des Dalles) and the old Lépine quarry, below it, now completely covered. There is also the Deschambault exposure (thickly bedded coarse grained limestone) of the Ciment Independent Quarry already refered to in the Black River Section of this report and the exposure of the abandoned quarry of Joliette Construction Ltd adjacent to the Ciment Independant Quarry. In this two quarries intraformational slumping is well displayed in the Deschambault Formation. In the latter quarry, half pilled with water 25 of coarse grained light brown, thickly bedded limestone are present.

In the former quarry (Ciment Independant Ltd) large, black colored ostracods are abundant in a more argilaceous shaly horizon (1 foot thick) stratigraphically situated towards the base of the Deschambault Formation.

Because of the weathered and waterworn nature of the exposures the building up of a stratigraphic section from the exposures along the river banks is difficult, and is not so likely to lead to such good results as the logging of the rock seen along the quarry faces neares to the river. The sections of these two quarries and of the L'Assomption river banks follow:

Beaudry quarry. This section (table6) was taken near the southwest end of the quarry. See Fig. 8 and Plate XIII

Table 6 Coupe de la carrière Beaudry /Beaudry Quarry Section

Top of quarry. Glaciated surface. 0 to 2 feet soil.

A. 8" Light gray, fine-grained crystalline limestone, with thin irregular bands of medium-grained limestone. Chert occurs as thin plates in the middle of this bed. Prasopora

B. 2" Coarsely crystalline limestone, very fossiliferous. Thin, 1/3" thick, plates of chert at base.

Unconformity

C. 9' Medium coarse-grained crystalline limestone. Strongly cross-bedded with beds inclined at 25° near the top. With the above there alternate fine-grained darker limestone beds. No chert. Fossils few, abundant on one bedding plane Rafinesquina.

D. 6" Coarsely crystalline limestone, full of fossils, especially Solenepora

E. 2' Dark, fine-grained limestone. No fossils

F. 5' Medium- to medium-fine-grained crystalline limestone, horizontally but poorly bedded. One layer in middle carries fossils, no others seen.

G. 1' 10" Coarse-grained, very fossiliferous crystalline limestone, interbedded with darker medium-fine-grained limestone. Conglomeratic at base, with limestone pebbles up to 2".

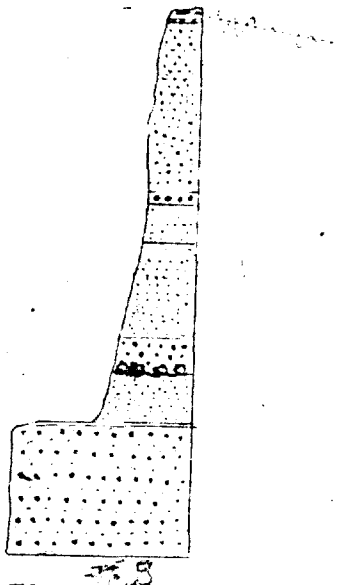


Figure 6. Vertical section of beds in Beaudry quarry, Joliette. See p. 38

LEGEND

- Coarse-grained limestone
- Medium-grained limestone
- Fine-grained limestone
- Conglomerate

Unconformity

H.	2'	6"	Dark, medium-fine-grained crystalline limestone, with many black bedding seams. No fossils. Base is the intermediate bench floor of the quarry.
I.		2"	Richly fossiliferous shaly limestone covered by a ripple-marked shale bed less than 1" thick. Peculiar cracks with edges turned up are filled with lighter fine-grained crystalline material. These cracks are evidently original structures, although they resemble in pattern the cracks developed by blasting.
J.	7'		Coarse to medium-fine-grained crystalline limestone, still coarser toward the top, but no general gradation. About 1 foot below the top there is a very fossiliferous layer, especially rich in Rafinesquina. 3' below this there is a 3" Solenopora bed.
K.	5'	6"	Dark, medium-grained finely bedded crystalline limestone. Fossils scarce.
			Base of present quarry (1952). Probably 13 feet above base of formation.

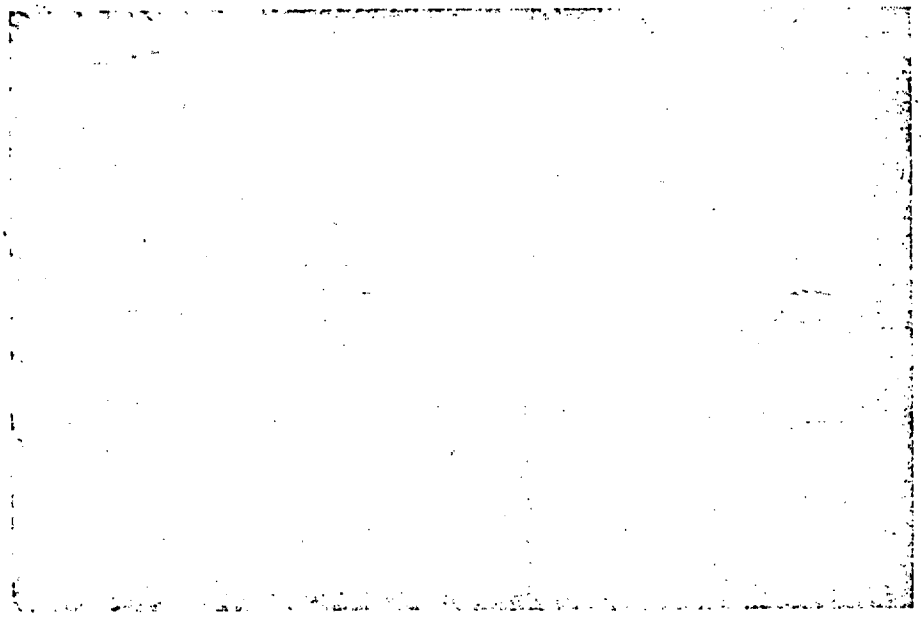
Lépine quarry. South of intersection of Querbes St. and L'Assomption river. The following section (table 7) is a composite one. Fig. 9.

Table 7. Coupe de la carrière Lépine / Lépine Quarry Section

Top of quarry			
a.		4"	Dark, crystalline limestone with an abundance of pelecypods, Rafinesquina, etc.
b.	2'	6"	Dark gray, dense, much seamed, white weathering limestone, crowded with pelecypods on the weathered surface. Gastropods, Rafinesquina, bryozoa, all common.

c.		4"	Normal coarse-grained crystalline limestone. Fossils.
d.	3'		Ditto, but fossils rare.
e.	1'	1"	Crystalline limestone. Bryozoa common, both Prasopora and ramose types. Weathered surface pitted with holes about ¼" to 1/8" across and deep, possibly sites of bryozoa.
f.	2'	6"	Crystalline limestone. No fossils. In places separated into distinct beds of 4" to 6". Pitted.
g.	1'	8"	Ditto. Solid bed.
h.	1'	6"	Coarse-grained crystalline limestone. Rafinesquina.
i.		0-3"	Fine-grained, light weathering, sandy looking crystalline limestone.
j.		2"	Medium gray, crystalline limestone, containing small pebbles of bed k.
k.		5"	Fine-grained, white weathering, crystalline limestone.
l.		9"	Medium-grained, dark weathering, crystalline limestone. Rafinesquina.
m.	1'	10"	Medium- and coarse-grained, crystalline limestone. Light gray weathering. Rafinesquina
n.		2-4"	Medium-grained, white weathering limestone, with chert
		3"	conglomeratic. All pebbles are of limestone.
o.	1'	4"	Medium-grained, white weathering limestone, with chert.
p.	1'	6"	Medium-grained, crystalline limestone, no chert.
q.	1'	8"	Mixture of limestone types. Light weathering fine-grained together with coarse-grained beds. Chert throughout. This corresponds to beds A. and B. of the Beaudry quarry.

Plate XIII



Deschambault Formation in abandoned Beaudry Quarry at Joliette.

LEGEND

- Coarse-grained limestone
- Medium-grained limestone
- Fine-grained limestone
- Chert nodules
- Bryozoan bed, silicified
- Conglomerate
- Slump structure

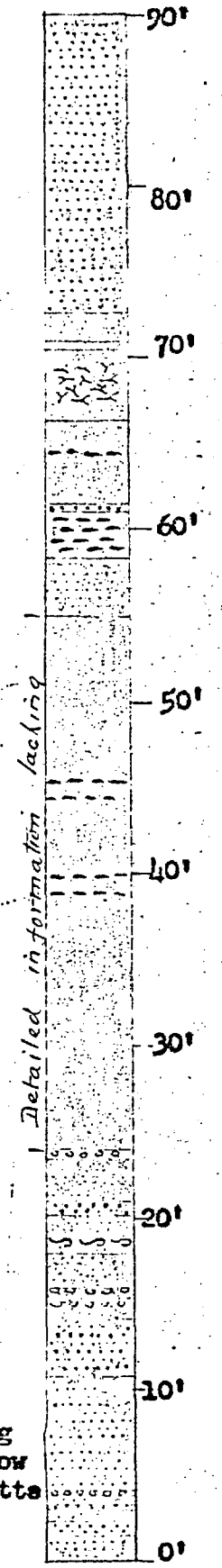


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Figure 9. Section of Deschambault limestone formation exposed along L'Assomption river below Pont des Dalles, Joliette
See page 256.

r.	8'	Medium-coarse-grained crystalline limestone. No chert
		Fossils common in lower part.
	29' 3"	Total thickness exposed and measured.

The section exposed along L'Assomption river is described in table 8 below. This begins at Pont des Dalles, where the basal Deschambault rests upon the uppermost bed of the Ouareau Formation. Above the bridge the Deschambault limestone overhangs the Ouareau, but below the bridge, the Deschambault has been worn back to provide a shelf up to 30 inches wide (see plate XIV,A) composed of Ouareau limestones. The section continues (see plate XVA,B) to within 800 feet of the first dam below Pont des Dalles. It is almost perfectly complete on the right bank, but not so alon the left bank. The section (see fig. 10) follows:

Table 8. Coupe de la rivière L'Assomption/L'Assomption River Section

17'	6"	Thin bedded crystalline limestone
1'	6"	Dense, semi-lithographic limestone in beds 2" to 4" thick. Practically no fossils.
	6"	Dove gray colored dense limestone, with silicified material standing in relief.
4'		Bryozoan limestone. In upper part the bryozoa are silicified in places.
5'		Dense, dark, semi-lithographic limestone, weathering pale gray, in beds 2" to 4" thick, with a few beds of medium-grained crystalline limestone 4" to 6" thick. Silicified fossils stand in relief on the surface of the latter.
	6"	Coarsely crystalline limestone. Sharp contact with bed below. Fossils stand out in relief (see plate B).

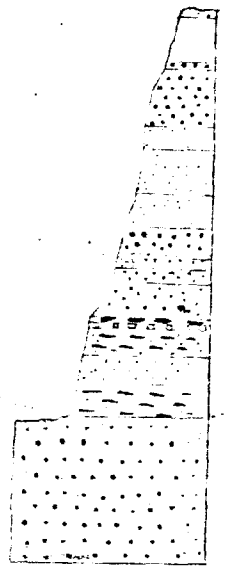


Figure 21.
Vertical section of the beds shown in the Lépine quarry, Joliette.
See p. 50, 54.

LEGEND

Coarse-grained limestone

Medium-grained limestone

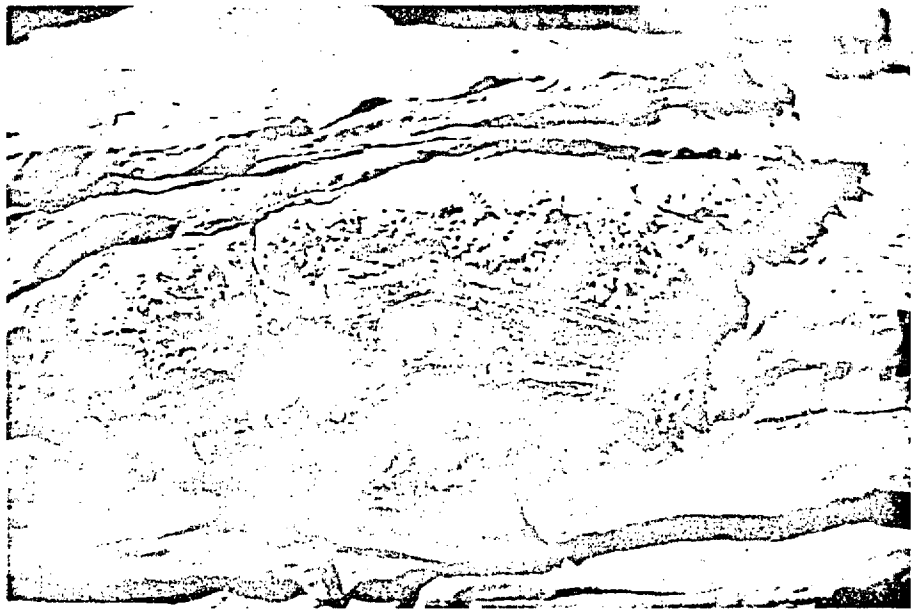
Fine-grained limestone

Chert nodules

Conglomerate

Plate XIV

A, Deschambault Formation. L'Assomption river below Pont des Dalles Joliette. On the right side of photo, Ouareau limestone.

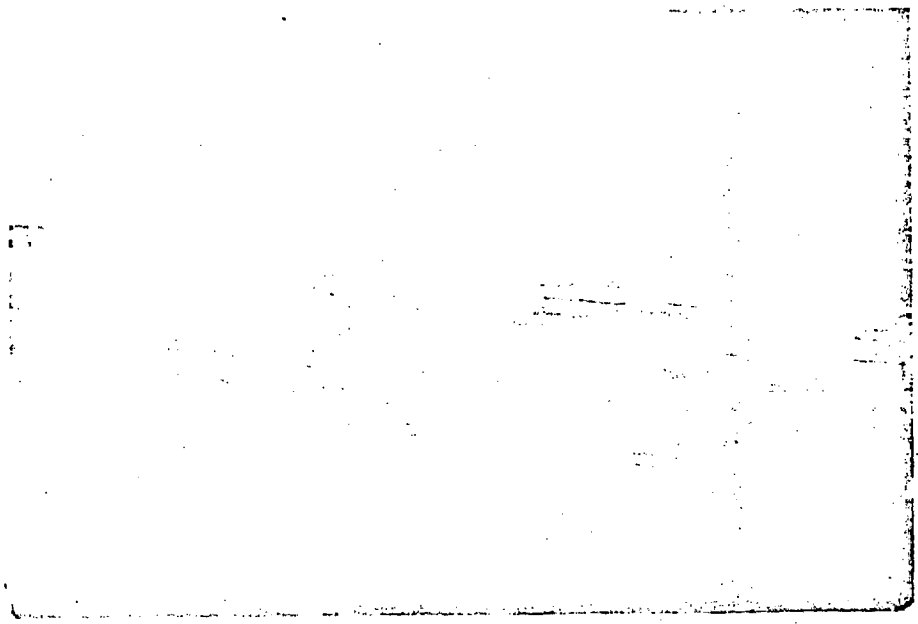


B. Algal structure in Deschambault Formation. Close-up of A.

in the Beaudry and Lépine quarries (see fig.8,9 and plate XV A.B)

	6"	Limestone conglomerate. Slabs and masses up to 6" across.
2'	6"	Very finely bedded, fine-grained crystalline limestone. Small masses of chert.
	9"	Coarsely crystalline detrital limestone. Highly fossiliferous.
1'	3"	Fine-grained, even bedded crystalline limestone
1'		Very coarsely and irregularly bedded limestone. Slump structure, with disrupted fragments up to 1 foot across
2'		Fairly uniformly bedded limestone in beds of 3".
	6"	Dark gray, fine-grained crystalline limestone, with conglomerate at top.
1'	3"	Thin to thick bedded, ½" to 5", fine-grained, conglomeratic limestone. Fragments up to 8" across, but no evidence of fragmentation in situ.
3'	3"	Medium- to coarse-grained crystalline limestone. Solenopora common, forming a veritable reef in the upper 3". Conglomeratic in places with irregular blocks up to 8" across. Some of the conglomerate is obviously composed of slightly distrubed joint blocks of limestone, probably mud crack polygons. Cherty material in thin smears over the upper surface, and filling joints. Thin pyrite smears 1" X 2" X ¼" close to chert
6'	9"	Well and irregularly bedded limestone. Mostly medium to fine-grained.

Plate XV



A. Deschambault Formation. L'Assomption river below Pont des Dalles, Joliette.

B. Deschambault Formation. L'Assomption River, Joliette. Photo taken downstream from Plate A. and showing how the river widers as it approaches the contact with the Montréal Formation.

	3"	Strongly cross-bedded and conglomeratic fine-grained limestone.
	6"	Thin bedded, fine-grained apparently unfossiliferous limestone, with a little chert.
	6"	Medium-grained very fossiliferous limestone. Rafinesquina and Solenopora abundant. Pelecypods present.
	6"	Thin bedded, fine-grained, unfossiliferous limestone.
1'		Medium-grained, fossiliferous limestone, light gray weathering. Pelecypods and Solenopora.
1'	6"	Thin bedded, fine-grained, sandy weathering limestone.
90'		Total exposed and measured.

The interesting development of chert deserves brief comment here. From the base up to 39 feet up in the section, chert occurs sparingly. Between 39 and 40 feet, and again between 45½ and 46½ feet there are two strong developments of chert in which the chert shows as discs, nodules, or in places as fairly continuous plates. Still higher, between 58½ and 65½ chert is prominent, though here in addition to occurring as before, it forms massive replacements of bryozoan beds, and the limestone for several feet above the chert horizon contains silicified fossils. It was hoped that these chert horizons would prove to be reliable stratigraphic markers, but that hope was not fulfilled, the chert being more or less regularly developed along certain horizons, but not dependably so.

C. Joliette Ridge Exposures.

Except for the few discontinuous exposures of Black River and Ouareau beds along the northwestern edge of this ridge, and the Upper Trenton in faulted contact at the northeastern end, nothing but Deschambault limestone occurs here. In most exposures there is a thin zone of conglomerate, inches thick only. This is followed by 15 feet of dark gray, fine-grained crystalline limestone, some parts of which contain a great deal of black carbonaceous matter, both in disseminated form and as bedding films. Then come another 15 feet of coarse-grained light gray limestone, and these beds are succeeded by about 25 feet of very fine-grained crystalline limestone containing a zone of black chert at its base. Following this there are 20 feet of medium to coarse-grained beds, again with a black chert zone. Finally, the uppermost beds exposed are five feet of medium-grained limestone. This makes a total of 80 feet, and doubtless another 10 feet have been lost by erosion, making a grand total of 90 feet, thus coming into harmony with the section along L'Assomption river.The data from which the above generalizations were taken are in logs borings put down on the Joliette ridge by Shawinigan Chemicals Limited, to which company we am indebted for permission to include here the combined logs of two holes. This compilation is to be seen in Figure 11.

Good sections of the lower parts of this formation can be seen in the various quarries that have been dug along the northwestern margin of the ridge (fig. 12) but which are now all abandoned. Descriptions of a few typical quarry sections will suffice.

Gadoury quarry. 2½ miles south of Ste.Elisabeth, on the east side of the road to St.Thomas.

12' Dark crystalline limestone, with a fair amount of shaly and hydrocarbon interbeds. Chert occurs in the lowest 6". Dinorthis and large pelecypods abundant in uppermost beds.

Pelland quarry. ½ mile northwest of Grand La Chaloupe bridge. Well crystallized light gray limestone, mostly coarse-grained. Bedding is irregular in detail, cross-bedding is common. Dinorthis and pelecypods are rare. Rafinesquina, Bumastus, Zygospira, are common, together with abundant bryozoa. These indicate a somewhat higher horizon than that of the Gadoury quarry. A small reef os Solenopora occurs in the northern corner of theis quarry.

Lavallée quarry . South of La Chaloupe river, due north of At.Thomas (see plate XVIA). Coarse and fine-grained crystalline limestone, with chert in the upper 2' only. Bedding is irregular in detail, though regular enough to be seen along the entire quarry wall. Cross-bedding is marked in some layers. The section follows in table 9

Table 9. Coupe de la carrière Lavallée / Lavallée Quarry Section.

1' 6"	Dark, dense limestone in beds 1" to 2" thick, with shaly interbeds and discontinuous chert masses. Very fossiliferous, especially with Rafinesquina and crinoid debris.

