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HONORAT - REBOUL AREA, BONAVENTURE COUNTIES

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GEOLOGICAL EXPLORATION SERVICE

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GEOLOGICAL REPORT 107

HONORAT-REBOUL AREA

BONAVENTURE COUNTY

by

W. B. SKIDMORE

QUEBEC

1965

G.R. 107

E R R A T A

At pages 2, 6, 13, 21, 23, 24, 25, 26 the dates 1963 and 1964 should read 1965.

P. 1 - para 3, line 14 - should read "...of the Ordovician rocks may also have been deformed..."

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HONORAT-REBOUL AREA*

BONAVENTURE COUNTY

by

W.B. Skidmore

INTRODUCTION

General Statement

The Honorat-Reboul area was geologically mapped by the writer in the summer of 1957. It completes the mapping, by the Quebec Department of Natural Resources, of a north-south section across eastern Gaspé peninsula (McGerrigle, 1950, 1959; Badgley, 1956; Skidmore, 1963).

The map-area is in the southeastern part of the peninsula, in the Bonaventure River drainage system. Its surface is moderately rugged, with a total relief of 2,000 feet.

The consolidated rocks are predominantly sedimentary and volcanic, and mostly of Ordovician and Silurian age. A very small part of the area is underlain by Devonian rocks. Two Ordovician sedimentary units, the Honorat and Matapedia groups, occupy the central part of the area. They are overlain on the north and south sides by the Mount Alexander and Chaleurs Bay groups respectively, both of Silurian age. The Chaleurs Bay group is divided into six formations, at least five of which, all sedimentary, are present in the area. The Mount Alexander group contains a thick series of volcanic rocks. On its north side it lies in fault contact with the Devonian Grande Grève and York River formations. Small basic intrusions are fairly common in the Ordovician rocks, and in the Mount Alexander group. All the rocks were folded and faulted during the Acadian orogeny of Devonian time. Some, or all, of the Ordovician rocks were also deformed by the Ordovician Taconic orogeny.

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*Corresponds to the Honorat 22 A/6 West Half sheet of the National Topographic Series.

Location

The area is bounded by longitudes 65°15' and 65°30', and by latitudes 48°30' and 48°15', and covers nearly 200 square miles. It lies in northeastern Bonaventure county, some 50 miles west of Percé, and 20 to 35 miles north of New Carlisle on Chaleurs bay. It includes large parts of Reboul, Guéguen, Garin, and Honorat townships, together with small parts of Robidoux and Weir.

Previous Work

McGerrigle (1942) made a reconnaissance geological survey of Bonaventure river. The adjoining area to the south of the present area was mapped by Badgley (1956), and that to the north by the writer (Skidmore, 1963). A preliminary version of the present report was published in 1958.

The work of Jones (1938) in the nearby Mount Alexander area and that of Northrop (1939) and of Alcock (1935) in the Chaleurs Bay region to the south are also particularly relevant.

Field Work

Aerial photographs with a scale of about 3,000 feet to the inch and a topographic map with a scale of 1/2 mile to the inch and contour interval of 50 feet were obtained from the Surveys and Mapping branch of the Department of Mines and Technical Surveys, Ottawa.

All the major streams, and most smaller ones, were traversed by pacing, controlled by frequent references to aerial photographs. Interstream areas were traversed by pace and compass, at 1/2-mile intervals for the most part.

The best, and most plentiful, outcrops are found along the streams and their steep valley walls. Elsewhere they are uncommon. Between the streams, close attention was given to debris, most of which is approximately in place. However, erratics do occur and caution is necessary.

Traversing was shared by the writer with Jean Lajoie, undergraduate at the University of Montreal, and J.G.E. Provençal, undergraduate at the University of Sherbrooke. During October the writer was assisted in the completion of the area by P.T. Moyer, a staff member of the Department of Mines. Other assistants were W.F.P.

Castle of McGill University, Clément Desrochers of Université Laval, Paul Desbiens, Omer Roussy and Armand Roussy of Bonaventure, and Mitchell Harrison of Grand Cascapedia. The party's cook was Gilles Caron of Cap-Saint-Ignace Station.

Acknowledgments

The writer is indebted to Monsieur Poirier of the Syndicat de St-Elzéar for his permission to use the Syndicat's spacious lumber camps on Duval river. Also to Mr. John Campbell of Grand Cascapedia for his assistance and advice on many occasions during the field season.

The fossils were kindly identified by Dr. L.M. Cumming of the Geological Survey of Canada, and Professor A.J. Boucot of, at that time, Massachusetts Institute of Technology. Boucot has also advised on questions of Silurian and Devonian paleontologic correlation.

DESCRIPTION OF THE AREA

Topography and Drainage

Bonaventure river flows through the area close to its western boundary, southwards to Chaleurs bay. Most of the area drains into this river through two west-flowing tributaries, Reboul river and Garin brook. The southern fringe of the area is drained southward by Duval river and Hall river, which also empty into the Bonaventure.

The area, in common with almost all of Gaspé peninsula, is a dissected upland. The upland surface lies mostly between 1,000 feet and 1,800 feet above sea-level, though some hills rise as high as 2,300 feet. The topography of this surface has a general northeasterly trend, paralled to the geological structure, and the ranges of higher hills correspond with bands of resistant rock. The larger streams are sharply incised below the upland, with very steep valley walls reaching heights of as much as 900 feet. The lowest point in the area, on Bonaventure river, is only 300 feet above the sea.

Considered in more detail, the area falls naturally into four topographic subdivisions. The first is the Mount Alexander range, which crosses the northwest corner of the area. It is underlain by volcanic rocks, and includes the highest ground. On its southeast side it falls away sharply to a broad area of moderate elevation 6 to 8 miles across from north to south and underlain mainly by soft limestones. The upland surface is here a remarkably even local peneplain rising

gently from about 1,100 feet on the west, close to Bonaventure river, to 1,500 feet at the east edge of the area. The surface is, however, deeply trenched by the valleys of Reboul river and its tributaries.