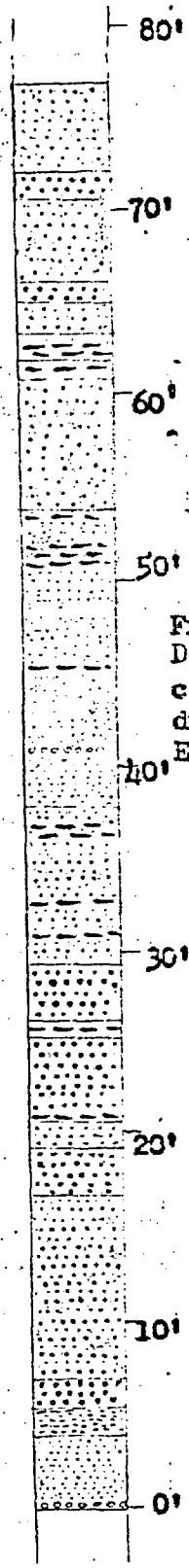


Figure 10. Section of the Deschambault limestone compiled from logs of wells drilled southeast of Ste. Elisabeth. See page 45.

LEGEND

Coarse-grained limestone

Medium-grained limestone

Fine-grained limestone

Chert nodules

Conglomerate

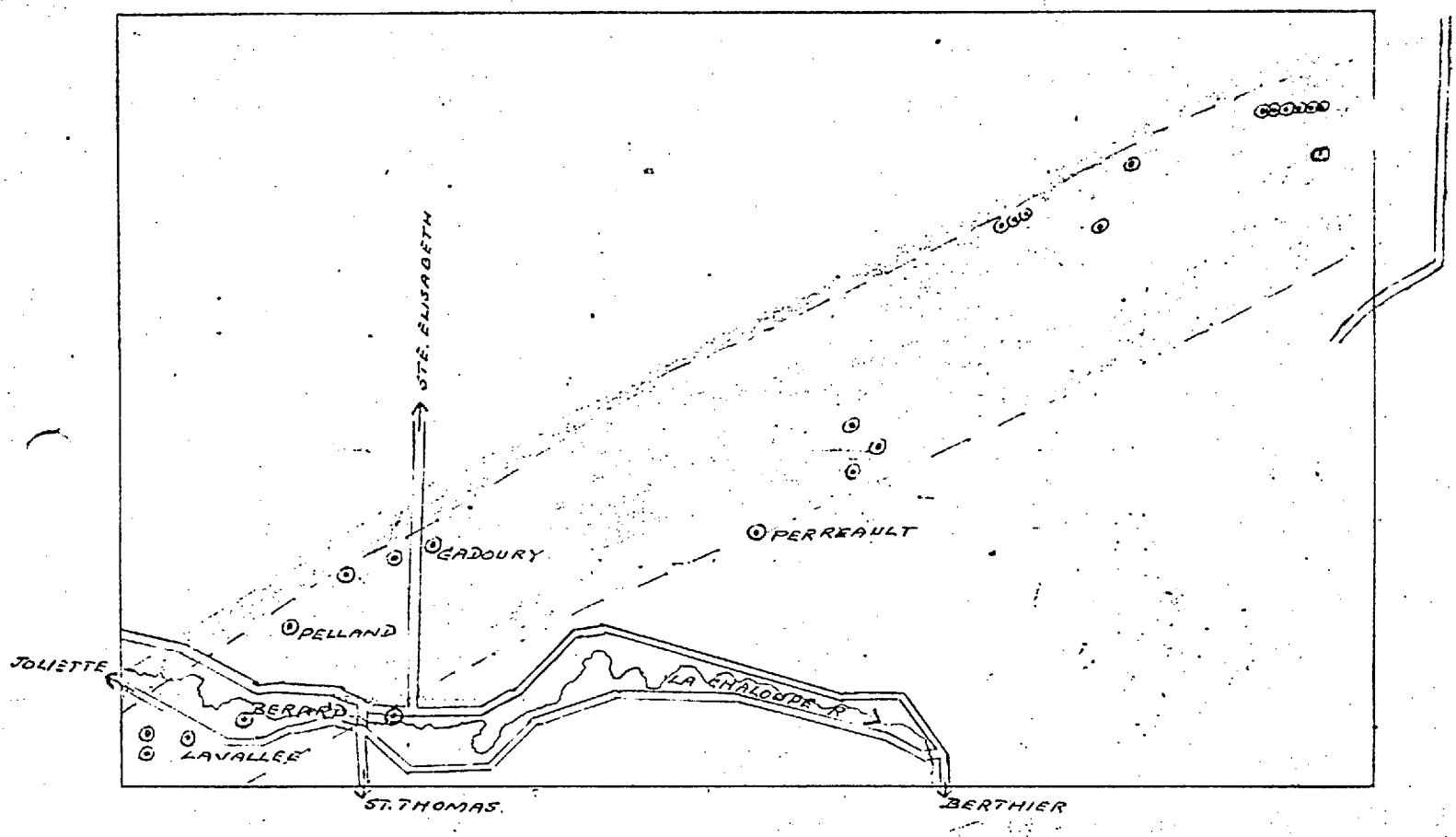


Fig. 12 Map of the northeastern half of the Joliette ridge, to show locations of some of the former quarries and openings into the Deschambault limestone. See page 65 . Scale: half mile

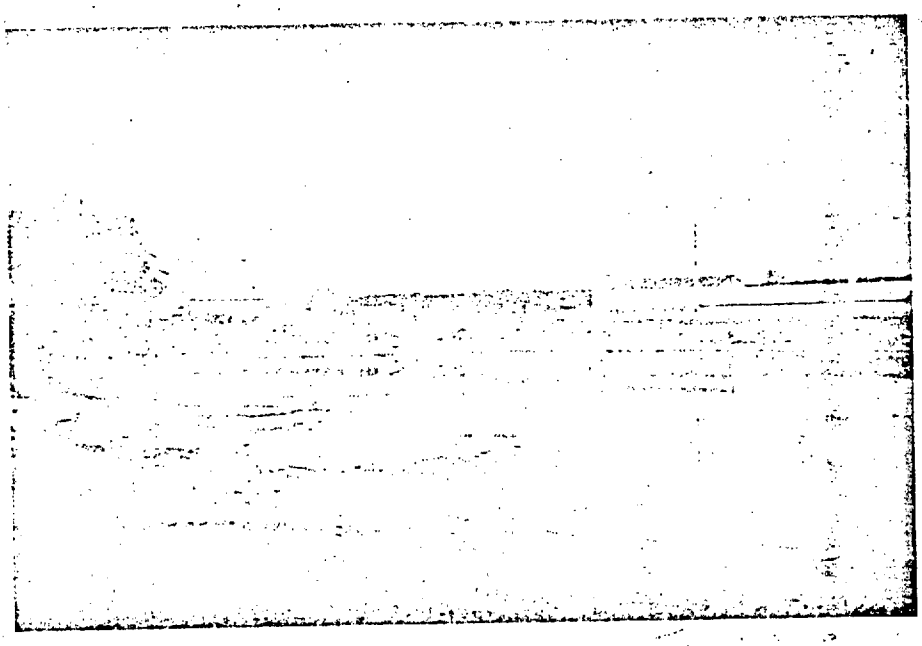
LEGEND FOR THIS PAGE

Deschambault ls.

Montréal ls.

Ouareau ls.

Plate XVI



A. Deschambault Formation. Abandoned Lavallée quarry, ½ mile northwest of Grand La Chaloupe bridge.

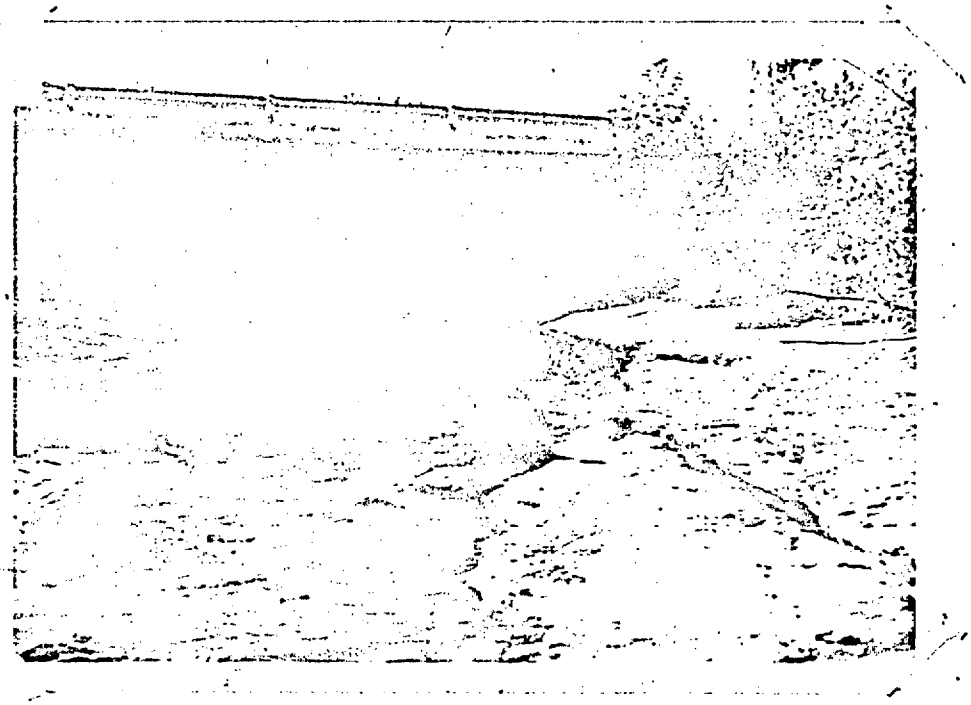
B. Close-up view of worm burrows in small abandoned quarry adjacent to Lavallée quarry.

1'		Coarse-grained, light gray limestone, very fossiliferous, especially with Rafinesquina. Similar to above, but with numerous dark bedding streaks.
18'	4"	Medium-grained, medium dark gray limestone, with dark bedding streak
	11"	Medium-coarse-grained crystalline limestone, light gray, with dark bedding streaks.
	2"	Fine-grained, medium dark gray crystalline limestone.
	2"	Very fine-grained, dark gray limestone.
1'	6"	Medium-grained, medium gray, crystalline limestone. Poorly bedded, dark bedding streaks common.
	9"	Coarse-grained, light gray crystalline limestone. Friable. Conglomeratic, with slablets and masses of fine-grained limestone up to 4" across.
1'	1"	Fine- to medium-fine-grained dark gray crystalline limestone. Fossils not common.
	2"	Medium-grained crystalline limestone
	9"	Fine-grained, dark gray, crystalline limestone.
2'		Fine-grained to medium-fine-grained limestone, dark gray. Fossils uncommon. Upper 4" well and finely bedded
12'	7"	Total section exposed.

A small adjacent quarry to the west shows the same type of limestone but at some levels worm burrows are very abandant (see plate XVIB) and appear as filled tubes or cavities.

Perrault's quarry. 2 miles south-southeast of Ste.Elisabeth Heavy bedded, coarse- to medium-grained crystalline rock. Fragments of fossils common, whole ones very rare. Cross bedding common. Chert beds, up to 1" thick, for the most part discontinuous.

Plate XVII



Deschambault Formation. Exposure below bridge on Chaloupe river on the road going from St-Thomas to Ste-Elisabeth.

Bérard quarry. ¼ mile west of Grande Chaloupe bridge, and south of the river. Medium to fine-grained crystalline limestone, with some light colored, coarse-grained beds, which thin and thicken remarkably. Fossils are common in the crystalline beds, rare in the remainder.

Joly quarry. One mile south of railway crossing on road going due west from Ste.Elisabeth. Mostly dark, fine-grained crystalline limestone, with a few beds of coarse cystid columnals. Cross bedded. No chert. Probably a higher horizon than any of the others. No more than 8 feet exposed.

Below and above the bridge on Chaloupe River on the road going from St-Thomas to Ste-Elisabeth, Deschambault limestone is exposed (see plate XVII). It is a coarse-grained thickly bedded limestone grey brown and containing masses of chert. Intraformational slumping is here also well displayed a little downstream from the bridge.

Beyond the Joliette ridge Deschambault beds are to be seen at only three localities: 1. Doucette's dam on Bayonne river, 2, Chicot river at St.Cuthbert, and 3. two streams half-a-mile west of St.Barthélémy station (C.N.R.).

D. Doucette's Dam, Bayonne River.

At the bridge which crosses Bayonne river close to the Joliette Berthier county line, Beekmantown dolomite occurs on both sides of the river, and both above and below the bridge. It occupies the entire

bed of the river downstream as far as the sharp falls about 1,000 beet below the bridge (fig.11). The falls are in fact composed entirely of the same rock. Immediately below the falls Trenton limestone lies in faulted contact with the dolomite, and on the left bank is medium gray, crystalline and in places filled with bryozoa, and obviously belongs within the Deschambault Formation (fig. 11 plate XVII). Withal, it is considerably deformed by folding, faulting, and brecciation. Near the dolomite the brecciation appears to be normal; farther away (10'-) it appears to have resulted in the rolling of the Deschambault rock into rounded masses. Downstream, this is succeeded, probably with an intervening fault contact, by beds apparently identical with the Montréal Formation.

E. Chicot river at St. Cuthbert

Half a mile upstream from the dam just above the highway bridge, and on the left bank of the river, there is a very interesting exposure of Deschambault limestone beds. (see plate XVIII). This was seen to excellent advantage in August, 1950, when Savoie's dam downstream was being reparied, and the level of the water upstream was considerably lowered. The section (fig. 14) is as follows:

Table 10. Coupe du calcaire de Deschambault, rivière Chibot/ Chicot River Deschambault limestone Section.

Top of section. South, or downstream, end.	
2'	Dark, crystalline limestone, with a few dense beds; shaly partings very abundant. Much black matter distributed throughout the rock. Fossils very common, plainly seen on smooth surfaces. Rafinesquina, Dalmanella, Dinorthis.

18' Alternating light gray, crystalline, very fine-grained to medium-grained limestone. The latter type is in places a coquina, but no recognizable fossils can be extracted from it. The very fine-grained rock is almost without fossils, and closely resembles the chert-bearing beds below dark seams along the bedding stand out in relief, and give the rock an appearance very much like that of the lower beds of Deschambault limestone in the St. Alban gorge of the Ste.Anne river (Grondines map-area).

3' Single bed of very fine-grained limestone, holding a few blobs of chert, mostly near its lower contact. Seams show up in relief, but do not show more than a dark film on the broken rock surface.

6"-8" A. Limestone conglomerate. This appears to contain pebbles strangely alike in size and circularity, but in fallen blocks they are seen to be the ends of cylinders, presumably rolled, and about ½" x 2", hence making up a true intraformational conglomerate. The material of the pebbles is the same as bed B below. The matrix is fine-grained crystallized limestone. See figure 14, 14a, 14b.

B. Dense, sub-lithographic limestone. Numerous cracks, flaring downward and filled with black calcite, occur in this bed. Upside-down, one would call them mud cracks.

C. The same kind of conglomerate as A. above. The regularity of the rolled cylinders is really remarkable. This bed thins and thickens, and pinches out completely upstream.

D. Dense to very fine-grained limestone. Eroded and replaced by bed C. It could have provided the pebbles of bed C.

4' The main chert-bearing horizon. The rock is similar to the 3' bed above. Strongly cross-bedded and finely crystalline. Some layers are rich in Rafinesquina. The chert occurs only as nodules or as pancakes, the latter form 2" to 6" across and 1" thick. Though the density of the chert nodules is not uniform it is rare to find more than one per square foot. The containing limestone gives the appearance of being very hard, probably siliceous.

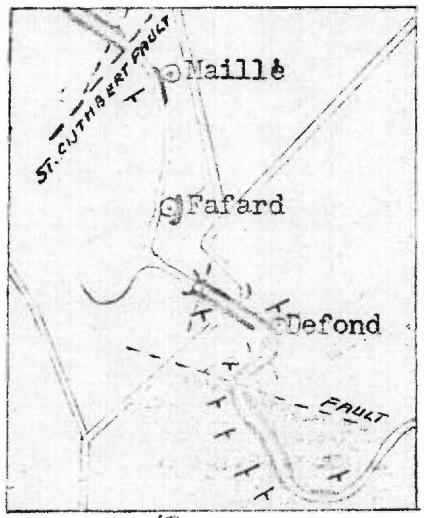
10' Conglomeratic limestone makes up at least 6' of this bed. The rest is all dense limestone. The pebbles are all of Deschambault limestone, and are of various sizes. Many are fossiliferous, Dalmanella being the commonest form.

Base of section. Total thickness 37' 6". General attitude 60° 10°S.

Further downstream, and just above the dam on the left bank of the river is the old Fafard quarry, (see fig. 13) long since disused. The section here is as follows: (in table 11)

Table 11. Coupe de l'Ancienne Carrière Fafard/Old Fafard Quarray Station

10' Dense, chunkily-breaking dull gray limestone containing chert nodules throughout. In the field east of the house there is an outcrop of this rock in which there is a vein of chert. This is probably the same bed as the vein-bearing



LEGEND ~~FOR THIS PAGE~~

- Tetreauville ls.
- Montréal ls.
- Deschambault ls.
- ~~Quarreau ls.~~
- ~~Beekmantown dol.~~
- Potsdam ss.

Figure ~~22.~~ 13 Map of Chicot river at St.Cuthbert to show localities of quarries in Deschambault limestone
See page ~~65.~~ 74. Scale: / half mile /

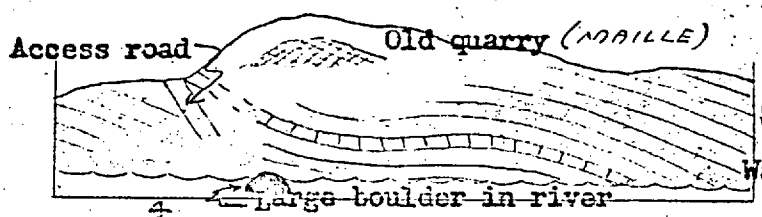


Figure 12. Deschambault limestone exposed on left bank of Chicot river half mile above St.Cuthbert. See page 50.73.
Horizontal scale / 100 feet /

Figure 13a Diagrammatic view of rolled cylinders, to show their circular section on exposed surface of rock. Natural to half scale. See page 50.73.

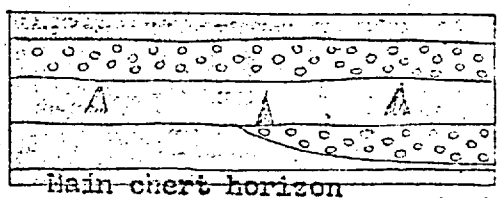


Figure 13b Enlargement of 6"-8" bed shown in Figure 13, to show rolled cylindrical pebbles, and inverted wedge-shaped fissures. See p. 50.73.
Vertical scale / 10 inches /

		layer below the dam, though the lithology is not quite the same.
1'	8"	Solid crystalline bed
	4"	Very finely bedded crystalline limestone.
	6"	Very thin (½") bedded limestone.
	10"	Irregularly bedded crystalline limestone, especially so at base.
1'		Solid bed of crystalline limestone. Chert at base.
	8"	Irregularly breaking limestone, some layers showing dense white ewathering effects.
6'		Solid bed of crystalline limestone. Tendency to break into 6" or 8" beds.
10'		Mixed types of crystalline limestone.
31'		Base of section. Dip 12°S.

Immediately below the Savoie's (see plate XIX) dam rock is exposed on both sides of the river. On the west (right) bank the beds have been broken by a fault (see Fig. 14, 14a). The probable succession is as follows

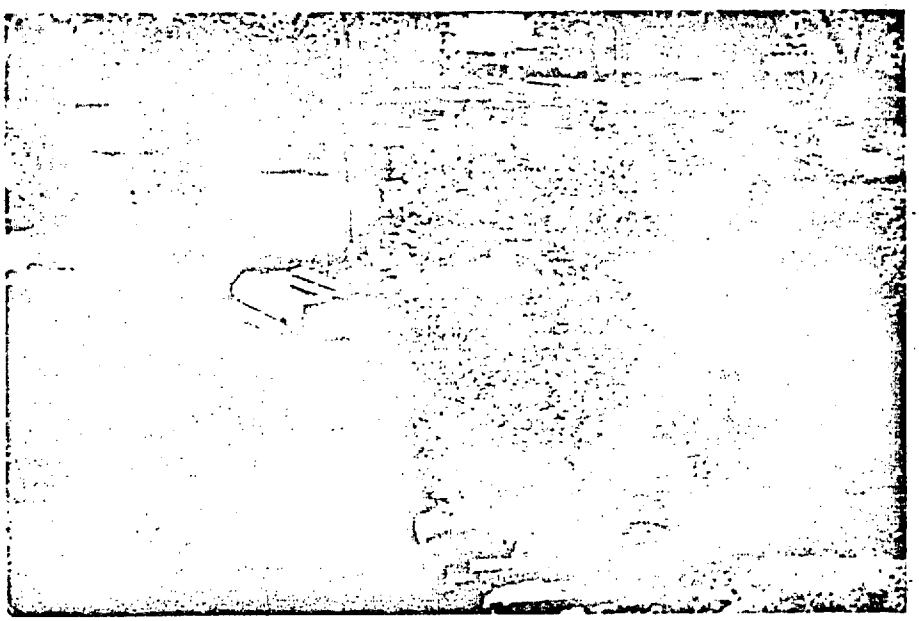
Table 12. Coupe de calcaire de Deschambault au barrage Savoie/ Deschambault limestone Section at Savoie's Dam.