To the south of this is a zone, about 5 miles wide, of more irregular topography, underlain by rocks of varied character and complex structure. In this zone, the upland surface ranges between 1,000 and 2,200 feet above sea-level, and there is again a general descent westward towards the river. Deep trenches are cut into the surface, principally by Garin brook and its tributaries.

The south margin of the area is underlain by bedded rocks of fairly simple folded structure, and this structure is clearly shown in regular lines of hills, rising to 2,000 feet, with intervening straight valleys. A trellis pattern of drainage is particularly well developed here, although it is apparent throughout the area. This pattern has been imposed by northeasterly to easterly bedding and northwesterly to northerly joints.

Lakes are few and none are more than 1,500 feet across. With the exception of the Duval lakes they are found near the heads of small brooks on, or a little below, the upland surface, rather than in the main valleys. Along the main valleys are narrow flood plains, up to about 2,000 feet wide. The streams flow over rocky beds, and carry loads of very coarse detritus.

The topography is typically fluvial, and shows practically no evidence of glaciation. The only apparent exception is the valley of Duval river which, with its straight course, steep walls, and flat, lake-filled floor, has very much the appearance of a glaciated valley.

New Geographic Names

New names proposed by the writer are:

1. Chagrin lake, for the relatively large lake in the southwest corner of the area.
2. Duval-Est brook, for the west-flowing brook which joins Duval river a mile from the south edge of the area.

Vegetation and Resources

The area was originally covered by coniferous forest, but the greater part of it was burned in 1924. The new tree-cover

consists mainly of birch, poplar, pin-cherry, and mountain ash, with less common spruce and balsam fir. In most places the trees are not more than 25 feet high. They are fairly openly spaced on the flatter ground, but are very dense on some of the steeper slopes.

Extensive spruce-fir forest remains only in the southwestern part of the area, that is, in about the southwest half of Garin township and the south quarter of Reboul township. Lumbering operations are necessarily restricted to this part of the area and, in 1957, were taking place only in the district immediately west of Duval river.

Bonaventure river is a noted salmon stream, and an attraction to visiting sportsmen. The chief game animals are deer, moose, and grouse. Black bear are also very common. Many smaller fur-bearing animals are common, including beaver, which are particularly active along Reboul river.

Access

Access to the western half of the area is provided by Bonaventure river, which can be travelled by canoe with outboard motor, though difficulties may be experienced at times of low water. The point where the river leaves the area, near its southwest corner, may be reached by a gravel road from New Richmond through the settlement of Robidoux. From this point an old wagon road continues north along the west side of the river, but from the mouth of Reboul river northward it is now useful only for foot travel. Similar old wagon roads, still useful as pack trails, reach several miles up the valleys of Garin brook and Reboul river. A cabin on the right bank of the Bonaventure, about half a mile below Reboul river, is used occasionally by fire-rangers.

The eastern half of the area is most easily accessible from a road leading north from the settlement of Saint-Jogues, north of New Carlisle. This road does not enter the area, but terminates at Arsenault lake, the source of the south branch of Reboul river, 1 1/2 miles from the east boundary. It can be travelled, with difficulty, by a vehicle with four-wheel drive.

Two truck roads leading north from the settlements of Garin and Saint-Elzéar penetrate short distances into the southwestern part of the area, one to Chagrin lake, where there is a privately-owned cabin, and the other up Duval valley to Duval-Est brook. At the mouth of Duval-Est brook a large lumber camp is operated by the Syndicat de Saint-Elzéar.

On the upland surface, with its open valleys and relatively thin brush, foot travel is easy and pleasant. However, most traverses must be made along the deeper valleys, and here the going can be difficult and slow, especially where beaver dams or log jams have dammed the valley bottoms.

DESCRIPTIVE GEOLOGY

Outline

The southern part of Gaspé peninsula consists of a continuous, northeasterly-trending zone of Ordovician rocks, bordered on either side by Silurian and Devonian rocks. In many places the Ordovician rocks are in direct contact with the Devonian, and the lack of Silurian is attributed in part to major faults. However, the present area, which spans the Ordovician belt, includes thick and fairly complete sections of Silurian rocks on both sides.

The rocks of the Ordovician belt were named by Crickmay (1930) as the Matapedia series, and further described by Alcock (1935, pp. 19-26) as the Matapedia group.* In the present area the zone is divided longitudinally by a major east-west fault, with markedly different lithological assemblages on either side of the fault. The term "Matapedia group" has been retained for the rocks of the northern part, which are grey limestones, and calcareous shales and siltstones. The rocks of the southern part are assigned to a new group, the Honorat. They consist of mudstones, siltstones, calcareous shales, limestones, sandstones, and conglomerates, and are structurally more complicated than the rocks of the Matapedia group.

The Matapedia group is overlain on the northwest, with probable slight unconformity, by the Silurian Mount Alexander group. This consists of limestones, silty limestones, calcareous siltstones and a thick volcanic sequence. On its north side it is faulted against the Devonian Grande Grève formation, and, to the north of the area (Skidmore, 1963), against the York River formation.

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* The Matapedia series or group of Crickmay and Alcock included a wide belt of rocks now assigned to the Devonian Fortin group (see McGerrigle, 1953).

The Silurian Chaleurs Bay group along the southern margin of the area is at least partly equivalent in age to the Mount Alexander group, although lacking in volcanic rocks here. It is better exposed, and better known, than the Mount Alexander group, and has been divided by previous workers into six formations: Clemville, La Vieille, Gascons, Bouleaux, West Point, and Indian Point. The lower five, at least, of these are represented in the present area. The contact of the Chaleurs Bay group with the Honorat group is partly a major fault and partly an unconformity.

Sills and dykes of fine, basic rocks are common locally in the Ordovician and the Mount Alexander sequences. They are possibly all of Silurian age.

Recent alluvial gravels occur in the bottoms of the valleys and gullies. The bedrock is covered almost everywhere else by a mantle of weathered debris, which has mostly been derived from the underlying bedrock. Some erratics are found, which have evidently not been transported to their present sites by the existing streams, but their distribution is in accordance with the general drainage pattern.

Table of Stratigraphic Units

Age	Group	Formation	Description
Recent			Alluvial gravels
Pleistocene			Erratics
Early Devonian	Gaspé Sandstone	York River	Sandstone; mudstone; shale
	Gaspé Limestone	Grande Grève	Siliceous limestone
Silurian?	Intrusions		Basic igneous rocks
Silurian	Chaleurs Bay	Indian Point	Calcareous siltstone; siltstone
		West Point	Limestone; silty limestone and calcareous siltstone; sandy limestone; silty, nodular limestone; fossil-fragment limestone
		Bouleaux	Calcareous siltstone; silty, nodular limestone
		Gascons	Siltstone and sandstones; calcareous siltstone and sandstone
		La Vieille	Limestone; silty, nodular limestone; sandy, fossil-fragment limestone
		Clemville	Shale; siltstone; sandstone; conglomerate; calcareous siltstone and shale
	Mount Alexander		Limestone; silty and shaly limestone; shale; calcareous siltstone; basic to acidic lava; agglomerate and tuff
Ordovician	Matapedia		Limestone; silty and shaly limestone; calcareous shale and siltstone
	Honorat		Mudstone; siltstone; calcareous, slaty shale; argillaceous and silty limestone; sandstone; conglomerate

Honorat Group

The Honorat group occupies roughly the south-central quarter of the area, comprising mainly the drainage area of Garin brook. It is bordered on the north by the Matapedia group, and on the south by the Chaleurs Bay group. The name is taken from the township in which most of the best exposures are found. These exposures occur along Garin brook and its larger tributaries on the north side. The most accessible exposures are along Bonaventure river, but they are few and not representative of the group as a whole.

The geological structure within the group is complex, and it was not found possible to work out the stratigraphic sequence. Likewise, the thickness of the group is unknown, though it must be great, possibly as much as 14,000 feet.

The bulk of the group is dark grey non-calcareous to very slightly calcareous mudstone or argillite and siltstone. In some places the rock is dark olive-grey, and in many places lighter coloured, commonly calcareous laminae and beds up to about 3 inches thick occur. Finely sandy beds, to about 2 inches thick, also occur but are more rare. The rock is weathered dark grey to brown, the calcareous beds being invariably brown. In some places the bedding shows the severe contortions and dislocations of slump structure. Fracture cleavage is poorly to moderately developed. In thin sections, the rocks are seen to be mostly fine argillaceous material, mixed with silt and very fine sand and, in some cases, a little calcite cement. The range of composition of four sections is as follows:

	%
Quartz	5-13
Feldspar	5-21
Mica	2- 4
Rock particles (shale, volcanic rock)	0- 5
(Total silt and sand	14-43)
Fine argillaceous material and opaques	50-86
Carbonate	0-7

In all cases the silt and sand fraction contains at least 40% feldspar, so that the rocks might be classed as arkosic. One thin section from a one-inch bed of calcareous mudstone has the following composition:

	%
Quartz	23
Feldspar	11
Mica	1
Fine argillaceous material	24
Carbonate	41
	100

The maximum grain size in most sections is about 0.1 mm., though there may be mica flakes to 0.5 mm. The grains are angular to subangular. Laminations, in some cases disturbed, reflect differences in sorting characteristics, and adjacent laminae range from claystone, through mudstone, to well-sorted calcareous siltstone. Particles, particularly the mica flakes, are well oriented parallel to the bedding. Cleavage is either not apparent, or is shown by irregular strings of fine argillaceous material, probably drawn out along micro-shear planes.

Grey, argillaceous to silty limestone, and calcareous, slaty shale are present locally, particularly to the south along Garin brook. An outcrop on Bonaventure river contains a few beds, up to 2 feet thick, of coarse calcarenite and fine conglomerate. The rock is dark grey, and composed mostly of fossil fragments and fine rock grains, with some rounded quartz. One thin section has the following composition:

	%
Fossil carbonate	60
Quartz, quartzite, chert	9
Feldspar	2
Unstable rock	23
Fine argillaceous material	5
Authigenic calcite	1
	100

The rock particles are mostly varied types of shale, with some fine-grained volcanics. The grains are subangular to rounded, and closely packed. Many of the shale particles are severely deformed.

In the eastern half of the area, north of Garin brook, the rocks of the group are notably different. Massive beds, mostly 3 feet or more thick, of poorly-sorted sandstone, and conglomerate, alternate with grey siltstone, mudstone, and slaty shale, and rarer green and reddish-brown mudstone. The sandstones are greenish-grey,

brown weathering and non-calcareous. In thin section, the finer-grained types are seen to be feldspathic or arkosic wackes. Two sections gave the following compositions:

	%	%
Quartz, quartzite, chert	23	36
Muscovite	1	6
Feldspar	35	16
Unstable rock	13	10
Sphene, leucoxene	5	2
Argillaceous and chloritic matrix ...	20	30
Carbonate cement	3	-
	100	100

The maximum grain size in both these sections is 0.2 mm., and the grains are angular to subangular. The unstable rock particles are of fine volcanics, shale, and muscovite and chlorite schists.

The coarser-grained sandstones tend, as would be expected, to be lithic, rather than feldspathic, wackes. One section with average grain size of about 0.5 mm. and a maximum of 3 mm. had the following composition:

	%
Quartz, quartzite	28
Chert	12
Muscovite	3
Feldspar	8
Unstable rock	13
Clastic calcite	1
Argillaceous matrix	34
Carbonate cement	1
	100

The particles are subangular to subrounded. The unstable rock particles are varied, and include phyllite, shale, calcareous siltstone, volcanic rock, feldspathic muscovite schist, and granite.

The conglomerates are varied, but in general are composed largely of rounded granules and small pebbles of white quartzite and quartz, with larger pebbles of various fine rocks. They may be better sorted than the sandstones, and more calcareous. A typical fine conglomerate with maximum grain size of 6 mm. has the following composition:

	%
Quartzite, quartz	59
Feldspar	4
Unstable rock	20
Argillaceous matrix	6
Carbonate cement	11
	100

The rock and feldspar fragments are crushed and deformed between subrounded quartzite and quartz grains. The unstable rocks are siltstone, shale, argillaceous limestone, pellet limestone, fine volcanic rocks, and quartz-feldspar-calcite schist.