Top of section		
	4"	Dark, shaly, rubbly weathering, crystalline limestone
	6"	Well bedded, fine- to medium-grained limestone
	6"	White to drab weathering almost lithographic limestone.
	6"	Well bedded, fine- to medium-grained limestone.
	2"	White to drab weathering, almost lithographic limestone.
2'		Poorly fossiliferous, fine-grained, crystalline limestone.
8'		Well bedded, fine- to medium-grained limestone. The basal 12" bed fills irregularities in the chert-bearing bed below. Poorly fossiliferous.

Plate XVIII

Deschambault Formation, Chicot River above St-Cuthbert

Plate XIX



Deschambault Formation, Savoie's Dam on Chicot river at St-Cuthbert, just above the highway bridge. East side of the river.

10' Very fine-grained crystalline chert-bearing limestone. Bedding scarcely perceptible. Chert in discrete masses and in veins. Fossils scare.

24' Base of section.

Downstream the chert beds flank the river on both sides as far as the highway bridge and for 200 feet below it. Throughout this entire stretch the limestone exposed along the stream is lithologically uniform, a fine-grained, light gray limestone making up a bed 9 to 10 feet thick. It contains chert in two conditions, first, as dicrete nodules from 1" to 8" long, the smaller ones tending to a sperical form, the larger ones tending to be tubeshaped or cylindrical (fig.15c) and second, as dike-like masses, (see plate XX) vertical or nearly so for the most part, up to 9" thick, and not reaching the upper surface of the limestone bed as far as present observations allow one to judge (fig. 15). Both nodules and veins show a weathered zone about $\frac{1}{4}$" thick which is dull, porous, and granular, and moreover pale dirty buff in color. Inside this weathered shell is the unchanged dark gray to black chert nucleus (fig. 16). This weathered zone does not appear in specimens released from within the rock; it can therefore be correctly considered as a phenomenon of weathering. There is no orientation preference for the tube-like nodules on the bedding plane, but on vertical surfaces there is apparent a tendency to follow the direction of the prevailing joints (fig. 15b)

Plate XX

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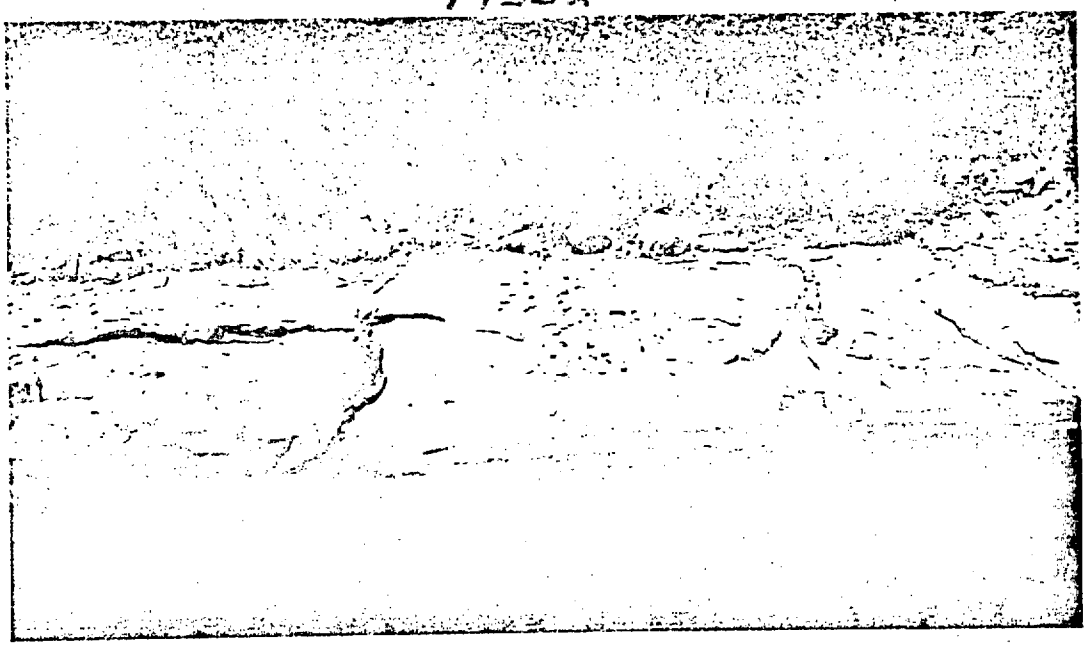

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A. Chert veins in Deschambault limestone. Chicot river at St-Cuthbert.

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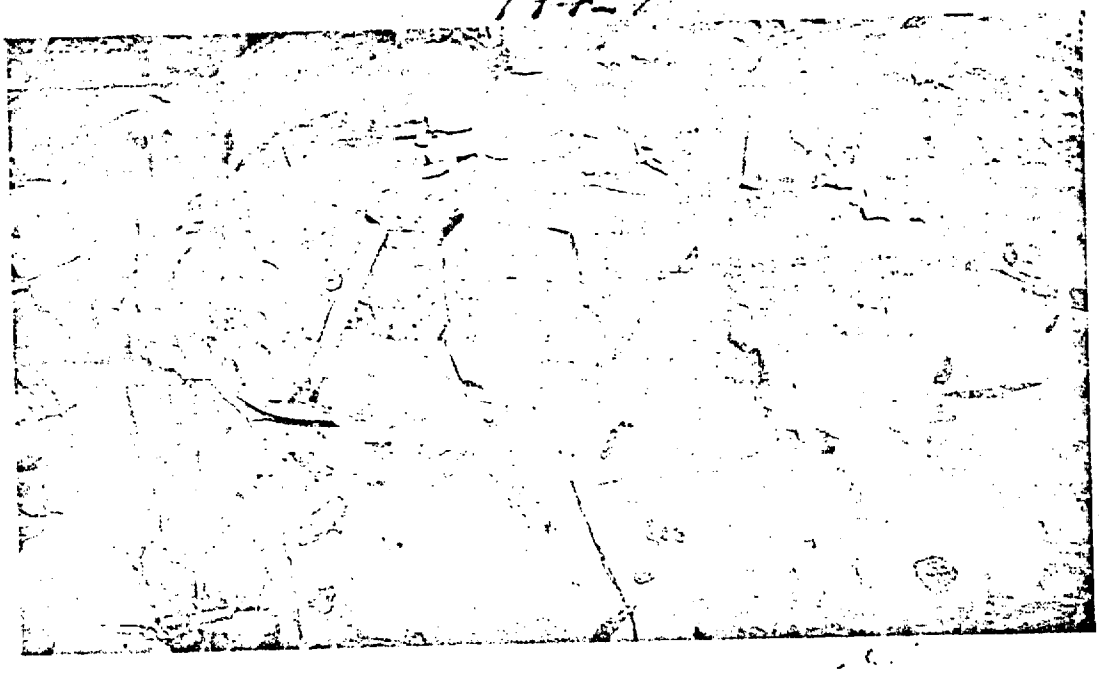

B. Chert stringers and elongated nodules. Chicot River at St-Cuthbert.

The vein-like masses are very striking in appearance. They rarely preserve a constant width, but range from a general minimum of 2 inches to a maximum of 9 inches. A few have roughly parallel walls, but the majority have boundaries which show no correspondence in outline (fig. 15a) and hence cannot have been the result of fracturing alone. Many of them split and anastomose, or give off branches which persist in a new direction. Some have 'inclusions' of the host limestone rock within them. Where they occur on sloping banks of the river and have been weathered out to stand at an elevation of from 4 to 6 inches above the containing limestone, they look from a short distance exactly like stranded logs.

The veins and nodules have a most interesting distributional relationship. The veins are spaced about 10 to 12 feet apart, and are in most cases vertical. For 22" on each side of the veins there are no nodules; after that distance the nodules begin to appear and are thickest midway between the veins, though there is actually little difference in their areal abundance wherever they (see fig. 15) occur. The problem of the origin of this peculiar distribution has not yet been solved.

200 feet below the highway bridge on the right bank the limestone beds fail, but are continued on the left bank. The chert beds pass below a similar but coarser grained limestone devoid of chert, which, just below the mill, once supported a small quarry. Practically no more Deschambault limestone occurs downstream thence.

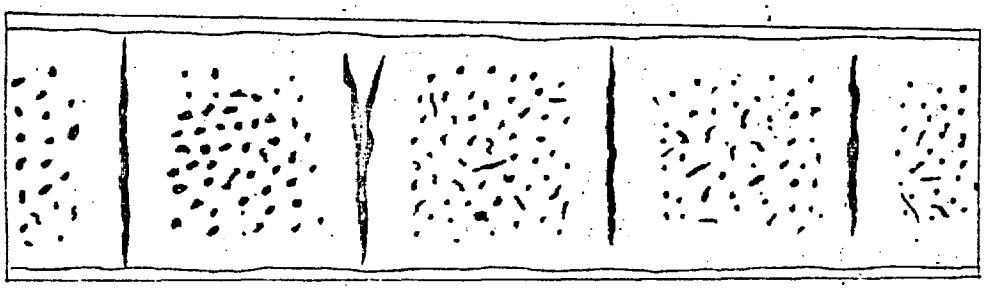

Figure 15. Vertical section of the chert bearing bed exposed on Chicot river above and below the highway bridge. See page 53. 77
Scale; the chert bed is about 10' thick; the 'veins' are about 20' apart.

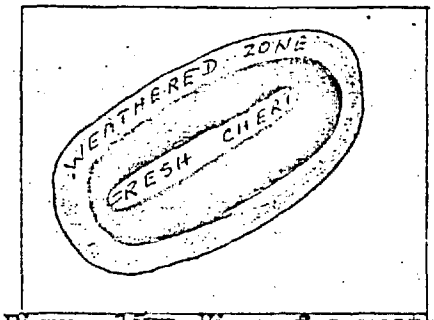

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Figure 15a. View of a weathered chert nodule on the surface of the limestone outcrop. See page 53.
Natural scale.

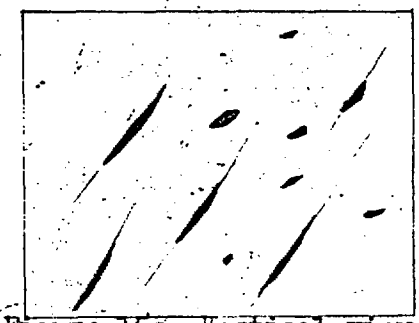

Figure 15c. Vertical view of the chert bearing bed above the bridge to show dependence of chert deposition there upon joints. Page 53. 77
Scale / 10 feet /

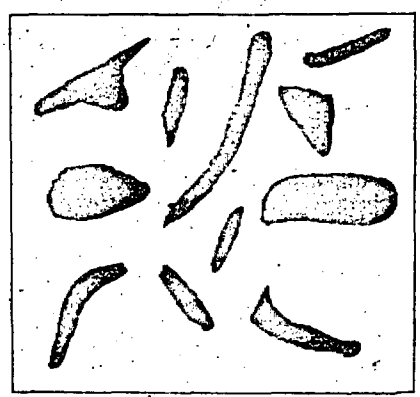

Figure 15d. Enlargement of part of the limestone shown in Figure 15 to show actual shape and spacial relationships of chert masses.
Condensed from one square yard.

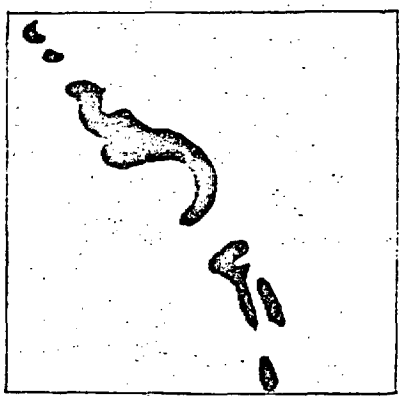

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Figure 15b. Sketch of part of one of the 'veins' to show lack of correspondence between the opposite sides. See page 53. 77
Scale: / 2½ feet /

F. Near St.Barthélémy Station.

Proceeding southwestwards along the Canadian National Railways track from St. Barthélémy Station one crosses two streams at 500' and 1300' from the highway near the station. Deschambault limestone occurs in the bed of the western stream from 700' to 800' from the railway track going upstream. It is so much waterworn that no attitudes can be discerned. 500' further upstream Precambrian gneiss is found in the stream bed.

Upstream from the track along the creek nearer St.Barthélémy station a distance of 1200' brings one to an outcrop of Deschambault limestone, which is separated from Precambrian gneiss by a gap of 28'. In between these recognizable rock types, 5' from the Deschambault and 20' from the Precambrian, there is a width of three feet occupied by mylonitized and brecciated quartz-rich gneiss (fig. 20). About 8' of Deschambault can be seen here, and are followed downstream by beds of the Montréal Formation. The faulting which has disrupted this outcrop belongs obviously to the same system as does that to which the St-Cuthbert fault belongs.

Fossils and Correlation.

The combined faunas of these Deschambault occurrences is large, and about a dozen species can be considered common. No corals or graptolites occur here. Cephalopods are exceedingly rare, and the rafinesquinid brochiopods are almost all of the R. alternata type. Bryozoa are common and of many kinds. Dinorthis pectinella is characteristic of the lower beds, with which large, poorly preserved

pelecypods are usually associated. Above this one finds the Rafinesquina- Dalmanella -bryozoa assemblage, with Zygospira recurvirostris, Calyptaulax calderi, Bumastus milleri, Ceraurus pleurexanthemus. The beds become less fossiliferous upwards. The complete list of species so far identified follows:

Table 13. Fossiles du Deschambault/ Fossils in Deschambault Formation

Species	Symboles/Symbols
ALGAE	NOTE:
Solenopora compacta Billings	U signifies that the species also occurs in the Upper Trenton
Branching forms	
BRYOZOA see p. 84 - To be included in here	Husain's List
BRACHIOPOD	C signifies Common
Trematis ottawensis Billings	U CCsignifies very common
T. terminalis (Emmons)	U
Schizocrania filosa Hall	U
Pholidops trenton Hall ensis	U
Platystrophia sp., prob. P. amoena McEwan	U
Dalmanella rogata (Sardeson)	U CC
Dinorthis browni Wilson	C
D. dubia Wilson	
D. pectinella (Emmons)	CC
Doleroides pervetus ottawanus Wilson	
Sowerbyella sericea (Sowerby)	U C
S. punctostriata Mather	

Leptaena sp.		
Rafinesquina alternata (Conrad)	U	CC
R. minuta Salmon		
R. spp.		
Opikina sp.		
Strophomena filitexta Hall		
S. minuta Wilson		
Triplesia nuclea (Hall)	U	
Parastrophia hemiplicata (Hall)		C
Rhunchotrema increbescens (Hall)		
R. intermedium Wilson		
Zygospira recurvirostris (Hall)	U	CC
PELECYPOD		C
Large species		C
GASTROPOD		
Cyrtolites ornatus Conrad		
Hormotoma gracilis (Hall)		
H. trentonensis Ulrich & Schofield	U	
Cyclonema hallianum Salter		
Phragmolites compressus Conrad		
CEPHALOPODA		
Endoceras sp.	U	
TRILOBITA		
Bathyrus sp.	U	
Isotelus gigas DeKay	U	
Isotelus sp.		
Illaenus sp.		
Bumastus milleri (Billings)		C
Acrolichas cucullus ottawense Foerste		

Encrinurus trentonensis Walcott		
Hermiarges paulianus (Clarke)		
Flexicalymene senaria (Conrad)	U	
Ceraurus pleurexanthemus Green	U	C
Calyptaulax calderi Wilson		C
COELENTERATA		
Conularia trentonensis Hall	U	C
Eocunularia sp.		
Hallopora splendens var. clarki Husain		
H. subplana (Ulrich)		
Diplotrypa fritzi Husain		
Pachydictya gigantea Ulrich		
P. splendens Ulrich		
P. cf. P. triserialis Ulrich		
Sorelopora clarki Husain		
Mesotrypa infida Ulrich		
Bassleropora proava (Eichwald)		
B. concentricus Husain		
B. grondinensis Husain		
OSTRACODA		
Aparchites sp. cf. A. ellipticus		Carter's List
Briartina sp. cf. B. modesta		
Bythocypris cylindrica		CC
B. sp. cf. B? granti		
B. ovalis		
Ceratopsis laevicornis		CC
Coelochilina dorsotropoa		
Eurychilina reticulata var. incurva		
Krausella sp. cf. K. arcuata		

To be included p. 82

Leperditella elliptica	
L. sp. cf. L. magnapuncta	
L. ornata	
L. centrinota	
Macronotella velata	
Parabolbina valata	
P. ventricornis	
Primitia lineata	CC
Schmidtella latimarginata	C
Tetradella ulrichi	CC
ANNELIDA	
Serpulites sp.	
INCERTAE SEDIS	
Translucent rods	
Receptaculites sp.	

Ostracod and bryozan specimens identified from the area by Carter (1957) and by Husain (1955) have been added (when available) to the fossil lists of each formation.

There is no essential difference between this fauna and that of the equivalent beds in the Grondines--Portneuf areas. Strangely enough, between it and the assemblage from the presumable equivalent beds, from Montréal area, there is little in common. This peculiar condition will be investigated during the work upon the Laurentides map-area.

Montréal Formation

The beds overlying the Deschambault Formation are very poorly exposed in the Sorel map-area, and are best seen along L'Assomption river a mile or so below Joliette. Elsewhere these rocks are poorly or inadequately developed and may be so seen on Bayonne river at Doucette's dam, on Chicot river at St.Cuthbert, and at a few other scattered localities. The non-appearance of these Middle Trenton beds is due in part to the low degree of their resistance to weathering and in part to their near elimination along the St.Cuthbert fault.

In general, this formation is thin bedded, and displays a great variety of lithologic types. It is dominantly a dark, slightly crystalline rock containing an abundance of shaly partings which separate the rock into beds from one to two inches thick. No one lithologic type predominates. Fossils are common, though the fauna is restricted in numbers of species. Sowerbyella, Dalmanella, Zygospira, Platystrophia Prasopora, and Flexicalymene are the genera most often seen.

The most nearly complete section of the beds of this formation, everywhere unsatisfactorily exposed, occurs along the banks of L'Assomption river, (see plate XXIA,B) where for 300 feet above and 2,500 feet below a dam 3/8 mile (straight line) below Pont des Dalles these beds may be well seen in the upstream part of this stretch though poorly exposed downstream. Their contact with the underlying Deschambault is obscured, but there is no sign of a gradation, Downstream, the Montréal Formation shows definite signs of a gradation into the overlying Tétreauville Formation, though what might be the actual contact is not exposed. These contactual relationships are similar to what one finds elsewhere in this and nearby map-areas. To the east the equivalent formation would be the St-Casimir Member of the Neuville Formation.

The characteristic of the Montréal beds along L'Assomption river are in general as given above. The bulk of the formation consists of a dark limestone, containing here and there a number of phanerocrysts of calcite, but never enough to allow one to call the rock definitely crystalline. This type is also generally 'dirty', by which is meant that there is an obviously large amount of muddy matter incorporated in the limestone itself, as well as the muddy matter which makes up the shaly interbeds and partings. These beds are irregular in thickness in detail, though some may be followed along the river bank for two or three hundred feet, maintaining their thickness of from one to three inches throughout that distance. There is, associated with this type, a definitely crystalline limestone, reminiscent of the Deschambault, in which mud is practically absent. These beds are everywhere prominent on account of their slightly superior resistance to weathering. Less abundant is a third type of semi-lithographic limestone. Associated

with, and separating the limestones into beds of one to four inches, there are shaly partings and interbeds which are rarely as much as 1/8" thick. No chert has been seen in this formation. The crystalline, Deschambault-like limestone is commoner in the lower part of the formation, whereas the dark dense beds are commoner in the upper part, and provide the basis the assumption of a gradation into the Tétreauville Formation, especially since these limestone beds are separated by thicker shale interbeds than is the rule within the main part of the Montréal Formation or the St-Casimir Member in the areas to the east.

The thickness of this section cannot be directly measured. There are too many gaps, which, combined with the undulatory nature of the bedding, make the building up of a stratigraphic column a matter of questionable value. The upstream part of the section is exposed along the banks of the river (see plate XXI) where the latter flows at an acute angle to the regional strike. Though exposures are good and continuous here, the presence of low swells and rolls in the bedding allows the 30 feet actually measured to be distributed over a greater horizontal distance than would be expected. For the lower 2000 feet or so the river flows almost at right angles to the regional strike (60° - 70°), though in places, particularly in the last thousand feet the strike changes to $90^{\circ}\pm$. This would reduce the thickness calculated upon the assumption of a 65° strike throughout, but because the dip increases towards the lower end of the section from a regional 2° to 7° to the south, and in one locality 8°, the thickness should therefore be increased somewhat. There is no way of evaluating these plus and

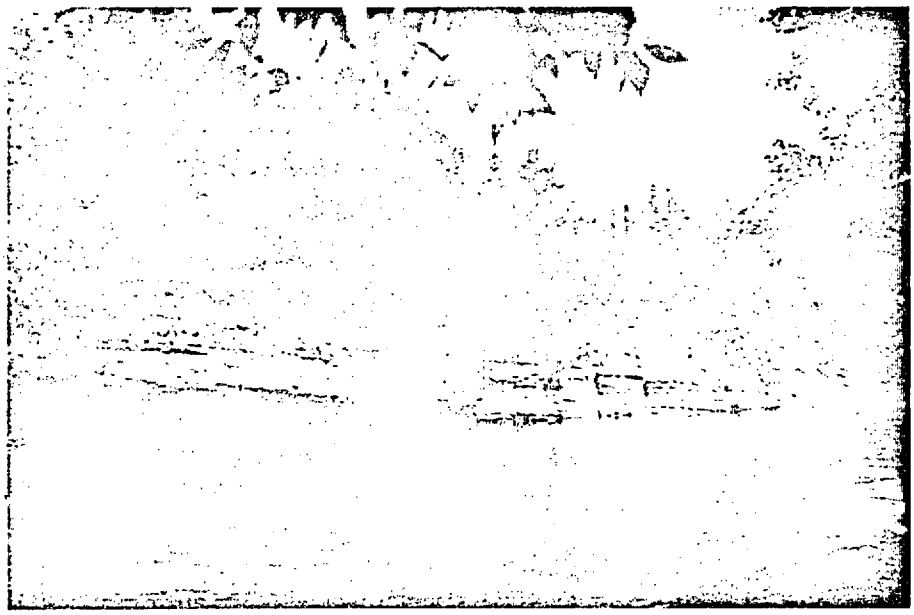
minus corrections with the exposural data at present at hand, but if we assume that they cancel each other the calculated and measured thickness becomes 30'+ 80', a total of 110 feet. This is quite in harmony with observations made in the neighboring map-areas.

To the southwest, on St.Peter river, beds of the Montréal Formation are very poorly and intermittently exposed, beginning at a point about a quarter of a mile due south of the bridge which carries highway number 41 over the river. Here the river makes a sharp turn to the southeast, and thence as far as the southern margin of the map, where the river passes beneath a farm-road bridge, infréquent and poor exposures obtain. Throught, the rock is thin-bedded, rubbly weathering dark muddy limestone, with the same general characteristics as characterize the beds on L'Assomption river.

A mile and a half east of Joliette thin-bedded, rubbly weathering 'dirty' limestone beds have been exposed in the artificially deepened bed of St.Thomas brook. They are quite characteristic of the Montréal Formation.

No other exposures are known towards the northeast until the Bayonne river is reached. There, on both sides of the stream these same thin-bedded 'dirty' limestones occur. On the left bank they are in probably faulted contact with Deschambault beds (fig.23, plate XXXII and grade upwards into the Tétreauville. On the right bank the contacts are not shown, but they are presumably similar to those on the left bank. Only a few tens of feet are exposed here.

Plate XXI



A. Montréal Formation. L'Assomption river dowstream from Pont des Dalles

B. Close-up view of A.

Another long outcrop free hiatus occurs between the Bayonne and the Chicot rivers. On the latter stream Deschambault limestone outcrops at the highway bridge at St.Cuthbert, and persists for 450 feet along the river banks. 528 feet below the bridge, measured along the banks, thin-bedded limestones of various types outcrop and persist as far as the 892 foot mark, where they are in faulted contact with beds of the Tétreauville Formation(see fig. 22). Dark, crystalline, shaly limestone predominates, interstratified with finely crystalline limestone of the Deschambault type in beds up to 4 inches thick, which latter stand out as prominent horizons on account of their slightly superior resistance to weathering. This is also the case along L'Assomption river. Several small faults cur these beds at the 600' mark, but no essential elimination or duplication seems to have resulted. In the last hundred and fifty feet along the river a thickness of twenty feet of crystalline crinoidal detrital limestone is well shown on the right bank, between which and the Tétreauville downstream and the remainder of the Montréal beds upstream there are faulted contacts. Because the river runs more or less irregularly parallel with the regional strike of the formations no satisfactory calculation of the thickness of these beds can be made, and the exposures do not allow a section to be measured that would in any way represent the entire exposure. We should suppose that not more than 60 feet are exhibited here. The crinoidal detrital beds at the top, and a darker, somewhat more shaly type of limestone eslewhere, are the only details which distinguish these beds from the Montréal Formation elsewhere.

The only other known exposure of this formation is to be seen along the first stream to cross the C.N.R. track west of St.Barthélémy Station. The rocks there, are shown in Fig.20 but are not shown on the map because of their smallness. Followein 8 feet of Deschambault limestone, there lie, with a fairly high dip, some 10 feet of Montréal-type limestone together with limestone conglomerate. The conglomerates and the abundance of silicified Dalmanella remind one of the limestones of the St.Casimir Member of the Portneuf--Grondines map-areas, whose stratigraphic position is precisely that of the Montréal further southwest.

Fossils and Correlation.

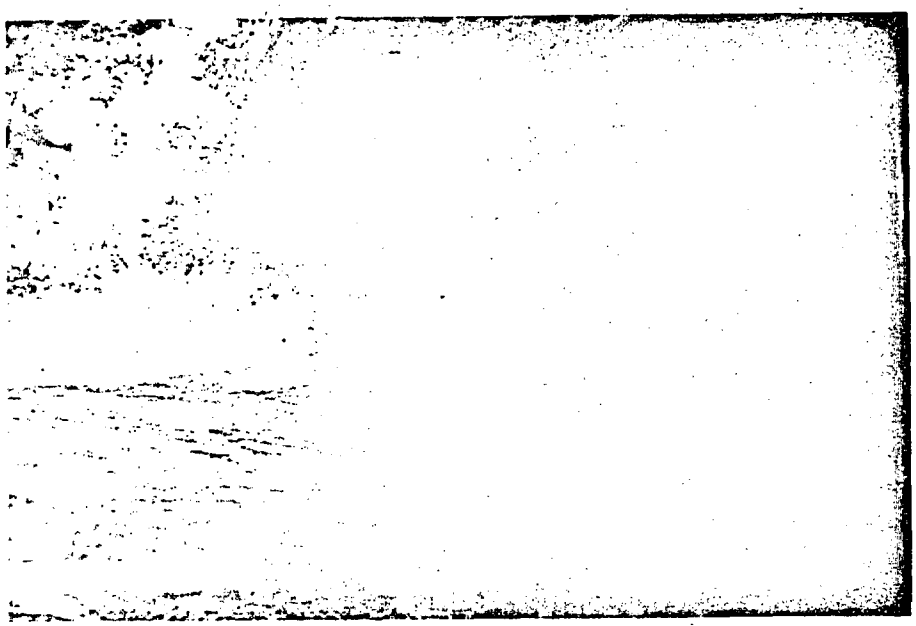
The list of species is a short one. This is also the case in the Montréal area, where the Montréal limestones are in many places crowded with fossils, but belonging to a relatively small number of species. The complete list identified from the exposures in the exposrues in the Sorel map-area follows:

Table 14. Fossiles du Montréal / Fossils in the Montréal Formation

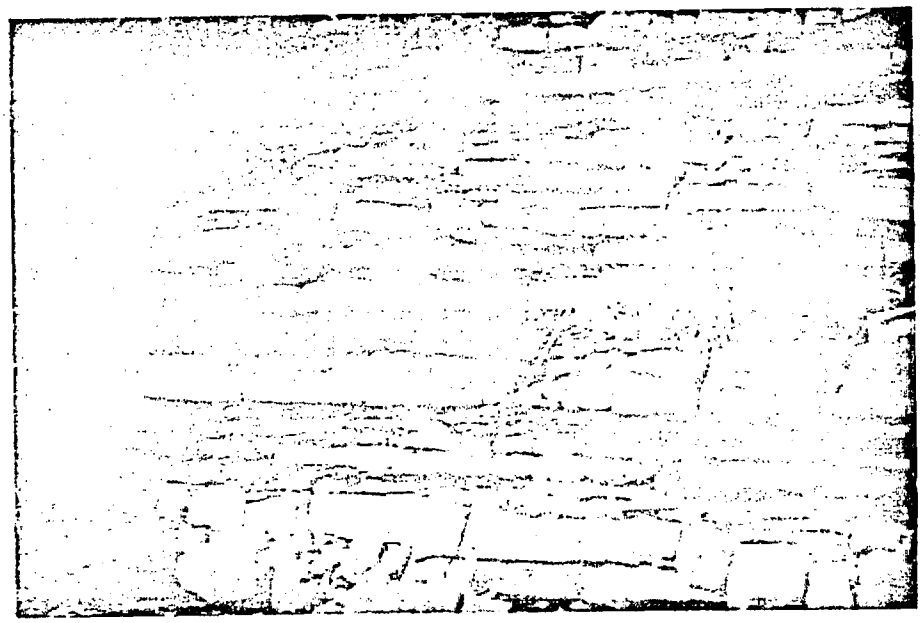
BRYOZOA	
Prasopora orientalis Ulrich	C
Prasopora simulatrix Ulrich	Husain's List
P. insularis Ulrich	Husain's List
Prasoporina selwynii (Nicholson)	Husain's List
Nematopora ovalis Ulrich	Husain's List
Glauconomella cf. plumula (Wilman)	Husain's List

BRACHIOPODS	
Pafinesquina alternata (Emmons)	
R. prestonensis Salmon	
R. patula Wilson	
Sowerbyella sericea (Sowerby)	C
Dalmanella rogata Sardeson	C
Platystrophia sp. prob. P. amoena McEwan	C
Triplesia nuclea Hall	C
Zygospira recurvirostris (Hall)	C
Rhynchotrema increbescens (Hall)	
R. ainslei N.H. Winchell	
PELECYPODA	
Rhytimya sp.	
TRILOBITA	
Hypodicranotus striatulus (Walcott)	
Isotelus gigas DeKay	C
Ceraurus pleurexanthemus Green	C
OBSTRACODA	
Bythocypris cylindrica (Hall)	
Smooth ostracods	
* C:common	

Plate XXII



A. Tétreauville Formation, Bayonne river at the first turn of the river below Doucette's Dam.



B. Close-up view of A

Tétreauville Formation

The most widespread of the Trenton formations is the Tétreauville. It is well exposed along the Assomption, Chaloupe, Bayonne, Bonaventure, Ste-Catherine, Chicot, St-Barthélemy, and Cachée rivers, and in a number of intermediate localities and minor creeks. In all these exposures there is a homogeneity of lithologic expression which makes the identification of this formation easy and certain. It consist almost everywhere of alternations of very dark bluish gray dense limestone in even beds from 2 to 6 inches thick separated by continuous shale beds from half an inch to 3 inches thick (see plate XXII). In rare cases the limestone beds reach a thickness of one foot, and still more rarely the shale may be uninterrupted by limestone over a thickness of as much as 4 feet.

The evenbeddedness of the limestone and the shale, their sharp lithological contrast, and the yellow to buff weathering of the limestone (see plate XXIIB) conspire to allow an identification of this formation from a distance. The limestone is characteristically dark bluish gray when fresh, usually dense and grainless at least macroscopically, but often holding small and widely separated crystals may be abundant enough to make up a crystalline bed. Fossils occur sparsely in this limestone. Rafinesquina and fragmentary remains of cystids are the only ones that can be depended upon, but Conularia and Sowerbyella are locally abundant. The shale is highly fissiles, usually brownish, and though on the whole unfossiliferous, it may have certain surfaces thickly strewn with ostracods, and more rarely, with fragmented tests of Triarthrus.

L'Assomption river exposures.

Along the Assomption river this formation first appears with its characteristic bedding at station 5900' ± (river bank distance in feet downstream from Pont des Dalles). The normal type persists for 700 feet and is succeeded thence as far as the prominent bend of the river to the left (N.E.) by beds dominated by shale (see fig. 17).Thereafter limestone resumes the dominance. Because of its being constantly washed by the water of the river it lacks the usual buff color on the weathered surface, and instead is pale blue-gray. One such bed of semi-lithographic limestone reaches a thickness of three feet, and overhangs a part of the river, which there flowing northeastward and is split up into longitudinal strikewise channels separated by the protuding edges of some of the beds (see fig.18). Where the river bends back to a nearly southerly course it passes the site of an old dam, now partly corvered on the right bank by the Joliette city garbage dump. From this point downstream (8640') the beds gradually lose their bi-lithic character and, within 20 feet stratigraphically, are seen to consist of very irregular and thin-bedded limestone, nowhere with either the shaly partings or the dark dense semi-lithographic rock so diagnostic of the typical Tétreauville beds. Instead, it is when fresh a fairly dark gray to medium gray limestone, weathering light gray, solid looking when fresh but weathering into separate beds one, two, or three inches thick. Shaly partings are conspicuously absent from most of this rock. Fossil fragments, especially of cystids, are common, but whole specimens, except those of Rafinesquina and Sowerbyella, are rare. This, in earlier reports (e.g. Clark 1952) was considered to be a formation (Terrebonne Limestone) distinct from the Tétreauville but is now (Clark 1972) treated as a facies development within the Tétreauville, and the name

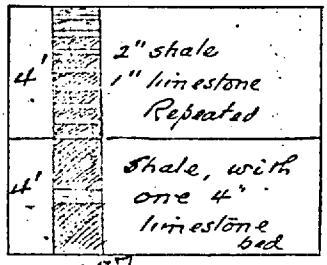


Figure 187 Detail of shale-rich section of Tétreauville formation, L'Assomption river, 1 mile below Joliette. See page 95.

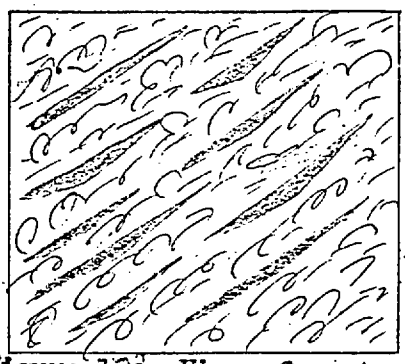


Figure 178 View of part of the bed of L'Assomption river to show the formation of longitudinal rapids by protruding edges of flow-wise strata. See page 595. Scale: approx. 100 feet

Terrebonne, if used at all, refers to the facies type of limestone within the Tétreauville.

Throughout the typical Tétreauville development no dip of less than 4° were recorder; the majority were 5°, and at the prominent bend just above the city dump an unusual value 14° occurs. On the basis of a 5° dip and a cross-strike width of outcrop of 5000 feet, the thickness would be 436 feet. A reasonable estimate of the drop in the surface of the river over this distance is 65 feet. Hence the adjusted thickness of the typical Tétreauville Formation from its base up to thin horizon might well be in the neighborhoed of 370 feet.

The "Terrebonne" facies continues as far as the southern limit of the map-area, a cross-strike distance of 3,000 feet. To this should be added another 2,300 feet displayed on the Verchères map-area, giving a total breadth of outcrop of 5,300 feet. The dip ranges from 5° at the upstream end to 2° and finally 1° for the rest of the Sorel area, and rises again to 2° for the balance of exposures in the Verchères map-are. An average of 2°, which seems to be approximately the regional dip, gives a thickness of 185 feet (105 feet within the Sorel area and 80 feet in the Verchères area. Thus within the Sorel area, the Tétreauville Formation reaches a thickness of 475 feet approximately, and its total thickness along L'Assomption river is probably of the order of 500 feet.

La Chaloupe river exposures.

Splendid but limited exposures of this formation can be seen on this river a mile and a half, more or less, above its junction with

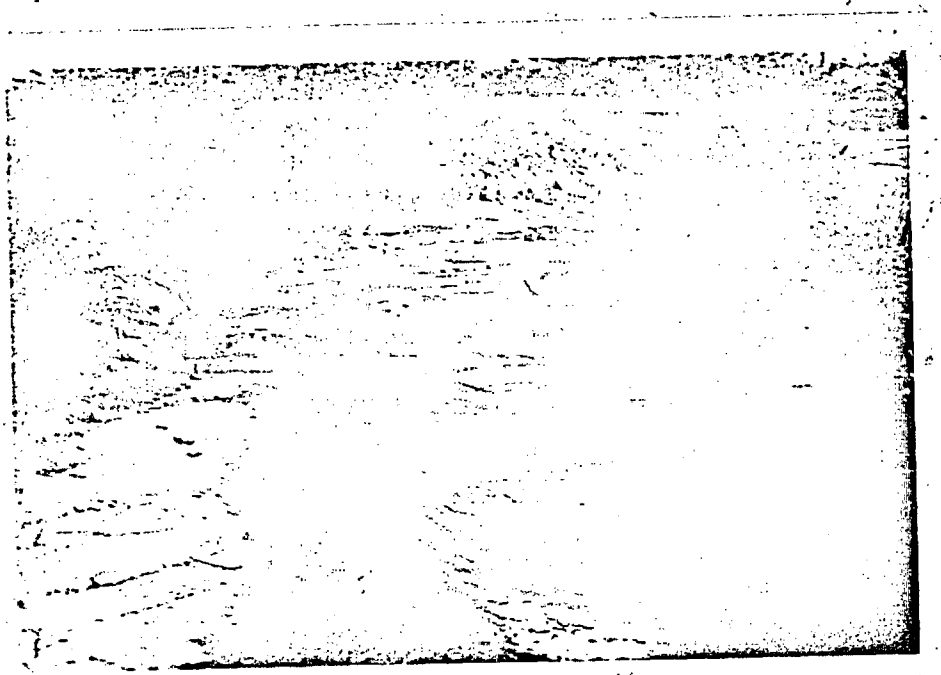
St.Thomas brook, both above and below Corriveau bridge (see plate XXIII). Though only 157 feet are exposed in the continuous section (see fig.24), discontinuous exposures to the northwest increase the breadth of outcrop so that a minimum thickness of 297 feet is indicated.

Here the limestone occurs in beds from 2" to 8" in thickness with shaly interbeds ranging from partings to beds 4" thick, though usually about ¼". The limestone breaks readily into sharpedged blocks where fresh, but where prolonged weathering has occurred a tendency towards knobbly weathering is apparent. Rafinesquina and Sowerbyella are common, Endoceras and Conularia are present throughout.

Bayonne river exposures.