In the coarser conglomerates the larger cobbles and boulders are sedimentary rocks, mostly shales, limestones, and sandstones, that are very similar to the rocks of the group.

No fossils were found in the Honorat group.

Matapedia Group

The term "Matapedia series" was first used by Crickmay (1930) to include a series of slates, quartzites, and limestones exposed along the lower Matapedia valley. Fossils found in the limestone, which formed the southern part of the series, indicated correlation with the similar limestones of the Upper Ordovician White Head and Pabos formations in eastern Gaspé. Alcock (1935, pp. 18-26) reported that ordovician rocks of varied lithology could be traced continuously along a belt from Matapedia to Percé. He employed the term "Matapedia group" for all the rocks of this belt west of Little Cascapedia river, and assigned them to the Upper Ordovician, though admitting that "some of the rocks may be the equivalent of the Mictaw and Tetagouche and, therefore, of Middle instead of Upper Ordovician age". Subsequent work by McGerrigle (1946) showed that the northwestern part of the belt, including most of Crickmay's original Matapedia series, belonged to the Devonian Fortin group. The remaining part of the type section at Matapedia consists of grey limestones and shales of the kind correlated with the White Head and Pabos formations. The writer proposes that the term "Matapedia group" be restricted to this limestone sequence, throughout the length of the peninsula. The Honorat group, described above, has been separated from the Matapedia group in conformity with this proposal.

The Matapedia group occupies most of the northern half of the present area, including most of the drainage area of Reboul river.

It is bordered on the south by the Honorat group, and overlain on the northwest by the Mount Alexander group. It is best exposed along Bonaventure river, and the main branches of Reboul river.

The group is made up almost entirely of grey, calcareous rocks. These vary from fairly pure, sublithographic limestone, through shaly and silty limestones, to calcareous shale and siltstone. The sublithographic limestone has a characteristic light dove grey, smooth, rounded weathered surface, whereas the less pure rocks weather in various shades of brown. Commonly the various types are interbedded or interbanded, in thicknesses from a few feet down to about 1/2 inch. In a few exposures the smooth limestone contains subrounded pebbles of similar limestone, and may be classed as intraformational conglomerate. Beds of non-calcareous, greenish grey shale occur in a few outcrops. Debris of fine-grained, non-calcareous sandstone is found in some places in the area occupied by the group, but the rock was not seen in outcrop.

The rocks are folded into a broad anticline. In the axial region of the anticline silty and argillaceous limestones predominate, whereas elsewhere, in the upper part of the group, fairly pure limestone is the more common. The thickness of the group appears to be at least 8,000 feet.

The broad anticlinal structure of the group is clear, but intense minor folding and faulting are common locally (Plate III-B). Cleavage is well developed in the more argillaceous rocks (Plate IV-A). Close to intrusions, the limestones are harder and commonly light greenish or brownish.

The only identifiable fossil collected from the Matapedia group probably belongs to the Ordovician gastropod genus Loxobucania.

Mount Alexander Group

The term "Mount Alexander group" was applied by the writer (1964) to a belt of Silurian sedimentary and volcanic rocks lying on the south side of the Fortin group in the area adjoining to the north. The group crosses the northwest corner of the present area, overlying the Matapedia group. The part of it exposed in this area appears to be about 13,000 feet thick and to dip consistently to the northwest.

The lower part of the group is very poorly exposed. Thus, the position of the contact between this group and the underlying

Matapedia group is based mainly on the more regular or consistent structure of the younger group as shown by aerial photographs.

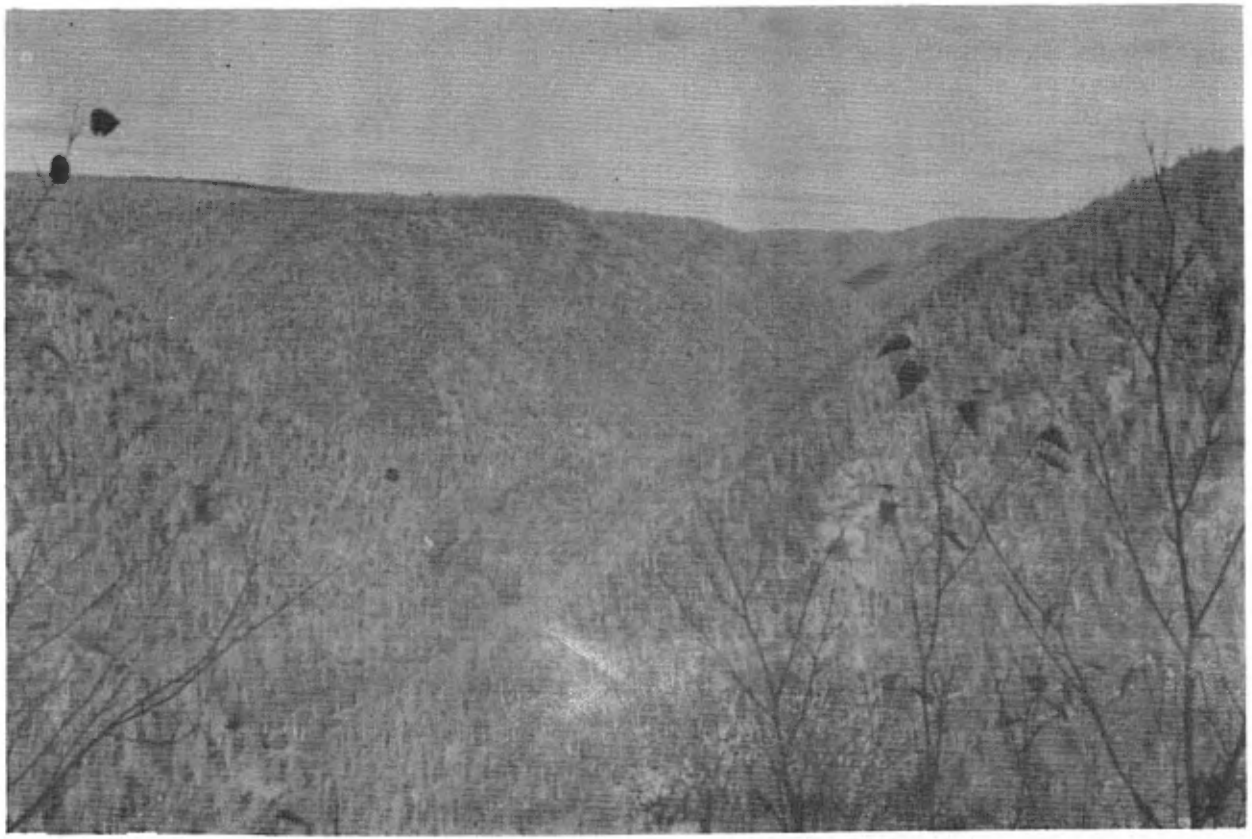
The lower part of the group consists of about 3,000 feet of sedimentary rocks. The basal part is apparently grey, laminated, shaly to silty limestone, and fairly pure limestone, with some brownish grey, laminated shale. These rocks grade upward into greenish grey, silty limestones and calcareous siltstones. Two thin sections of these silty rocks have the following compositions:

	%	%
Quartz	12	28
Muscovite	-	2
Feldspar	5	21
Biotite, chlorite	1	-
Clastic carbonate	7	-
Argillaceous material	7	28
Carbonate cement	68	21
	100	100

The detrital fractions are arkosic in composition. The particles are angular to subangular, with maximum diameters of 0.08 mm. to 0.1 mm.

At the top of the sedimentary sequence, immediately underlying a basal volcanic breccia, a bed of dark grey, silty, spicular limestone was found. As seen in thin section, abundant silica sponge spicules, up to more than 2 mm. long and partly replaced by calcite, a few carbonate shell fragments, and angular quartz silt are contained in a matrix of calcite, cryptocrystalline silica, and argillaceous material. The proportions of constituents are as follows:

	%
Quartz silt	20
Muscovite	1
Feldspar	2
Fossil silica	6
Fossil carbonate	2
Cryptocrystalline silica, argillaceous material	19
Pyrite, leucoxene	2
Carbonate cement	48
	100



Looking northeast up the valley of Garin brook. Showing steep, V-shaped valley cut into gently rolling upland surface.

PLATE I

PLATE II

A — Hills of the Mount Alexander range. Looking north.

B — Looking southeast down branch of Hall river cutting through ridge of Clemville formation.

PLATE III

A — Large outcrops of Matapedia group limestone in steep bank of Reboul-Nord river.

B — Outcrop of closely folded Matapedia group limestone; Reboul river.

PLATE IV

A — Intersecting bedding and cleavage in grey, silty limestone and argillaceous limestone of the Matapedia group. Reboul-Nord river.

B — Looking southwest down Duval-Est brook. Showing grey, nodular limestone of the La Vieille formation, dipping steeply northwest.

The sedimentary rocks are overlain by a band of volcanic rocks whose width increases northeastward from 5,500 feet at the southwest end to at least 8,000 feet. The corresponding range of thicknesses is probably about 4,500 to 7,000 feet. The volcanic rocks are fairly well exposed on the sides of the gullies and steepest hills of the Mount Alexander range. They are commonly too altered for precise identification, but apparently they are mostly andesites and basalts, with some rhyolite.

The basic rocks are greenish grey, grey, or dark red, where fresh, brown weathering, and commonly porphyritic; phenocrysts of feldspar, and more rarely pyroxene, range up to about 1 cm. long. In some places amygdules of white and pink calcite and fibrous chlorite are abundant. In thin section the fabrics are seen to be intergranular to intersertal, the groundmass grain-size ranging from 0.1 mm. down. Plagioclase occurs both in phenocrysts and as slender laths in the groundmass, making up 53%-67% of the rock. The phenocrysts appear to range from oligoclase to sodic bytownite, and the groundmass feldspar from oligoclase to calcic andesine. The other mineral constituents are clinopyroxene, chlorite, magnetite, pyrite, hematite, sphene, and calcite, with accessory biotite in some sections. In the finer rocks as much as 40% of the section may be fine matrix of indeterminate composition. One section of basalt contains apparent pseudomorphs after olivine, occupied by biotite, chlorite, and pyrite.

The rhyolitic rocks are pink, pinkish brown to brownish red weathering, aphanitic, and hard. They contain stubby phenocrysts of pink feldspar and, more rarely, flakes of chlorite, up to 3 mm. In thin section they are seen to contain about 75% altered feldspar, probably mainly sodic plagioclase with some potash feldspar. Quartz occupies about 10% of the rock, and occurs mainly in irregular interstitial patches and corroded phenocrysts. The rest of the rock is indeterminate brown matrix, probably largely biotite, chlorite, and altered feldspar.

Agglomerates and tuffs, found in a few places, contain rounded fragments of lava up to about a foot across. The smaller fragments are subrounded to subangular. They are set in green, chloritic, or red, hematitic matrix. In some places there is also a little calcite cement. Thin sections of the matrices of these rocks showed them to be unsorted lithic tuffs, mainly composed of fragments of varied volcanic rocks, with minor feldspar, chlorite, pyroxene, and biotite.

The volcanic rocks are apparently succeeded by about 3,000 feet of sedimentary rocks, which are exposed only in a few outcrops

along one brook on the west side of the Bonaventure. The lowest outcrop, stratigraphically, is a dark green, poorly sorted, calcareous sandstone, with crude graded bedding. In thin section this proved to be a lithic tuff, or tuffaceous sandstone. Its composition is as follows:

	%
Quartz silt	2
Fine volcanic rock	37
Feldspar	28
Clastic calcite	4
Calcite cement	22
Limonite and magnetite	7
	100

The grains are subrounded to angular, and the larger rock particles are squeezed and deformed.