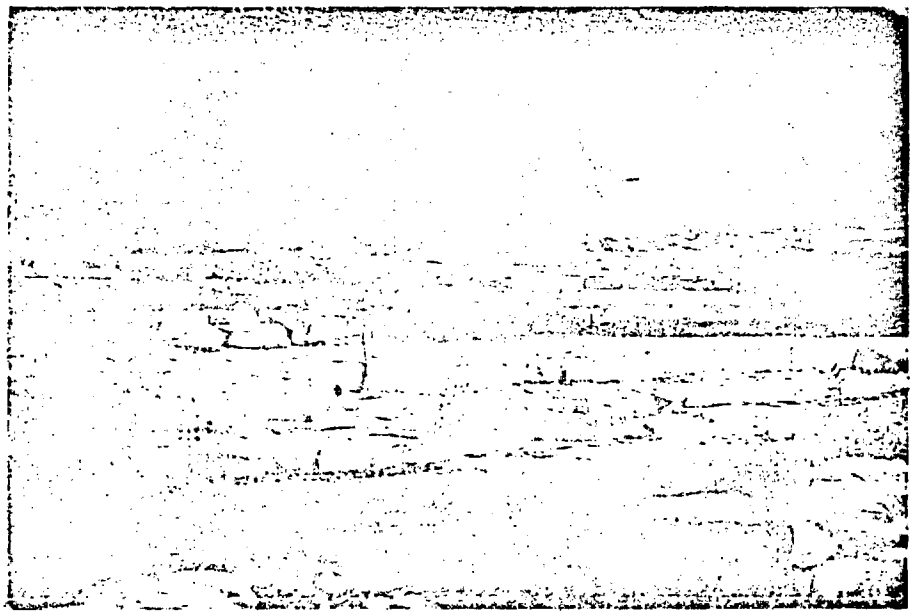
The section along Bayonne river consists of essentially the same kinds of rocks (see plates XXII, XXIV). In several localities the shale her bears Triarthrus, an uncommon but not unknown characteristic elsewhere. Because the Trenton section is limited upstream by the St.Cuthbert fault the dips are steep in that direction, so much so that for the highest 990 feet (riverwise) an average of 8° is fair figure. For the rest of the section, 5,300 feet (both, distances taken at right angles to the regional strike average 3½°). From these data the thicknesses can be calculated to be 130 and 142 feet respectively, a total of 272 feet. This section begins with the contact with the Montréal Formation (fig.23 plate XXXII) but no upper, stratigraphically, limit is known. Hence 272 feet is a minimum estimate.

Plate XXIII



Tétreauville Formation, La Chaloupe River, below Corriveau bridge.

Plate XXIV



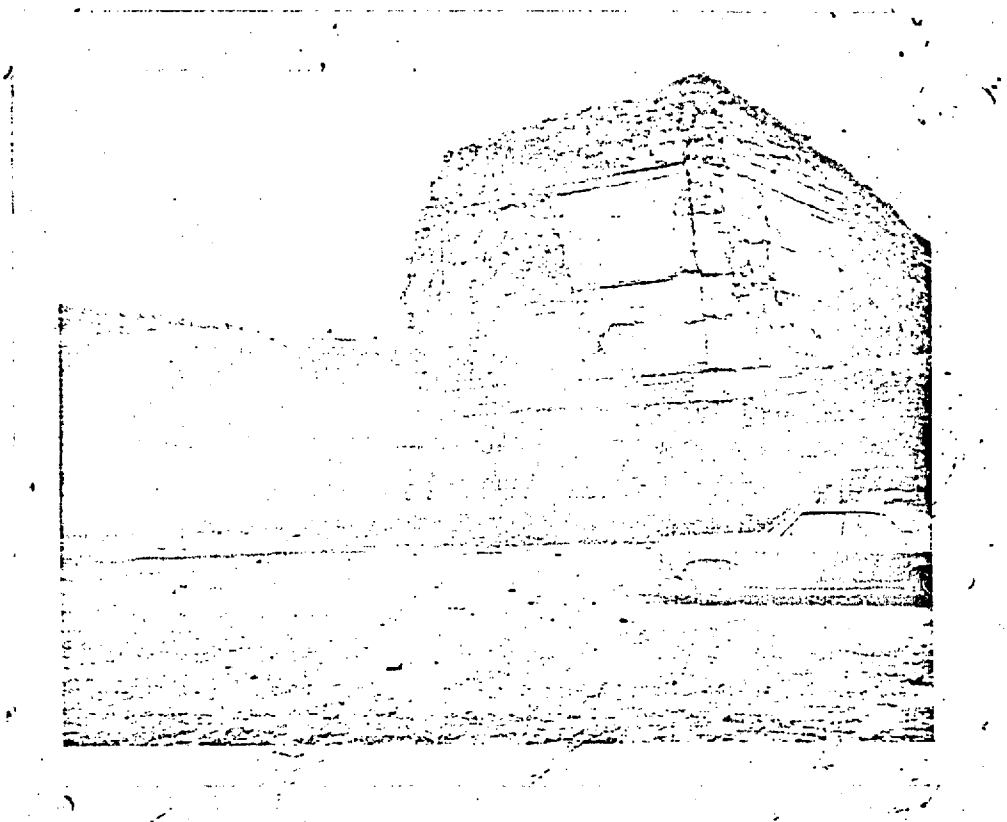
Tétreauville Formation, Bayonne river, a little less than 3/4 mile from the old Doucette's Dam. The limestone beds are a little thicker than in the rest of the section.

South of Bayonne River and of the road leading from Ste-Elisabeth to Berthierville, at about 1 mile from Ste-Elisabeth, there are two adjacent quarries: the Ste-Elisabeth quarry and the St-Barthélémy quarry (see plate XXV). The limestone exposed in these two quarries are dark colored in fresh surface, lithographic and in beds of 5" to 6" thick interbedded with shale in thin beds ½" to 1". The percentage of shale is however low. The bedding is very regular, and the total thicknesses of the exposed sections is 60 feet in the St-Elizabeth quarry and 87' in the St-Barthélémy. The limestone breaks easely along fractures planes or joints resulting in very smooth walls (see plate XXV). On some beds, numerous Sowerbyella sericea are present. Numerous crinoïdal stems are also observable and some Rafinesquina.

Bonaventure, Ste-Catherine and Chicot rivers exposures.

The sections along these streams are normal in all respects and add nothing to our knowledge of the characteristics of the thickness of the formation. Along Chicot river the total width of exposure is comparable to that along Bayonne river and the distribution of dip values is similar, though in both cases a lower figure obtains. Hence, a lesser thickness, perhaps 230 feet, is indicated here as a minimum figure. The outcrop-less gap of more than a mile between the extremities of the breadth of outcrop reduces the credibility of the determination considerably.

Plate XXV



Trenton Group, Tétreauville Formation

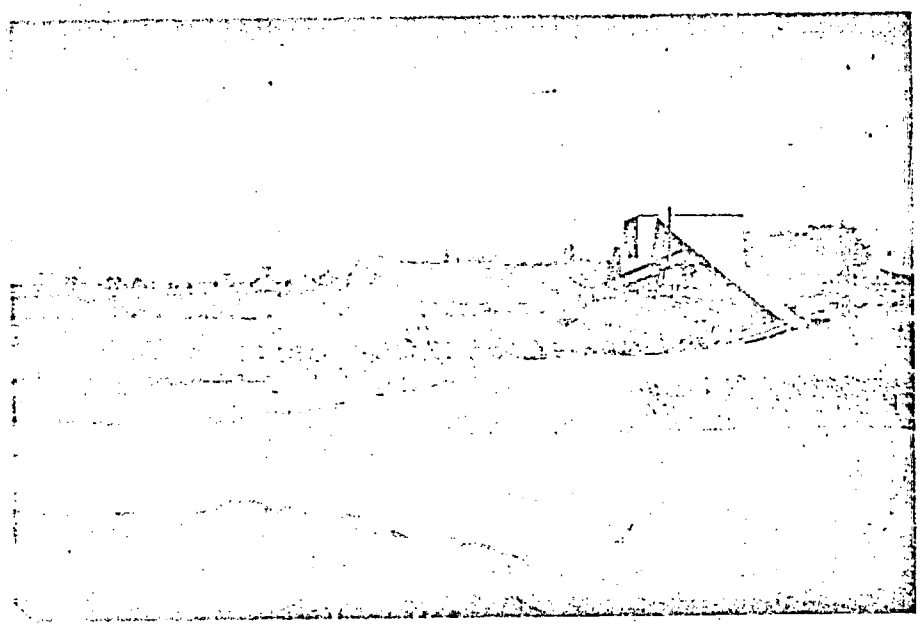
St-Barthélémy Quarry, 4 miles east of Ste-Elisabeth. The upper level seen above the car belongs to the Ste-Elisabeth Quarry and it extends westward from this eastern limit. Note fracture planes or joints resulting in very smooth walls.

St.Barthélémy

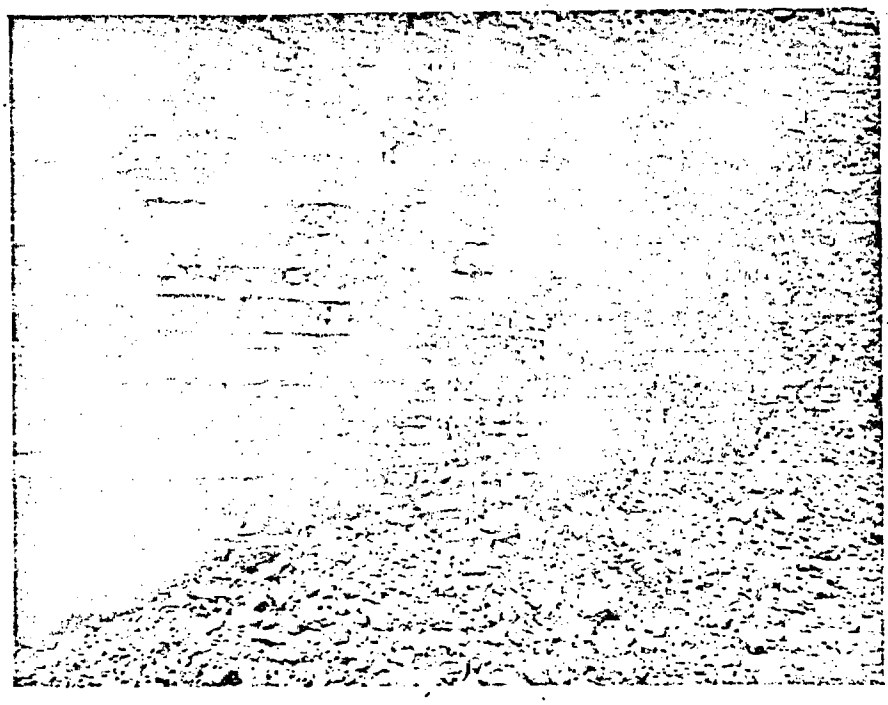
The greatest breadth of outcrop occurs in the vicinity of St-Barthélémy. There, Tétreauville limestone is extensively quarried at the St-Barthélémy quarry, (see plate XXVIA), in the village, and is well exposed along the creek which runs southeasterly from St-Barthélémy Station and parallel to the road through St-Barthélémy (see plate XXVII) on which exposures begin half a mile below the railroad, are well seen both above and below a secondary road, and continue for a mile or more downstream. The total width of outcrop here is 2½ miles. Throughout the stream dips of 1°, 1½°, and 2° are recorded. At the quarry 1° is a fairly accurate average, all dips being towards the southeast. On the basis of 1½° throughout the thickness would be 191 feet. Allowing for the lessened dip of the rocks of the quarry 180 feet seems a reasonable figure. Moreover, with so low a dip the topographic drop from the highest to the lowest levels of outcrop of at least 50 feet, should be subtracted from the calculated thickness. Hence, this wide section, initially promising, yields a thickness which cannot be estimated to be above 130 feet. Tétreauville limestone is also exposed below a small dam situated on a small creek, about 1 mile east of the St-Barthélémy Station (see plate XXVIII).

The section exposed in the St-Barthélémy quarry consists of argilaceous, dark grey colored, lithographic limestone, similar to the one exposed in the quarry at thé Ste-Elizabeth, 5 to 6" beds, very regular bedding (see plate XXVIB) except that in thi s quarry the percentage of shale is higher. The shale interbeds are thicker and more nimerous which would indicate and horizon higher in the Tétreauville Formation. The total thickness of the section is 40 feet. The following fossils were observed in this quarry: Conularia, Endoceras, Isotelus gigas and Rafinesquina.

Plate XXVI

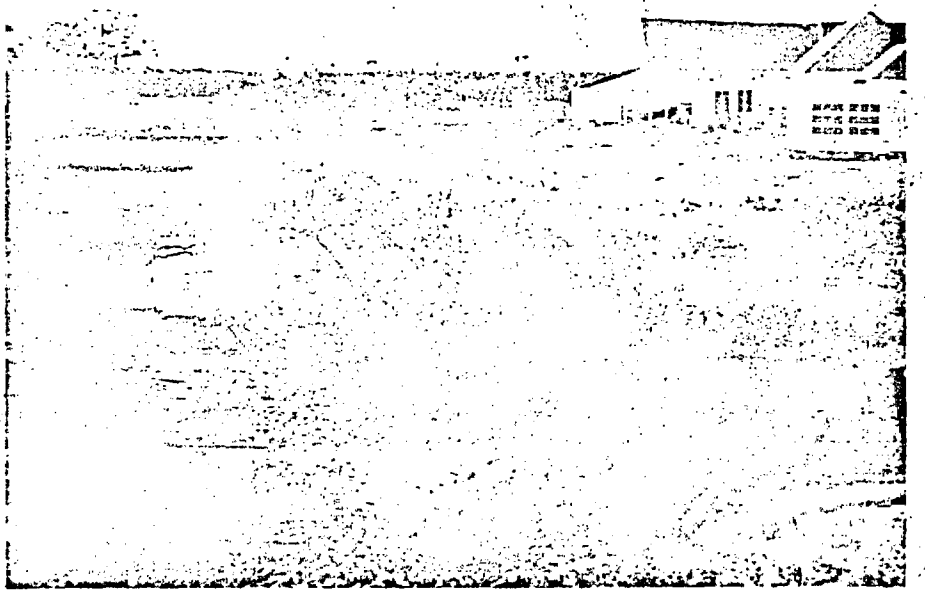


A. Tétreauville Formation, St-Barthélémy Quarry, at St-Barthélémy.



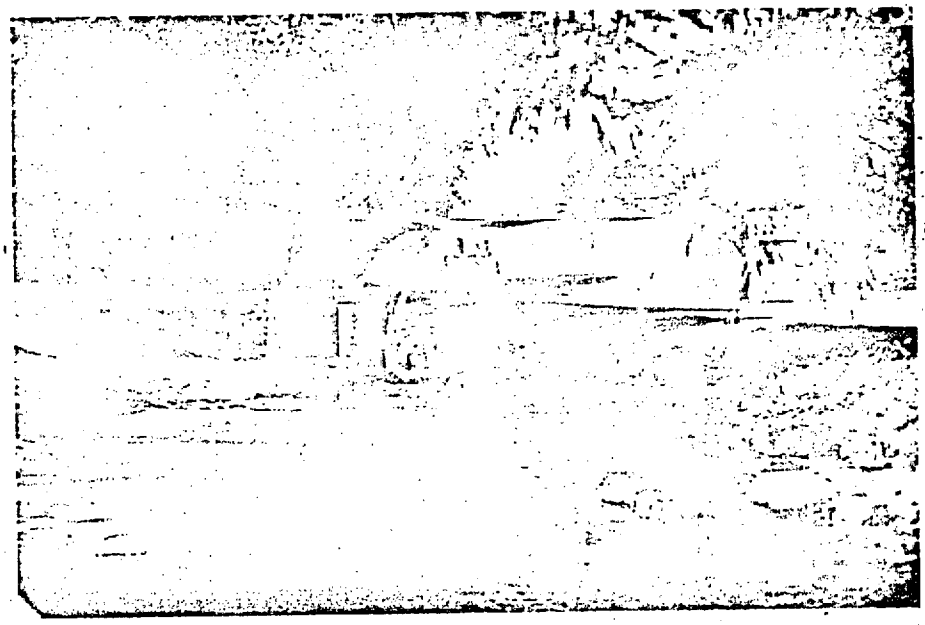
B. Close-up view of wall in A.

Plate XXVII



Tétreauville Formation, St.Barthélémy Station, small creek west of the road leading to St-Barthélémy.

Plate XXVIII



Tétreauville Formation. Creek about 1 mile east of St.Barthélémy Station, below the dam.

Thickness of the Tétreauville Formation.

The maximum estimated thickness comes from the section along L'Assomption river. All other estimates are of sections which are incomplete, and because none approaches the 485 feet estimated for the L'Assomption river section the latter may stand as the maximum observed within the Sorel area, with the reservation that the continuation of the section along L'Assomption river indicates a probable total thickness of about 550 feet.

Fossils and Correlation.

The fauna is extensive. From the list given below 28 forms not specifically allocated can be separated, and 56 definitely and specifically identified species occur. Thus, in all probability 79 different forms have been noted. In the list it is noted which species also occur in the other Trenton formations, Sowerbyella sericea is by all means the commonest and most widely distributed species. Cystid debris, Rafinesquina sp., Conularia trentonensis, Serpulites sp., and orthocone cephalopods are found in nearly every outcrop. Dalmanella rogata is rarely abundant and is in fact often absent. The great variation in abundance and species of Rafinesquina are also noteworthy. The list follows:

Table 15. Fossiles du Tétreauville / Tétreauville Fossils

ALGAE

Sponge spicule, network

Ditto, bundles. Prob. Rhombodictyon sp.

BRACHIOPODA

Conotreta rusti Walcott

Lingula briseis Billings

L. hastata Sinclair

L. divulgata Sinclair

L. placibilis Sinclair

L. sp.

Pseudolingula sp.

Cornwallia minuta Wilson

Trematis terminalis (Emmons)

T. ottawaensis Billings

Schizocrania filosa Hall

S. minuscula Wilson

Schizotreta canadensis Wilson

Orbiculoidea lamellosa d'Orbigny

Pholidops trentonensis (Hall)

Dalmanella rogata Sardeson

Soverbyella sericea (Sowerby)

S. subovalis Wilson

Leptaena diminuta Wilson

Platystrophia sp., cf. P. amoena McEwan

Clyptorthis insculpta (Hall)

Rafinesquina miodeltoidea Wilson

R. sp., cf. R. deltoidea (Conrad)

L. trentonensis Wilson

L. sp. nov., close to L. trentonensis

Rafinesquina sp.

R. alternata (Conrad)

R. carlottina Wilson

R. declivis (James) Foerste

R. miodeltoidea Wilson

R. semicircularis Wilson

R. s. minor Wilson

R. apicalis Wilson

R. camerata (Conrad)

R. deltoidea (Conrad)

R. deerensis Salmon

R. ?lennoxensis Salmon

R. normalis Wilson

R. prestonensis Salmon

R. ?trentonensis (Conrad) emend. Salmon

Strophomena sp.

Triplecia nuclea Hall

Parastrophia hemiplicata (Hall)

Zygospira deflecta (Hall)

Z. recurvirostris (Hall)

Glybtorthis insculpta (Hall)

Z. nicolleti (Winchell & Schuchert), or n.sp.

Cyclospira bisulcata (Emmons)

BRYOZOA

Corynotrypa delicatula (James)

Prasoporoid species

Branching species

Fenestelloid species

INCERTAE SEDIS

Serpulites sp.

Translucent rods

Conularia trentonensis Hall

Eoconularia amoena Sinclair

BIVALVIA

Several unidentified forms

GASTROPODA

Sinuites cancellatus (Hall)

Holopea nereis Billings

Hormotoma gracilis (Hall)

H. sp.

Helicotoma planulata Salter

Lophospira medialis Ulrich & Schofield

Straparollina sp.

CEPHALOPODA

Oncoceras sp.

Spyroceras sp.

Straight cephalopods

TRILOBITA

Basilicus sp., Young

Isotelus gigas DeKay

Lophospira sp.

Flexicalyrone senaria Conrad		
Ceraurus pleurexanthemus Green		
Triarthrus eatoni (Hall)		
T. becki Green		
OSTRACODA		
Bythocypris cylindrica (Hall)		
Ceratopsis chambersi (miller)		
Dicranella sp.		
Ulrichia binodosa		
Opikella ellipsa		Carter's List
Tallinella quebecensis		Carter's List
Bythocypris? extenuata		Carter's List
Briartina minuta	CC	Carter's List
Bythocypris? oualis	C	Carter's List
Schmidtella brevis vav. sulcata	C	Carter's List
Tetradella prostoloba	CC	Carter's List
Primitia binodosa	C	Carter's List
Krausella arcuata		Carter's List
CIRRIPEDIA		
Lepidocoleus jamesi Hall & Whitfield		
CYSTOIDEA		
Cheirocrinus logani (Billings)		
GRAPTOLITHINA		
Diplograptus sp.		
D. amplexicaulis Hall		
Climacograptus sp.		

Thickness of the Trenton Group.

As elaborated above, the estimated or measured thicknesses of the various parts of the Trenton Group within the Sorel area are as follows:

Tétreauville Formation	495
Montréal Formation	110
Deschambault Formation	92
Ouareau Formation	19
Total thickness	706 feet

This last total compares very favorably with the estimated thickness of 800 feet in the Montréal area (Clark, 1952, p.76) and with the figures 645 to 725 feet for the Assomption Experimental Farm Well (Belyea 1952, p.18). Further to the north the Trenton beds have an estimated thickness of 524 feet (Q.D.M.' unpub. rept. Grondines map-area and Portneuf) where the rocks, as in the Montréal, L'Assomption, and Sorel areas are all largely limestone. East of the St.Lawrence thicknesses of from 870 to 1,100 feet have been recorded (Belyea, 1952, p. 18). These eastern and greater thicknesses own their increase largely to the presence of excessive amounts of shale towards the top of the Trenton, whereas in the Sorel area, shale is restricted to the interbeds of the Tétreauville Formation. Evidently Sorel area was in Trenton times a locus of limestone deposition in a fairly clear sea, whereas further east, at least late in Trenton time, muddy waters prevailed.

STRUCTURE

The gross structure of the rocks exposed in the Sorel map-area is that of a sedimentary series, unconformably overlying a Precambrian basement exposed in the northwestern portion of the area, and inclined gently down towards the southeast, and actually forming part of the western limb of the Chambly-Fortierville syncline. The sedimentary rocks range in age from Potsdam (Uppermost Cambrian or Lowermost Ordovician) to Upper Trenton; the southeastern corner of the area is probably underlain by Utica shale and Lorraine shale and sandstones. No exposrues are known southeast of the Canadian Pacific railway line passing through Maskinongé or within approximately two miles of it on its northwest side. Thus, about 200 square miles in the southwestern corner of the map is without rock exposures.

Thickness of the Sedimentary Rocks

From surface observations and calculations. The dips of the upper beds of the Trenton Group exposed southeast of the St.Cuthbert fault range from 0° to 12°, omitting certain extreme dips adjacent to the fault. Grouping the outcrops with regard to their closeness to the fault bounding them from the Precambrian (St.Cuthbert fault), and this is, by inference, more of less their stratigraphic order, we get the following results.

	Close to fault	Medium position	Far from fault	Farthest
Range	1° to 10°	1^{0} to 4°	0° to 6°	1°
Average	$5\frac{1}{2}^{\circ}$	$2\frac{1}{2}^{\circ}$	$2\frac{1}{2}^{\circ}$	1°

This gradation is in harmony with the expected deformation consequent upon the downdropping of the block southeast of the St.Cuthbert fault, and also with the expected flattening of the dips towards the axis of the Chambly syncline.

Northwest of the St.Cuthbert fault there is a similar prevailing dip to the southeast, with, however, fairly uniform and lower dips. The Potsdam sandstone dips from 0° to 8°, but the higher and exceptional dips of 5°, 6°, and 8° recorded may well be due to irregularities in bedding characteristic of this rock. The Beekmantown dolomite, save for one exposure, dips pretty regularly from 1° to 2°. No reliable information is as yet at hand for the attitude of the Chazy and Black River rocks, though every indication favors the view that the Black River beds follow the Trenton in their attitude. Trenton beds, and this means Lower Trenton, save for the exposure of Upper Trenton along La Chaloupe river and for the exposure of Upper Trenton along La Chaloupe river and for a mile or two towards the northeast, dip from 0° to 12° towards the southeast, but the higher dips are close to the trace of the St.Cuthbert fault. A second group of somewhat higher dips is to be found west of the Ste.Elisabeth--St.Thomas road, in the vicinity of La Chaloupe river, and these are attributed to structural adjustment along the line of a minor fault in that place.

Thus, disregarding exceptionally high dips associated with fault or irregular bedding, dips of about 2° are standard over this whole area (but see page 116). A breadth of outcrop of 8½ miles can be measured from the Precambrian border north of Lourdes south-southwestward to the margin of the map near St.Thomas, at which place there is probably Utica shale. Assuming uniformity of structure, the thickness concerned can be calculated to be 1,566 feet. On the basis of 1½ miles of the total distance being occupied by Potsdam sandstone, 3 miles by Beekmantown, and the remaining 4 miles by Chazy, Black River and Trenton, the respective calculated thicknesses come out to be as follows:

Trenton, etc.	737 feet
Beekmantown	553 feet
Potsdam	276 feet
Total	1,566 feet

As has been recorded above the thicknesses of the Trenton (total), the Black River, and the Chazy formations have been estimated as 771 feet, 45 feet, and 30 feet respcetively, a total of 846 feet. Hence, on a strictly proportional basis the 737 feet of Trenton, etc., should be reapportioned as follows: Trenton, 672 feet; Black River, 39 feet; and Chazy, 26 feet. The revised tabulation, as calculated in this manner, becomes

Trenton	672 feet
Black River	39 feet
Chazy	26 feet
Beekmantown	553 feet
Potsdam	276 feet
Total	1566 feet

If, on the other hand, one considers the thickness of the Trenton, 771 feet, recorded as well as possible from field observations, to be reliable, one must entertain the possibility that the calculated total thickness of 1566 feet based upon a regional dip of 2^{o} may be erroneous. A revision of this latter total so as to include a revised thickness for the Beekmantown and for the Potsdam in harmony with the change of the Trenton from 672 feet to 771 feet gives figures htat are tabulated below.

Table 16.

Tabulation of estimated thicknesses of Paleozoic formations

A. Largely from observation	B. From calculations based on width of outcrop and dip of 2°	C. Colum B reculculated to thickness of 771 for Trenton
Trenton 771	672 feet	771 feet
Black River 45	39	45
Chazy 30	26	30
Beekmantown	553	634
Potsdam	276	317
Total	1,566 feet	1797 feet

Hence there is a spread of 215 feet between these two sets of measurements. It may well be that the maximum figure is nearly correct for the southwestern corner of the map, and the minimum for the northeastern corner, towards which the Beekmantown and Potsdam thin out and disappear before the St-Maurice River is reached.

From records of boreholes. Fortunately, there is within this area a deep well - Bald Mountain Berthiereville No. 1. Which began in the Lower Lorraine and bottomed in the Chazy. The log of this well is shown in Figure 19 the data for which are taken from Q.D.N.R. Publication S-75, page 8, 1964. The sequence of formations passed through and extrapolated from nearby wells is given below under Column D. All measurements are in feet.

Table 17. Tabulation of thicknesses from records of boreholes.

Bald Mountain Berthierville No.7		Column D thickness	Column E
Rock group	Depth in well		
Overburden	0 - 305		
Lower Lorraine	305 - 900	595	595
Utica	900 - 1390	490	490
Upper	1390 - 1660		
Tranton Middle	1660 - 1990	735	753
Lower	1990 - 2125		
Black River	2125 - 2195	70	57
Chazy	2195 - 2543	348+	348+
Beekmantown (Beauharnois (Theresa	Extrapolated	400 250 650	642
Potsdam			
		Total 3088+ 200+	3199+ 314

Comparing the above thicknesses with those in Column C on page 116 the closeness of the thicknesses of the Trenton and Bekmantown Groups is remarkable. As for the Chazy the thickness given on page116 is excessively low because most of the Chazy section is eliminated at the surface by the Joliette fault. In Joliette area its original thickness probably approximated that measured in Well No.8

In order to arrive at a compromise sequence of thicknesses to be used in calculating the amount of movement along local faults the figures for the Trenton, Black River, and Beekmantown in columns C and D are averaged. The Chazy is left at what is a minimum figure taken from Borehole No. 8, and the Potsdam remains at 314 feet. The final tabulation is given above in Column E. Figure 19. Diagram to show stratigraphic correlation between Holes 88, 80, 8, 12, 13,and 28, the positions of which are shown in the inset map. The line of holes lies approximately along the strike. Noteworthy is the general decrease in thickness toward the northeast. Inset logs show the thicknesses worked out on page 116 from surface indications, the controlling datum line being the base of the Black River.

Faults

St.Cuthbert Faults

Slicing across the map-area from northeast to southwest is the continuation of the fault which, in the Three Rivers map-area and in the Joliette map-area (northern half) bounds the Précambrian from the Paleozoic rocks. In the latter map-area it passes through the base of Ste-Ursule falls on Maskinongé river, and within the Sorel map-area it crosses Chicot river near St.Cuthbert (fig. 3), from which locality the fault takes its name. It is of first-class importance as a controlling

unit marking the northern boundary of the lowland Paleozoics, (see fig.20) and is comparable in influence, strike, and magnitude with the Neuville (Portneuf map-area), Deschambault (Portneuf map-area) and St.Prosper (Grondines and Three Rivers map-areas) faults, and emphasizes the structural pattern of the relationships between the Precambrian and Paleozoic rocks.

Evidence, Occurrence, and Displacement.

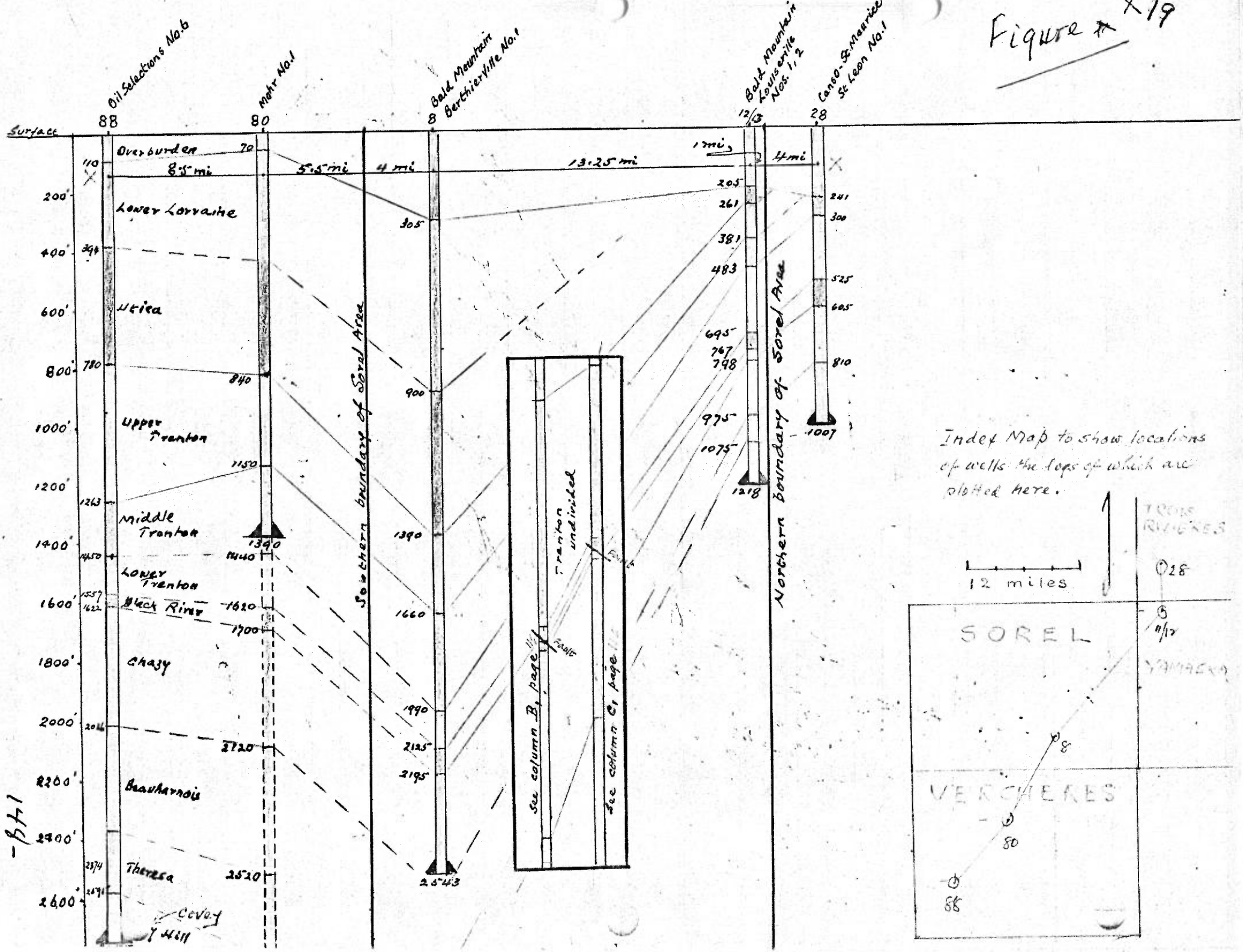
Bois Blanc

The fault enters the map-area at Bois Blanc, where, however, there is no direct evidence of its presence. The physiographic evidence -- an escarpment of Precambrian rocks, facing southeast with a lowland in that direction, is not entirely satisfactory, for it does not follow that the fault follows the trace of the escarpment. The latter is a feature as much dependent upon the filling of the lowland by post-glacial deposits as it is by differential resistance to erosion. However, it can be said that for 5 miles southwest of Bois Blanc the escarpment is very close to the Precambrian --Paleozoic contact.

Riv. Cachée and St-B-Station

A mile and a half southwest of Bois Blanc, the Canadian National Railway crosses a stream (R. Cachée) at the head of an artificial lake dammed by Lajoie's (Hamelin's of Logan, 1863, p. 150) mill. Upper Trenton limestone lies along the stream bed outcrops in the wooded hills one mile to the northwest. The fault must pass between these two locations, and it has been placed on the map just along the course of the railway track. Similar relationships occur near St.Barthélémy

Figure X19


Oil Selections No.6
88
Mohr No.1
80
Bald Mountain & Berthierville No.1
8
Bald Mountain Louiseville Nos. 1, 2
12/3
Canso-St. Maurice St. Leon No.1
28
Surface
Overburden
8.5 mi
5.5 mi
4 mi
13.25 mi
1 mi
4 mi
Lower Lorraine
Utica
Upper Trenton
Middle Trenton
Lower Trenton
Black River
Chazy
Beauharnois
Theresa
Covey Hill
Trenton undivided
See column B, page
See column C, page
Southern boundary of Sorel Area
Northern boundary of Sorel Area
-841
Index Map to show locations of wells the logs of which are plotted here.
12 miles
TROIS RIVIÈRES
SOREL
VERCHÈRES
YAMASKA

Note to draughtsman Figure X-0

Space log columns apart by the distance given on line X-X

Either record these distances, or give a horizontal scale (presumably 6 mils to an inch).

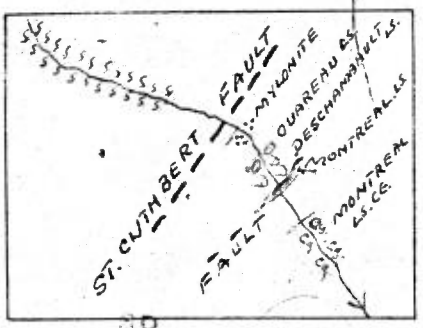


Figure 16. Exposures along stream near St. Barthelemi station. See page 55, 64.
Scale: / 40 feet /

LEGEND FOR THIS PAGE

- Deschambault ls.
- ~~Pétrolia ville ls.~~
- Ouareau ls.
- Montréal ls.
- Precambrian gneiss

station. However, upstream along the two creeks which cross the railway 500 feet and 1300 feet southwest of the highway adjacent to the station the exposures are as shown in figure 20. Along the stream nearer to St.Barthélemy Station, the fault can be located within a distance of 28 feet along one of the creeks. A brief description of the exposures alont this stream is in order. South of the obviously Precambrian gneiss there is a gap of 20 feet, following which there is a breadth of about 3 feet where there is exposed what appears to be a coarse sandstone. However, in this section this rock turns out to be crushed or mylonitized quartz-rich gneiss. Then downstream there follows a further gap of 5 feet, after which 40 feet of Trenton limestone are well shown along the stream bed. Though there is some lack of uniformity, the bulk of this rock strikes at 5° and dips 15° east. The first 8 feet of limestone is typically Deschambault, the reamainder after a gap of about 2 feet consists of limestones belonging to the Montréal Formation. Hence at least two faults occur here, one, the main trace of the St.Cuthbert fault separating Precambrian and Deschambault, and a secondary fault separating Deschambault from Montréal limestone.

A minimum figure for the displacement along the fault at this place can be arrived at as follows. All of the Potsdam, Beekmantown, Chazy, Black River, and, looking at the occurence as a whole, all of the Deschambault have been eliminated. A part of the Montréal Formation is missing, and there is no way of telling how much of the Precambrian is involved. The displacement according to column E, page 117, is as follows:

Montréal formation	???
Deschambault	92 feet
Black River	57
Chazy	348
Beekmantown	642
Potsdam	314
Precambrian	???
Total	1453 feet

Along the second stream Deschambault limestone and Precambrian rocks occur with a gap of 500 feet between them. No details of the structure of the sedimentary rocks close to the fault are known.

Chicot River

For a couple of miles to the southwest the course of the fault can be plotted by segregating the exposures of Precambrian rocks on the one hand from those of Trenton limestone on the other. There is nothing here concerning the position of the escarpment which is not in harmony with such a method of locating the fault. Thence, there are no close controls until Chicot river is reached, where, beginning at a point 2000 feet upstream from the highway bridge at St.Cuthbert, Potsdam sandstone occurs for 600 feet along the stream bed. Though coarse cross-bedding is abundant, the stratification of these beds shows a dip downstream of from 1° to 10°. At the lower end of this exposure the sandstone exhibits a fault, with relationships as shown in Figure 3. 450 feet downstream from this fault outcrops of Deschambault begin on the east (left) bank, little disturbed, though with an undulating structure. There is not room in the intervening 450 feet for the Beekmantown, Chazy, and Black River beds, and therefore one must postulate

a major fault somewhere in this gap with a downdrop on the southeast (see fig. 13). This, we take it, is the main trace of the St.Cuthbert. fault. The proximity of Precambrian outcrops to the Potsdam (within a mile west and northwest) sandstone, together with the assumption of a normal stratigraphic unconformity between the two formations, makes it certain that the fault crosses the belt of sandstone close to its presumed northern border, and hence there should be eliminated at least most of the Potsdam, if not nearly all of it. The complete displacement is indicated below:

Trenton	20± feet
Black River	57
Chazy	348
Beekmantown	642
Potsdam	200 ±
Total	1267 feet

Downstream, no exposures diagnostic of breaks occur until the dam just above the highway bridge is reached (see plate XXIX fig.21). There a fault, striking 10° and dipping 60° W, has resulted in a in a deplacement of uncertain but probably unsubstantial amount, possibility between 10 and 20 feet. Deschambault limestone continues downstream for 500 feet below the bridge. At the 528 foot mark below the bridge, Montréal limestones appear, and are cut by several minor faults, and ultimately, at station 892 (fig. 22), Tétreauville limestones are brought down to lie against those of the Montréal Formation. The minor faults are of little importance, and seem to cancel each other out insofar as total displacement is concerned. The last one, however may be of major import, for its minimum and maximum movements are 20

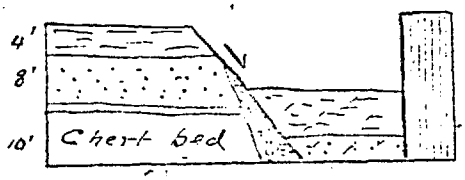


Figure 14. Section of Laschambault limestone exposed at Gaspie's dam, on Chicot river, St.Cuthbert. Looking S.W. across stream. See page 122. scale vertical, / 20 feet /

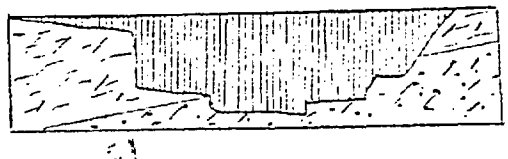
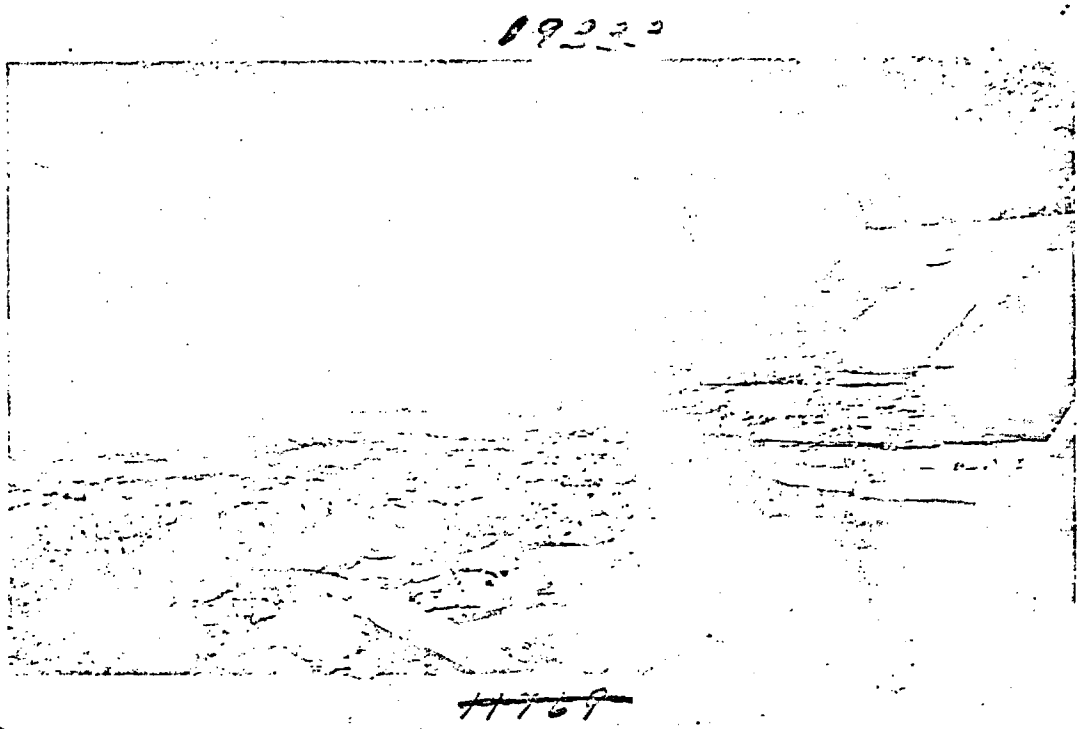


Figure 14a. Same location as Figure 14, but section taken parallel to dam and looking directly towards it. See page 122.