Above this are a few outcrops of brownish grey limestone, in part dense, in part silty, in part finely crystalline. The rock in some cases has a bituminous odour.

The structure of the Mount Alexander group is, so far as could be determined, uncomplicated. Cleavage is poorly to moderately developed in the more argillaceous rocks.

No fossils were found in the group in this area.

Chaleurs Bay Group

The Chaleurs Bay group* is of Silurian (upper Llandoverian to Ludlovian) age. It underlies the southern quarter of the area, and is estimated to have here a total thickness of about 10,000 feet. Parts of the group are exposed on most of the brooks and small rivers, but the most complete section is to be found on the branch of Hall river that flows southeastward across the southeast corner of the area. The group was divided by Badgley (1956) in the area to the south, into six formations, and the writer has recognized the same formations in the present area (rather than the seven formations of Schuchert and Dart, 1926, and Northrop, 1939). They are described in ascending order.

*Chaleur series of Logan and other authors, and Chaleurs Bay series of Alcock and others. It is here called a group because it is defined, and correlated, by lithological characteristics rather than by age.

Clemville formation

The Clemville is the basal formation of the group. No complete section of this formation is exposed in the area, the thickest being about 2,000 feet, barring undetected structural complexities.

The formation is mainly non-calcareous shale, siltstone, sandstone, and conglomerate. The shales and siltstones are mostly greenish grey, more rarely grey, and many are sandy. The sandstones are hard, green to brownish green, well-sorted quartzites for the most part. Some are slightly calcareous. Two medium-grained specimens of quartz arenite or quartzite have the following compositions in thin section:

	%	%
Quartz, quartzite	74	81
Chert	2	3
Feldspar, microperthite	7	6
Unstable rock	6	1
Chloritic and argillaceous matrix	6	6
Quartz cement	2	-
Calcite cement	3	3
	100	100

The grains are angular to subrounded, and many of their contacts are welded. The feldspar is fairly fresh, and is mostly orthoclase, with minor plagioclase and microcline and a little microperthite. The unstable rock grains are granite and shale.

Some of the coarser sandstones are markedly different, being arkosic, with a high content of pink feldspar and visible fragments of fine quartzite, shale, and volcanic rock. A thin section of a very coarse-grained specimen of this rock has the following composition:

	%
Quartz, quartzite	51
Chert	4
Feldspar, microperthite	19
Unstable rock	19
Chloritic matrix	7
	100

The grains are subrounded, with a maximum diameter of 4 mm. and an average of about 1.5 mm. The feldspar is mostly orthoclase, with rare plagioclase. The unstable rocks are granite, quartz-feldspar hornfels or gneiss, andesitic volcanic rock, and shale. The specimen is poorly cemented, and has some visible pore space.

The conglomerates contain rounded quartz and quartzite pebbles up to about one inch in diameter.

Towards the top of the formation the siltstones and shales become calcareous, and grade into the limestones of the succeeding formation.

Fossils collected from the Clemville formation were identified as follows:

Eocoelia hemispherica	Stegerhynchus ? sp.
Goniostrophia sp.	cf. Zaphrentis stokesi
Grammysia cf. triangulata	bryozoan
Leptaena "rhomboidalis"	rhynchonellid
Plectodonta sp.	schizophorid ?

The fauna has a general Silurian aspect, the Eocoelia hemispherica indicating upper Llandoverian.

Extensive collections made from the Clemville formation elsewhere indicate that its age is upper Llandoverian (A.J. Boucot, personal communication, 1961).

La Vieille formation

The La Vieille formation consists of about 1,800 feet of limestones. They are partly grey, dense, smooth to finely crystalline limestones in regular beds about a foot thick, and partly grey to greenish grey, silty and argillaceous limestones. The silty limestones are characterized by discontinuous beds, or layers of nodules, one inch to 2 inches thick, of purer grey limestone. The nodules, in many cases, are of organic origin, probably stromatoporoidal. Throughout much of the formation the two types of limestone are interbedded in layers up to a few feet thick. At a locality in the western part of the area the grey, crystalline limestone contains sandy to pebbly beds, with rounded quartz pebbles up to about 5 mm. and common crinoid and bryozoan remains. In thin section the rock was seen to contain about 82% fossil debris, 16% rounded quartz grains, and 2% argillaceous material.

The following fossils were collected from the La Vieille formation:

Atrypa "reticularis"	Syringopora bifurcata
Howellella sp.	unidentified brachiopods

This collection also has a Silurian aspect and Syringopora bifurcata has been found elsewhere in the La Vieille, Gascons, and Bouleaux formations.

The La Vieille elsewhere is dated as of upper Llandoverian to Wenlockian age (A.J. Boucot, personal communication, 1962).

Gascons formation

The Gascons formation is about 2,000 feet thick and very uniform. It consists of hard, greenish grey to brownish grey siltstone, and very fine quartzitic sandstone, weathering brown or greenish brown. The rock is in regular layers from an inch to a foot thick. Most commonly it is non-calcareous, but may be calcareous, especially near the base, where it grades into the limestone of the La Vieille formation. The Gascons of this area is distinguished by its hardness from the softer siltstones of the coastal sections. A thin section of a typical specimen of calcareous siltstone, or very fine sandstone, showed the following composition:

	%
Quartz	64
Muscovite	2
Feldspar	13
Unstable rock	2
Sphene, pyrite, limonite	4
Calcite cement	15
	100

The average diameter of grains is about 0.06 mm., with a maximum of 0.15 mm. The grains are subangular to angular, and are welded where in contact. The few rock particles are of microgranite.

No fossils were found in the Gascons formation. It is dated elsewhere as lower Ludlow (A.J. Boucot, personal communication, 1961).

Bouleaux formation

The Bouleaux formation is essentially a transition zone, about 1,250 feet thick, between the Gascons formation and the overlying West Point. It consists of greenish grey, calcareous siltstone and silty limestone, with nodular interbeds of purer, grey limestone similar to those in the La Vieille formation. Towards the top of the formation there is also a little finely crystalline, brownish grey, silty limestone.

Two corals, Favosites cf. hisingeri, and Heliolites interstinctus, were collected from the Bouleaux. These are found elsewhere in the Chaleurs Bay group, H. interstinctus being restricted to the middle part of the group.

West Point and Indian Point formations

The West Point formation is, in this area, mainly grey, smooth limestone, in beds about 3 inches to 1 foot thick, with common interbeds of grey, silty limestone and calcareous siltstone. Less commonly the limestone is finely crystalline. Rare sandy beds, near the base, contain scattered grains of rounded quartz, and silicified fossil fragments. The formation also contains some greenish grey, silty limestone, with nodular, fossiliferous beds, similar to that in the La Vieille and Bouleaux formations. At a few localities there are thick beds of grey, coarsely fragmental, fossiliferous limestone, similar to the "reefy" limestones that are common elsewhere in the Gaspé Silurian and form the type section of the West Point. These are particularly well developed in the northwest part of the formation's outcrop area, shortly south of Garin brook.

Towards the top the formation grades into grey and greenish grey, calcareous to non-calcareous siltstone. These beds probably represent the base of the Indian Point formation, the uppermost formation of the group.

The maximum thickness of the combined West Point and Indian Point formations in the area is about 3,000 feet.

The fossils collected from the West Point are as follows: Favosites forbesi, Favosites sp., Protathyris? sp., bryozoan, rhynchonellid. The aspect is Silurian, F. forbesi being found elsewhere in the Chaleurs Bay group. The West Point formation elsewhere is dated as Ludlovian.

Structure

The Chaleurs Bay group is moderately folded and faulted on a large scale, and minor faults are common. Cleavage is poorly to moderately developed.

Grande Grève Formation

The Grande Grève formation occupies a very small strip across the northwest corner of the area. It is faulted against the Mount Alexander group. Although only one exposure was found, the actual thickness is probably between 1,400 and 1,800 feet.

The rock is a fairly hard, medium grey, brown weathering, siliceous, faintly laminated limestone. It is in blocky beds up to 6 inches thick.

The Grande Grève formation is of Oriskany to Esopus age (i.e. Rensselaeria and Etymothyrus zones of Boucot (1959)) and forms an important part of the Devonian sequence farther north.

York River Formation

The Lower Devonian York River formation, which overlies the Grande Grève, is not exposed in the area. However, the distribution of rock debris, and previous mapping to the north (Skidmore, 1963), indicate that the extreme northwest corner of the area is underlain by this formation. It consists of fine- to medium-grained, poorly sorted, lithic and feldspathic sandstones, and greenish grey mudstone and shale.

Intrusive Rocks

Dykes and sills, up to about 50 feet thick or possibly 100 feet in a few cases, are common locally in the Honorat, Matapedia, and Mount Alexander groups. They are essentially restricted to two regions: first, along the lower part of the valley of Garin brook, in the southwestern part of the Honorat outcrop area; second, a broad belt between the Mount Alexander lavas and the main anticlinal axis in the Matapedia group. Only one occurrence was noticed above the volcanic rocks of the Mount Alexander group. No intrusions into the Chaleurs Bay group were seen.

The rocks are mostly dioritic in composition, with a few true diabases. They are greenish grey to grey, and generally fine grained although varying from aphanitic to medium grained. In hand specimen they appear to contain 50%-60% white feldspar, with interstitial dark green minerals, mostly chlorite, and disseminated pyrite. In some cases they are slightly calcareous. The rocks weather brown, greenish brown, or reddish brown.

In thin section, they are seen to contain 54%-65% plagioclase. This is mostly sericitized, and commonly replaced by calcite. Where freshest, it appears to be andesine or oligoclase. Pigeonitic pyroxene is seen in some sections, and may make up to 10% of the rock. The chief mafic mineral is chlorite, which forms close to 20% of each section. It is mostly in the form of fine, interstitial material, but in two sections it occupies pseudomorphs after amphibole. The opaque minerals (pyrite, magnetite, ilmenite, and leucoxene) make up 3%-10% of each section. Sphene is also common, and may make up as much as 6%. Carbonate and, more rarely, quartz occur in veinlets and as replacement minerals. Accessory minerals are biotite and apatite. The rock fabric

is intersertal, more rarely intergranular. The average grain size varies from 0.2 mm. to 2 mm. with a maximum grain size of 4 mm.

A single section of altered diabase contains probable pseudomorphs after olivine replaced by serpentine (?), calcite and biotite.

Most of the intrusions are probably associated with the Mount Alexander lava flows, and thus would date from Silurian time.

Pleistocene and Recent

It is now generally accepted that Gaspé peninsula was overridden by at least one continental ice sheet during the Pleistocene. However, in the present area no distinct evidence of this was noted. Loose debris on the upland surface is mostly derived from the underlying rocks. Notable exceptions are small boulders of the Mount Alexander lavas well to the south of the volcanic range. However, these were found only towards the western side of the area, within a mile or two of the Bonaventure, and it is possible that they are the remnants of gravels left by an ancestral Bonaventure river during a previous erosion cycle.

However, good evidence for continental glaciation was found outside the map-area, in the form of a large boulder of coarse-grained anorthosite. It was found on the upland surface in eastern Honorat township, on the road north from Saint-Jogues, about 7 miles from the settlement. It is almost certainly derived from the north shore of the St. Lawrence.

Alluvial gravels occur in the bottoms of all the valleys, and thicknesses of up to nearly 100 feet are visible in some river cuts.

Structural Geology

The most prominent structural feature of the area is a fault that strikes at about N.85°E. across the middle of the area, and shows very clearly on the aerial photographs. It separates the distinctive rocks of the Matapedia and Honorat groups, and cuts across the structures of both. As the stratigraphic relation between the Honorat and Matapedia groups is unknown, the displacement on the fault is also unknown.