Dam structure

Plate XXIX



Savoie's Dam. St.Cuthbert. Fault in Deschambault limestone.

and 200 feet respectively. Hence, if these faults be considered to be parts of the St.Cuthbert fault, the total displacement along this zone is from 1287 to 1467 feet.

Bayonne River

No further trace of the St.Cuthbert fault occurs until Bayonne river is reached, 1000 feet fownstream from where the Berthier -- Joliette county line bridge crosses the river. A mile northeast of here there is a fifty foot high ridge whose steep eastern face lies along the presumed trace of the fault, but no exposures were found on this hill, which seems to be made up completely of morainal material. On Bayonne river the structural relationships are as follows; (fig. 23) at and for 1000 feet, more or less, below the bridge nearly horizontal Beekmantown dolomite occupies the bed of the river, ending in a vertical 9 foot escarpment at the dam. In contact with the dolomite, still more or less horizontal, and at the foot of the falls, is an irregular brecciated zone, the breccia being related closely to the joints in the dolomite. This zone, from 0 to 2 feet wide, is followed downstream by brecciated Deschambault limestone which persists for 15 feet along the shore of the river on the left bank, then after a gap of 100 feet more or less, Montréal shaly limestones show up in a ten foot cliff. The latter beds may well be in faulted contact with the Deschambault, but in any case they contain a first-class fault within themselves. Just beyond the reentrant in the shore line where they are well displayed they grade into the Tétreauville beds, and therefore can only belong to the uppermost part of the Montréal Formation.

Figure 17. Section of Middle and Upper Trenton beds along left bank of Chicot river below highway bridge at St. Cuthbert. See p. ~~63, 81~~ 90
Scale in feet along river bank.
[NOTE: This section is not drawn to scale]

LEGEND:

1	Montréal	ls
2	Tétreauville	ls

Plate XXX

19342

There faults in Middle Trenton, Montréal limestone. Left bank of Chicot River, below highway bridge at St.Cuthbert. (see also fig. 22).

The main trace of the St.Cuthbert fault passes along the base of the falls, (see plate XXXI) the other faults are of secondary importance. The order of magnitude of the displacement can be estimated thus. Because this exposure is very close to the top of the Beekmantown belt of outcrop the minimum drop is to be measured by the thicknesses of the Chazy and Black River formations. To this should be added a least a part of the Beekmantown, say, 50 feet. Because it is obvious that the Deschambault and most of the Montréal Formation are cut out by the secondary faults we must include the Deschambault and all but, say, 10 feet of the Montréal Formation. The tabulation then reads as follows:

Montréal	100 feet
Deschambault	92 feet
Black River	57
Chazy	348
Beekmantown	50
Total	647 feet

Joliette Ridge

Further southwest, the sudden termination of the Joliette ridge in an east-facing escarpment, 1500 feet west of the farm road running south from Bayonne river half a mile west of the county line, suggests stoppage by dislocation. The rocks of the ridge are almost all Deschambault limestone, except in the lower eastern part, where drilling by Shawinigan Chemicals Limited has shown the presence of Tétreauville Formation and its Terrebonne facies. Similar rocks occur along the stream which flows east and southeast towards La Chaloupe river. The displacement here could include a little Deschambault, all of the Montréal Formation (see pages 61,129) and ~~can~~ an uncertain amount of Tétreauville, say 200 feet ± . Hence the tabulation is as follows:

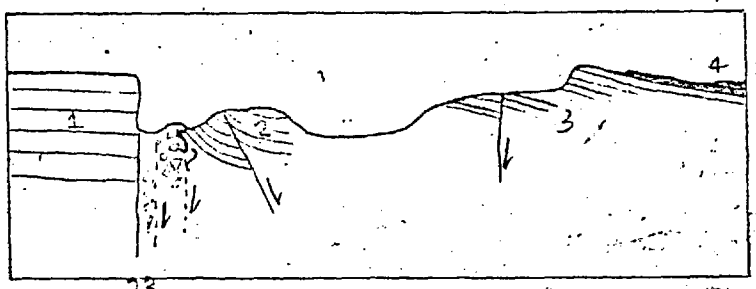
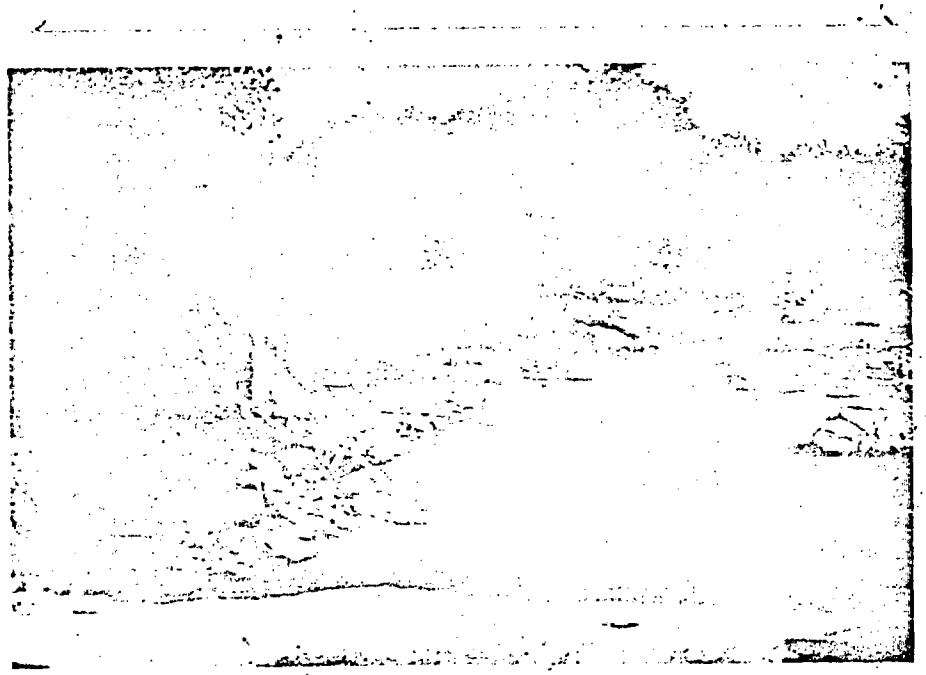


Figure ~~11~~ 23. Section along left bank of Bayonne river at and below Doucette's dam.
See pages ~~42~~, 24
Horizontal scale approx. / 100 feet /

LEGEND

- Upper Trenton ls.
- Middle Trenton ls.
- Deschambault
- Beekmantown dol.

Plate XXXI



St-Cuthbert fault passing close to the old Doucette's Dam on Bayonne River

- Beekmantown dolomite in foreground high dipping
- Deschambault limestone, immediately after
- In the covered area, Montréal ls, and in the background Tétreauville Formation forming a small cliff.

Tétreauville	200 feet±
Montréal	110 feet
Deschambault	20 feet ±
Total, possibly	330 feet

Beyond this last occurrence there is no distributional evidence for the presence of this fault.

At four localities some information is forthcoming concerning the nature of the faulting. At the St. Barthélémy locality there are at least three actual dislocations (see fig. 20). On Chicot river (see fig. 3) there is at least one subsidiary fault. Further southwest, on Bayonne river, four secondary faults accompany the main trace (see fig. 23). And lastly, along the eastern end of Joliette ridge the occurrence of both Tétreauville and Terrebonne limestones contiguous to the Deschambault shows that a complex pattern of faulting probably obtains here.

Hence, wherever information within one or two hundred feet of the main fault is forthcoming, the St. Cuthbert dislocation can be seen to be in reality a fault zone. Save for the Joliette ridge occurrence, about which little can be determined in detail, all downdrops are on the southeast sides of the faults.

The diminution in amount of displacement is progressive from northeast to southwest. The figures given above can be tabulated thus:

St. Barthélemy	1458 feet
Chicot river	1267
Bayonne river	647
Joliette ridge	330

Flexure on L'Assomption River

A mile and a quarter south-southeast of Pont des Dalles a prominent flexure crossing L'Assomption river, the axis of which runs at 30°. The dips above (riverwise) the flexure are the normal 5°dips; at the flexure itself the dip increases to 14°, and downstream falls off at once to 4°, all towards the southeast. However, this flexure does not seem to be related to any fault.

JOLIETTE FAULT

Within the city of Joliette and in the bed of L'Assomption river at highway Number 41-42 bridge, Chazy beds are succeeded downstream by strata of the Ouareau Formation so closely as to rule out the possibility of the intervention of the rest of the Black River formations -- the Leray, Lowville, and Pamelia. Hence a fault must be introduced here.

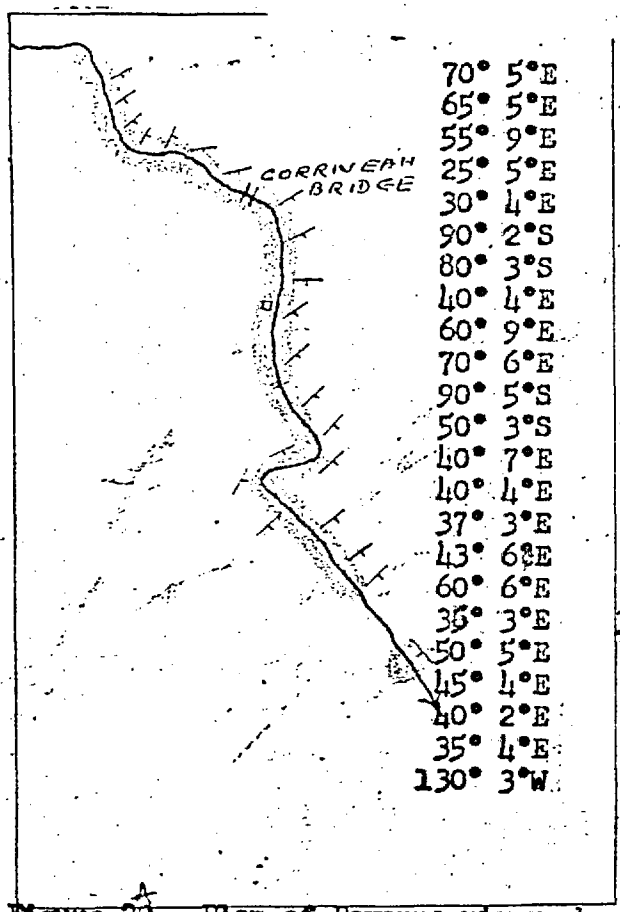


Figure 25. Plan of Bayonne river above and b below Corriveau bridge. The attitudes given at the right are in the same order as the symbols along the river. Page 67. 121

Scale: / 1,000 feet / approx.

Because it can be nowhere seen its attitude cannot be determined. The Chazy beds show many undulations, especially well seen on the left bank of the river, whereas the Ouareau beds seem to be quite undisturbed. This may be taken as evidence of the closer proximity of the fault to the Chazy outcrops than to those of the Black River beds; but tells nothing as to the direction of the fault. However, towards the northeast, along the margin of Joliette ridge, there is one spot (see Fig. 25) where Beekmantown dolomite and Lowville limestone are in faulted contact. The latter locality bears at 45° from the presumed position of the fault on L'Assomption river, a bearing lying between the two limits of 40° and 70° determined by the distribution. Because the downdrop in both cases is on the southeast side of the fault, there is really no good reason to oppose the continuation of the Joliette fault northeastwards to pass through this other locality save for the absence of intervening structural evidences. Its prolongation to meet, and in effect to be a westerly branch of, the St.Cuthbert fault is at present without justification. It may well be considered to be an en echelon continuation of the St.Cuthbert fault, which as already determined dies out as a fracture before reaching L'Assomption river.

MINOR FAULTS

Several minor faults occur here and there, probably of little structural significance. Of these the most easily seen cut the Deschambault limestone on the banks of L'Assomption river and in the quarries in Joliette. None, as far as known, effects a dislocation of more than five feet.

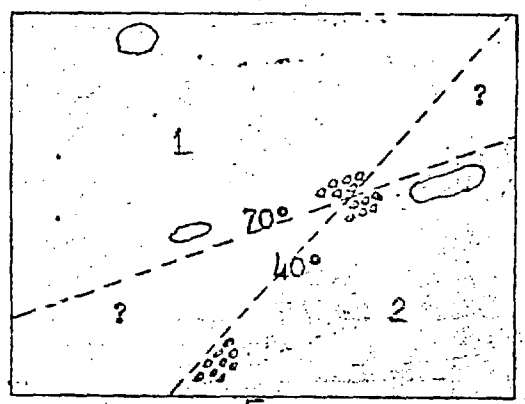


Figure 2. Map of exposures on northwestern margin of Joliette ridge, 1 3/4 miles N.E. of Joliette. See pages ~~25, 27~~, ~~28~~, 132
Scale: Apx. 100'

LEGEND

1. Beekmantown dol.
2. Ouareau ls.

ECONOMIC PRODUCTS

Except for the production of lime in the vicinity of Joliette by the Domtar Chemicals Ltd and the production of ciment by "Ciment Independant Inc", little of importance is being currently taken out of the rocks of this area. The Beekmantown dolomite was once quarried to provide stone for a local mill, the ruins of which now stand 4 miles, straight line, northwest of Joliette. Four miles east of Ste. Elisabeth it was quarried in the old Richard and Olivier quarries whence stone for several houses was taken. Recently two quarries have opened: the Ste-Elizabeth and the St.Barthélémy quarries on the same site. The Chazy sandstones have had no uses. The Black River limestones are intermittently quarry by Turnbull construction Co. on Rang II of "La Chaloupe". The Lower Trenton limestone (Deschambault Formation) has been dug into as a source of lime almost wherever it occurs. The rest of the Trenton limestones have been used for road material in the northeastern part of the area.

Lime, Ciment and Crushed Stones

Deschambault Limestone

In Joliette and vicinity there are several quarries active in providing limestone for lime and similar products derived from the Deschambault limestone. The largest of these are that of the Domtar Chemicals Ltd. quarry, two miles southwest of the city limits and Ciment Independant Ltd situated at about 1 mile northeast of the city which is operating partly in the Deschambault. A mile west of the city,

a small opening was, in 1951, operated by Mr. Majeau, a local contractor. Further northeast along Joliette ridge, dozens, one might as well say scores, of small openings, and a dozen fairsized quarries, almost all inactive or abandoned, attest the erstwhile attention paid to the Deschambault limestone because of its high calcium content. The accompanying figure shows the location of the chief openings (fig. 12 . Of these only the Lavallée quarry was active between 1951 and 1953, and only to an inconsiderable degree and in 1972 it is completely abandoned. Though the Deschambault limestone would almost everywhere produce excellent lime, it is probably uneconomical to compete with the products of the Domtar Chemicals Ltd. Before 1920, almost every range had its lime kiln, or several kilns, the remains of which can be seen along many of the roads and adjacent to many of the abandoned quarries.

It is said that the church at Ste.Elisabeth, which collapsed in 1950, was built in part of stone from the Gadoury quarry, an honour claimed equally by Pelland's quarry. An abundance of good workable stone is available locally.

At St.Cuthbert, where the Deschambault limestone is well exposed, three quarries were once engaged in producing stone of high clacium content. Their locations are shown on figure 22. None is now operating, though rumor (1951) had it that a lime kiln at St.Cuthbert was being readied to utilize stone from one or more of them. Nothing was done in this connection later.

A portion of the Joliette ridge northeast of the St. Thomas--Ste.Elizabeth road was owned in the past by Shawinigan Chemicals Limited, which company intended to open and to operate a high-calcium stone quarry there. The product would have been shipped to the carbide plant at Shawinigan Falls for conversion into calcium carbide, but this project was abandoned.

Upper Trenton Limestone

Two quarries, almost in the centre of the map-area, and one on the south side of Bayonne river, provide road material of excellent quality, mostly shipped to the Sorel area via the Berthier-Sorel ferry boat. An abandoned quarry 3 miles west of St.Barthélemy village, was operated half a century ago by the Canadian National Railways. The only quarry presently operating in this stone is situated in the village of St.Barthélemy, and is concerned solely with the production of crushed stone. The chemical analysis of this stone shows, it is said, that it would be a first-class source-rock for the manufacture of cement. See Appendix for further data.

Sand and Gravel

An abundance of sand occurs near the western margin of the map-area, some 5 to 6 miles north of Joliette. Some of the dozen or so pits are actively working today. We suppose that there must be enough sand here to supply all local needs for ~~thousands of years to come~~. Little gravel accompanies the sand, and what there is well washed, devoid of binding material, and hence not very well suited for use as road material. Almost the entire remainder of the lowland part of the map-area not showing rock outcrop is heavily underlain by clay, over which there may be

a venneer up to 5 feet or even 10 feet thick of sand.

NATURAL GAS AND PETROLEUM

Attemps so far made to find commercial quantities of natural gas and petroleum have been unsuccessful even if 39 wells were drilled in the area (see appendix II). However out of these 39 wells, only one, the Bald Mountain-Berthierville No. 1 (drilled 1957) has really penetrated the bedrock to a considerable degree, reaching a total depth of 2543'. All the other wells have a depth of less than 500 feet penetrating mainly the overburden.

None of the wells produced commercial amounts of gas or oil. However most of the wells, except well # 29, 97, 142, 222, 229, 233, 235, 248 and 249 have given gas. However, the gas was encountered in the overburden (mainly sand) except for the well Bald Mountain - Berthierville No. 1 mentioned above which has encountered gas in the Upper Trenton, in the Middle Trenton and in the Black River formations. However, as mentioned above, no commercial amount was found.

Most of the wells drilled for gas and oil, in the area, date back to the 1961 - 1965 period and since then, no more activities were recorded.

Plate XXXII

Sand Pit, about 1 mile west of Notre-Dame-de-Lourdes, operated by the Domtar Chemicals Ltd.

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APPENDIX - I

Quarries Chemical analysis

All the available chemical analysis of the quarries are included below.

St-Barthélémy Quarry 4 miles east of Ste-Elizabeth (1970).

70d-3315, 11-C-11-70-P

	%
SiO_2	8.72
Al_2O_3	2.39
Fe_2O_3	1.13
MgO	1.61
CaO	45.40
Na_2O	0.16
K_2O	0.67
P_2O_5	0.05
CO_2	37.20
S	0.23

Ste-Elizabeth Quarry 4 miles east of Ste-Elizabeth (1970)

70d-3309, 5-C5-70-P

	%
SiO_2	10.25
Al_2O_3	2.85
Fe_2O_3	1.31
MgO	1.38
CaO	43.50
Na_2O	0.17
K_2O	0.76
P_2O_5	0.01
CO_2	34.20
S	0.16

St-Barthelémy Quarry at St-Barthélémy

70d-3310, 6-C6-70-P

	%
SiO_2	10.98
Al_2O_3	2.94
Fe_2O_3	1.24
MgO	2.06
CaO	44.00
Na_2O	0.18
K_2O	0.76
P_2O_5	0.05
CO_2	24.28
S	0.15

Abandoned Lavallée Quarry

3 miles south of Ste-Elizabeth

SiO_2	:	0.93
Insol	:	-----
Al_2O_3	:	0.94
Fe_2O_3	:	0.49
$MgCO_3$	:	1.01
$Ca_3(PO_4)_2$	:	0.24
$CaCO_3$	:	95.89
Total	:	99.5
S	:	0.08

Analysis No. 835 Faessler R 6103 (1962)

Defond Quarry, Chicot River

St-Cuthbert (see fig. 22)

SiO_2	0.82
Insol	———
Al_2O_3	0.23
Fe_2O_3	0.22
$MgCO_3$	0.86
$Ca_3(PO_4)_2$	0.20
$CaCO_3$	98.25
Total	100.58
S	0.04

No. 812 Foessler R6103 1962

Arnaud and Beaudry Quarry, later owned by Petro Beaudry, east bank of L'Assomption river, below the Querbes Blvd bridge, Joliette. Faessler R6103 1962

No. 937: Upper 19 feet of strata

No. 938: Next 7 feet of strata

No. 939: Lowest beds

	937	938	939
SiO_2	———	———	———
Insol	0.80	2.00	2.00
Al_2O_3	.20	.60	0.15
Fe_2O_3	.30	.50	0.19
$MgCO_3$	1.17	1.21	1.04
$Ca_3(PO_4)_2$	———	———	———
$CaCO_3$	97.59	95.98	96.6
Total	100.06	100.29	99.98
S	———	———	———

Arnaud and Beaudry quarry later owned by Petro Beaudry east bank of L'Assomption river below the Québec Blvd. bridge, Joliette Foessler R 6103 1962

No. 940: Top 13 feet of strata

No. 941: Next 7 feet of cherty limestone.

(No chert included in the sample)

	940	941
SiO_2	0.52	1.90
Insol	-----	-----
Al_2O_3	.15	.78
Fe_2O_3	.27	.68
$MgCO_3$	.29	.92
$Ca_3(PO_4)_2$	.22	.22
$CaCO_3$	98.7	94.89
Total	100.15	99.39
S	.16	.07

No. 85 (Limestones of Canada, Part III Goudge, p. 77)

Upper 13 feet of medium grained limestone, used for lime.

SiO_2	:	0.52
Fe_2O_3	:	0.27
Al_2O_3	:	0.15
$Ca_3(PO_4)_2$	:	0.22
$CaCO_3$	:	98.7
$MgCO_3$	:	0.29
Total	:	100.15
S	:	0.16

No. 85A.

Following 7 feet of fine grained limestone (without chert).

SiO_2	:	1.90
Fe_2O_3	:	0.68
Al_2O_3	:	0.78
$Ca_3(PO_4)_2$	:	0.22
$CaCO_3$	:	94.89
$MgCO_3$	:	0.92
Total	:	99.39
S	:	.07

Clercs St-Viateur quarry later owned by Lépine.

No. 942 Raessler R6103 (1962)

SiO_2	:	1.44
Insol	:	-----
Al_2O_3	:	0.26
Fe_2O_3	:	0.25
$MgCO_3$	:	0.82
$Ca_3(PO_4)_2$	:	0.39
$CaCO_3$	:	96.5
Total	:	99.36
S	:	.05

Standard Lime Co. Ltd. Quarry now owned by Domtar Chemical Ltd.,

2 miles southwest of Joliette Faessler R6103 (1962)

No. 943: Upper 17 feet of Strata

No. 944: Lower 7 feet of Strata

No. 945: Top 55 feet of Strata in the part of the quarry nearly free from chert.

No. 946: Top 55 feet of Strata in the part of the quarry, where chert is plentiful. (No chert included in the sample)

No. 949: 12 feet of strata just above floor of quarry.

	943	944	945	946	947
SiO_2	-----	-----	1.50	2.00	-----
Insol	1.0	2.5	-----	-----	2.37
Al_2O_3	0.45	0.21	0.39	0.27	0.35
Fe_2O_3	0.15	0.25	0.28	0.53	0.16
$MgCO_3$	0.87	2.36	1.68	0.50	-----
$Ca_3(PO_4)_2$	-----	-----	-----	0.42	-----
$CaCO_3$	97.94	93.37	96.66	94.66	95.6
Total	100.41	98.69	100.73	98.38	100.6
S	-----	-----	.08	0.12	-----

No. 84B (Limestone of Canada, Part III, Goudge p.77) Medium and coarsed grained limestone use in the fabrication of lime.

SiO_2	0.64
Fe_2O_3	0,18
Al_2O_3	0.21
$Ca_3(PO_4)_2$	0.15
$CaCO_3$	98.05
$MgCO_3$	0.97
Total	100.2
S	.05

No 44 C (Limestone of Canada part III Goudge, p. 77)

Sample derived from fine grained limestone beds.

SiO_2	:	4.18
Fe_2O_3	:	0.38
Al_2O_3	:	1.02
$Ca_3(PO_4)_2$	:	.09
$CaCO_3$	:	91.66
$MgCO_3$	:	2.39
Total	:	99.72
S	:	0.12

APPENDIX - II

Summary of Logs of wells Bored in the Area.

(taken from Q.D.N.R. Publications S-75. The well nimbers used in this summary correspond to the numbers in Publication S-75 and accompagnying 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. 8

Company: Bald Mountain Oil Co.

Well Name: Bald Mountain-Berthierville No. 1

GM- 4972
GM - 12218
GM - 12219
GM - 12211
GM - 12209
GM - 12205
GM - 12197
GM - 12236
GM - 16506

Formation	Depth interval (in feet)
Overburden	0 - 305
Lower Lorraine	305 - 900
Utica	900 - 1390
Upper Trenton	1390 - 1660
Middle Trenton	1660 - 1990
Lower Trenton	1990 - 2125
Black River	2125 - 2195
Chazy	2195 - 2543

Well No. -2-

Company: Bald Mountain Oil Company

Well Name: Bald Mountain-New Miller No. 1 Berthierville

GM - 12235 12237
12234 12220

Formation	Depth interval (in feet)
Clay.....	0 - 294
Sand.....	294 - 307
Upper Trenton (Tétreauville).	307 - 311

Well No. 24

Company: Bald Mountain Oil Company

Well Name: Bald Mountain No. 1 Sorel

Formation	Depth interval (in feet)
Sand.....	0 - 10
Clay.....	10 - 188
Sand.....	188 - 190
Clay.....	190 - 194
Sand and gravel.....	194 - 195
Clay.....	195 - 200
Shale.....	200 - 220

Well No. 25

Company: Bald Mountain Oil Company

Well Name: Bald Mountain-New Miller No. 2 Sorel

22546

Formation	Depth interval (in feet)
Sand.....	0 - 85
Clay.....	85 - 192
Sand.....	192 - 194
Lorraine shale.	194 - 195

Well No. 26

Company: Bald Mountain Oil Company

Well Name: Bald Mountain-New Miller No. 3 Sorel

22549 22639

Formation	Depth interval (in feet)
Sand.....	0 - 70
Clay and sand.....	70 - 107
Clay.....	107 - 179
Gravel.....	179 - 180
Shale.....	180 - 183

Company: Bald Mountain Oil Company

Well Name: Bald Mountain-New Miller No. 4 Sorel

Formation	Depth interval (in feet)
Sand.....	0 - 89
Clay.....	89 - 206
Shale.....	206 - 209

Company: Bald Mountain Oil Company

Well Name: Bald Mountain-New No. 1 St. Ignace

Formation	Depth interval (in feet)
Sand.....	0 - 6
Clay.....	6 - 246
Clay and thin sand beds.....	246 - 265
Sand.....	265 - 266
Siltstone and Lorraine shale	266 - 272

Well No. 84

Company: New Miller Copper Mines Ltd

Well Name: New Miller Bald Mountain No. 5 Sorel

Formation	Depth interval (in feet)
Overburden	0'- 212'
Schiste argileux.....	212'- 215'

Company: New Miller Cooper Mines Limited

Well Name: New Miller-Bald Mountain No. 6 Sorel

Formation	Depth interval (in feet)
Sand.....	0 - 80
Clay and sand.....	80 - 226
Clay.....	226 - 235
Gravel.....	235 - 240
Shale.....	240

Company: New Miller Cooper Mines Limited

Well Name: New Miller-Bald Mountain No. 7 Sorel

Formation	Depth interval (in feet)
Sand...	0 - 28
Clay...	28 - 199
Sand...	199 - 200

Company: New Miller Cooper Mines Limited

Well Name: New Miller-Bald Mountain No. 8 Sorel

Formation	Depth interval (in feet)
Clay....	0 - 205
Gravel..	205 - 206
Shale...	206 -

Company: St.Maurice Exploration Co. Ltd.

Well Name: Canso-St.Maurice-Sorel No. 1

GM - 5273 22640

Formation	Depth interval (in feet)
Overburden (Silt)....	0 - 22
Overburden (Clay)....	22 - 204
Lorraine.....	204 - 230

- 213 -

Company: Verchères Ore-Oil Corporation

Well Name: Verchères No. 1 Madkinongé

GM 24264

Formation	Depth interval (in feet)
Clay.....	0 - 220
Sand fine to coarse.....	220 - 227
Bedrock (Utica-Lorraine)...	227 -

- 221 -

Company: Laduboro Oil LTd.

Well Name: Laduboro C.I.G. No. 1 Ste-Anne-de-Sorel

GM - 23796

Formation	Depth interval (in feet)
Clay & sandy clay.....	0 - 80
Blue clay.....	80 - 183
Boulders with sandy clay.....	183

Company: Laduboro Oil Ltd.

Well Name: Laduboro C.I.G. No 2 Ste-Anne-de-Sorel

GM 23805

Formation	Depth interval (in feet)
Sand, sandy clay.....	0 - 40
Blue clay.....	40 - 204
Bedrock.....	204

Company: Laduboro Oil Limited

Well Name: Laduboro C.I.G. No. 3 Ste-Anne-de-Sorel

Formation	Depth interval (in feet)
Clay and sand.....	0 - 178
Clay.....	178 - 178.3
Silty clay.....	178.3 -

Company: Laduboro Oil Limited

Well Name: Laduboro C.I.G. No. 4 Ste-Anne-de-Sorel

23805

Formation	Depth interval (in feet)
Clay and sand.....	0 - 60
Clay.....	60 - 179.5
Gravel.....	179.5 - 181
Bedrock (shale).....	181

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques No. 1

Formation	Depth interval (in feet)
Sand.....	0 - 30
Clay.....	30 - 144
Bedrock.....	144

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques No.2

Formation	Depth interval (in feet)
Sand.....	0 - 25
Interbedded clay & sand....	25

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques No. 2A

Formation	Depth interval (in feet)
No log see New Miller Bald Mountain, Ile-aux-Barques No. 3	

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques No. 3

Formation	Depth interval (in feet)
Sand.....	0 - 25
Sand & clay (with gravel at 43').	25 - 50
Grey clay.....	50

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques No. 5

Formation	Depth interval (in feet)
Sand.....	0 - 42
Clay.....	42 - 183
Bedrock.....	183

- 233 -

Company: Bald Mountain Oil, Co.

Well Name: New Miller Bald Mountain Ile-aux-Barques

Formation	Depth interval (in feet)
Interbed clay & sand.....	0 - 48
Grey clay.....	48 - 180
Black clay.....	180 - 193
Bedrock.....	193

- 234 -

Company: Bald Mountain Oil Ltd.

Well Name: New Miller Bald Mountain Ile-aux-Corbeaux No. 26

Formation	Depth interval (in feet)
Loose sand.....	0 - 28
Fine gravel.....	28 - 30
Loose sand.....	30 - 44
Grey clay.....	44 - 160
Black & grey clay.....	160

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Ours No. 54

Formation	Depth interval (in feet)
Loose sand.....	0 - 12
Grey clay.....	12 - 34
Sand & Grey clay.....	34 - 54
Sand & Grey clay.....	54 - 60
Grey clay.....	60 - 115
Sand & Grey clay.....	115 - 121
Grey clay.....	121 - 231
Bedrock.....	231

Company; Bald Mountain Oil Ltd.

Well Name: New Miller Bald Mountain Ile-aux-Ours No. 54A

Formation	Depth interval (in feet)
Loose sand.....	0 - 10
Grey clay.....	10 - 34
Sand & grey clay.....	34 - 54
Grey clay.....	54 - 103
Grey clay.....	103 - 115
Sand & grey clay.....	115 - 121
Grey clay.....	121

Company: Bald Mountain Oil Ltd.

Well Name: New Miller Bald Mountain Ile-aux-Ours No. 54B

GM - 12225

Formation	Depth interval (in feet)
Loose sand.....	0 - 10
Grey clay.....	10 - 34
Sand & grey clay...	34

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-aux-Ours No. 75

GM - 12233

Formation	Depth interval (in feet)
Loose sand.....	0 - 12
Grey clay.....	12 - 36
Sand clay.....	36 - 54
Sand with traces of clay...	54 - 192
Sand with traces of clay...	192 - 275

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile Cardin No. 67

Formation	Depth interval (in feet)
Clay.....	0 - 15
Sand.....	15 - 16
Clay.....	16 - 44
Very hard clay.....	44 - 45
Clay.....	45 - 62
Gravel.....	62 - 63
Clay.....	63 - 238
Bedrock.....	238

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No. 23

Formation	Depth interval (in feet)
Gravel & Clay interbeds.....	0 - 20
Grey clay.....	20 - 31
Finely interbedded sand & grey clay	31 - 39
Grey clay.....	39 - 120
Hard gray clay.....	120 - 191
Thin gravel beds at 176-187' bedrock	191

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No. 30

Formation	Depth interval (in feet)
Sand.....	0 - 12
Grey clay.....	12 - 27
Sand & grey clay.....	27 - 85
ey clay & gravel...	85 - 110
Grey clay.....	110 - 185
Black clay.....	185 - 214
Bedrock.....	214

Company: Bald Mountain Oil Co.

ell Name: New Miller Bald Mountain Ile-de-Grâce No. 33

Formation	Depth interval (in feet)
No log	0 - 108

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No 33 A.

Formation	Depth interval (in feet)
Sand & clay.....	0 - 46
Gravel.....	46 - 47
Clay (6" gravel at 55').....	47 - 55
Soft grey clay.....	55

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No. 33B

Formation	Depth interval (in feet)
Sand & clay with lenses of gravel at 13', 25', 36', 43', 48'.....	0 - 48
Soft grey clay with thin sand interbeds.....	48 - 93
Shoulder.....	93

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No. 33-2A

Formation	Depth interval (in feet)
sand.....	0 - 13
grey clay.....	13 - 29
Interbedded sand clay...	29 - 48
Interbedded clay & sand.	48 - 108
Bedrock.....	108 -

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile-de-Grâce No. 33-"B

Formation	Depth interval (in feet)
Sand & clay with lenses of gravel	0 - 48
Soft grey clay with thin sand interveds gravel at 55'.....	48 - 108
Grey clay.....	108 - 196
Black clay.....	196 - 216
Bedrock.....	216

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile Ducharme No. 82

GM 12227

Formation	Depth interval (in feet)
Grey clay.....	0 - 30
Sand & grey clay.....	30 - 50
Grey clay.....	50 - 60
Sand & grey clay.....	60 - 63
Grey clay & sand.....	63 - 161
Sand loose coning.....	161 - 252
Bedrock.....	252 -

Company: Bald Mountain Co.

Well Name: New Miller Bald Mountain Ile-La-Pierre No. 13

Formation	Depth interval (in feet)
Sand.....	0 - 12
Grey clay.....	12 - 34
Interbedded sand & clay Boulders at 21' 33' 38' 43'.....	34 - 50
Clay with thin sand lesnes.....	50 - 100
Grey clay.....	100 - 203
Bedrock.....	203

Company: Bald Mountain Oil Co.

Well Name: New Miller Bald Mountain Ile Madame No. 62

12223

Formation	Depth interval (in feet)
Loose sand.....	0 - 12
Grey clay.....	12 - 38
Sand and clay.....	38 - 96
Grey clay.....	96 - 222
Bedrock.....	222

TERRAIN
PROPERTY .....

CANTON
TOWNSHIP .....

TROU No
HOLE No. .....

EN-22-227

MINISTÈRE DES RICHESSES NATURELLES - QUÉBEC - DEPARTMENT OF NATURAL RESOURCES

JOURNAL DE SONDAGES AU DIAMANT - DIAMOND DRILL RECORD

FEUILLE No
SHEET No. .....

CLAIM No. ..... *LOT No.* ..... RANG *RANGE* ..... # 2629

SECTION .....

COORDONNÉES ORIFICE
CO ORDINATES COLLAR

LAT. ..... *DEP.* .....

ÉLÉVATION ORIFICE
ELEVATION COLLAR .....

ORIENTATION
BEARING .....

ANGLE
DIP .....

LONGUEUR TOTALE 232'
TOTAL LENGTH .....

COMMENCÉ LE
DATE BEGUN .....

TERMINÉ LE
DATE TERMINATED .....

JOURNAL PAR
LOGGED BY .....

CAROTTE *CORE FOOTAGE* DE *FROM*	CAROTTE *CORE FOOTAGE* À *TO*	DESCRIPTION
0	227'	Mort-terrain.
227'	232'	Schiste argileux gréseux et surtout silteux, interstratifié avec des petits lits de grès à grains moyens de couleur gris pâle. Petits lits de 1" gréseux, très fossilifères surtout brachiopodes. Groupe de Lorraine.

ÉCHANTILLON — *SAMPLE* No.	DE *FROM*	À *TO*	LONGR. *LENGTH*	ANALYSE — *ASSAY*			

PROPERTY Comté Chicoutimi Sorel et Tracy

CANTON
TOWNSHIP

TROU No
HOLE No. 12

ΦRN-M-227

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CLAIM No. LOT No. RANG
RANGE

La Cie Nationale de forage et de sondage Inc.
Contrat # 2629

FEUILLE No
SHEET No.

SECTION

COORDONNÉES ORIFICE
CO-ORDINATES COLLAR

LAT. DEP.

ÉLÉVATION ORIFICE
ELEVATION COLLAR

ORIENTATION
BEARING

ANGLE
DIP

LONGUEUR TOTALE 229'
TOTAL LENGTH

COMMENCÉ LE
DATE BEGUN

TERMINÉ LE
DATE TERMINATED

JOURNAL PAR Yvon Globensky
LOGGED BY

204-

CAROTTE CORE FOOTAGE DE FROM	CAROTTE CORE FOOTAGE À TO	DESCRIPTION	ÉCHANTILLON — SAMPLE No.	DE FROM	À TO	LONGR. LENGTH	ANALYSE — ASSAY			
0	219'	Mort-terrain.								
219'	229'	Lits de schiste argileux gréseux gris médium interstratifiés avec lits de grès à grains fins de couleur gris pâle, en lits de ½" à 1" d'épaisseur. Groupe de Lorraine.								

19.1.3

TERRAIN
PROPERTY .....

CANTON
TOWNSHIP .....

TROU No
HOLE No. .....

ΦRN-M-227

MINISTÈRE DES RICHESSES NATURELLES - QUÉBEC - DEPARTMENT OF NATURAL RESOURCES

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FEUILLE No
SHEET No. .....

CLAIM No. ..... *LOT No.* ..... RANG *RANGE* .....

2629

SECTION .....

COORDONNÉES ORIFICE
CO-ORDINATES COLLAR

LAT. ..... *DEP.* .....

ÉLÉVATION ORIFICE
ELEVATION COLLAR .....

ORIENTATION
BEARING .....

ANGLE
DIP .....

LONGUEUR TOTALE 235'
TOTAL LENGTH .....

COMMENCÉ LE
DATE BEGUN .....

TERMINÉ LE
DATE TERMINATED .....

JOURNAL PAR
LOGGED BY .....

2351

CAROTTE *CORE FOOTAGE* DE *FROM*	CAROTTE *CORE FOOTAGE* À *TO*	DESCRIPTION	ÉCHANTILLON — *SAMPLE* No.	DE *FROM*	À *TO*	LONGR. *LENGTH*	ANALYSE — *ASSAY*			
0'	225'	Mort-terrain.								
225'	235'	Schiste argileux gris médium avec petits lits de grès de ¼ à 1" d'épaisseur, gris pâle à grains fins interstratifiés. Groupe de Lorraine.								