The Matapedia group, on the north side of the fault, is folded into a broad, compound anticline whose axis trends about N.65°E. and plunges 20° to the southwest. It is overlain on the northwest by

the Mount Alexander group. Exposure is very poor along the contact of the two groups, and the little direct evidence that can be seen indicates that the bedding in the two groups is parallel and that the rock types near the contact are similar. However, study of the aerial photographs indicates that the bedding strike is wavy in the Matapedia group, and more regular in the Mount Alexander, and this suggests a slight unconformity between the two groups.

Available evidence suggests that bedding in the Mount Alexander group dips moderately, and uniformly, to the northwest. In the northwest corner of the area the group is cut by a major fault, probably a thrust fault dipping southeast. The existence of the fault, which brings the Silurian Mount Alexander group against the Devonian Grande Grève formation, has been demonstrated in the area to the north (Skidmore, 1963) where it cuts sharply across the structure of the Mount Alexander group.

The structure of the Honorat group is complex and not well understood. It appears to be roughly that of a broad anticline, with axis running northeast, interrupted by an even broader syncline, with axis running northwest. In other words, this is a saddle structure. The south boundary of the Honorat group is formed, in part, by a fault running approximately east across the area, with downthrow on the south side. However, a thin wedge of the Clemville formation on the north side of the fault in the east half of the area appears to overlie the Honorat group with slight unconformity. Because the fault brings down the top of the West Point formation to rest against the Clemville, the vertical separation must be at least 8,000 feet.

The rocks on the south side of this fault belong to the Chaleurs Bay group. They are folded into two synclines and two anticlines, all plunging northeast. The more southerly syncline is complicated by a fault running along, or close to, its axis. It is probably a thrust, dipping northwest, but the same effect could have been achieved by horizontal, strike-slip movement to the northeast on the northwest side, or a combination of the two types of movement. Another fault, running parallel to the more southerly of the two anticlines, about 1/2 mile northwest of its axis, is down-thrown on the southeast side, and causes repetition of the northwest-dipping Clemville rocks. The vertical separation on this fault is at least 2,000 feet. In the southwest corner of the area, the structure is somewhat obscure. The Gascons formation is apparently cut out at the west end of the more northerly syncline, and a fault is postulated with downthrow on the east side. Lineation on the aerial photographs suggests the position of this fault and its trend of about N.20°E.

Cleavage is present throughout the area, though only well developed in some of the argillaceous Ordovician rocks. As seen in thin section, it appears to be fracture or slip cleavage rather than flow cleavage. In the Honorat group the direction of cleavage is varied, especially towards the south. In a few outcrops the cleavage is folded through angles of 90° or more in a distance of a few feet. Elsewhere the cleavage strikes approximately parallel to the fold axes, and dips steeply. As a general rule it dips in the opposite direction to the bedding. This relation is particularly clear in the Chaleurs Bay group, where there is a distinct fan cleavage.

STRATIGRAPHIC RELATIONS

Ordovician Rocks

Rocks similar in lithology to those of the Honorat group have been noted at many places in the Ordovician belt to the southwest (see Alcock, 1935, pp. 20-23). However, their relationship to the Matapedia group limestones (the Matapedia group of this report) has not been investigated in detail. Fossils recovered from these rocks have indicated an Ordovician age but nothing more precise. Alcock suggests the possibility that they may be in part equivalent to the similar Mictaw group and Tetagouche group, of the Port Daniel area and northern New Brunswick respectively. These groups are of Middle Ordovician age.

In the present area the rocks lie in fault contact with the Matapedia group, and their stratigraphic relation is therefore not clear. However, the fact that the Honorat rocks are more deformed than those of the Matapedia, although generally more competent, suggests that they may be the older. They may, indeed, have undergone some orogenic deformation before the deposition of the Matapedia group.

Silurian Rocks

Fossils found in the Mount Alexander group in previous work (Jones, 1938, pp. 14-15, Skidmore, 1963) indicate a Silurian age, probably about upper Llandoverian to lower Ludlovian. It is therefore almost certainly equivalent, at least in part, to the Chaleurs Bay group, which is well dated as upper Llandoverian to Ludlovian. If we were to rely on direct lithologic correlation between the two groups it would probably be assumed that the Mount Alexander volcanics are equivalent to those which occur at the level of the West Point formation at Black Cape, on the south coast. However, there are no volcanics in the intervening exposures of the Chaleurs Bay group at this, or any other, stratigraphic

level. Furthermore, previous work in the area to the north has suggested that the Mount Alexander volcanics provided the source for volcanic conglomerates in the Sirois formation, which are believed to be of lower Wenlock age (Skidmore, 1963). The volcanics are probably no younger, therefore, than the La Vieille formation. More precise correlation must await further fossil collecting in the Mount Alexander group.

ECONOMIC GEOLOGY

No mineral occurrences of economic importance were discovered. Disseminated pyrite, magnetite, and ilmenite occur in most, or many, of the intrusive and extrusive rocks.

In 1938, R.A. Brown reported (files, Quebec Department of Natural Resources) on some gold claims, then held by Edmond Essiambre and F. Boissoneau, that lie a little more than one mile east of the present area, near the north end of Arsenault lake in northwest Weir township. The gold occurs in a lenticular quartz vein penetrating feldspathic sandstone of the Honorat group. Values up to $7.00 per ton (at $25 per ounce of gold) were reported by the holders of the claims.

The rocks most suitable, from the point of view of porosity, for petroleum reservoirs are the conglomerates, sandstones, and fossiliferous limestones of the Chaleurs Bay group, particularly the arkosic sandstones. Closed folds within this group which would provide a trap for the accumulation of petroleum are not apparent. The bituminous limestone of the upper Mount Alexander group is also of interest. Here again, there seems to be little likelihood of closed folds being present. However, the possibility of the occurrence of stratigraphic and fault traps should not be overlooked.

BIBLIOGRAPHY

Alcock, F.J. (1935) — Geology of Chaleur Bay region; Geol. Surv. Canada, Mem. 183

Badgley, P.C. (1956) — New Carlisle map-area, Electoral district of Bonaventure; Que. Dept. of Mines, G.R. 70.

Boucot, A.J. (1959) — Brachiopods of the Lower Devonian rocks at Highland Mills, New York; Journ. Paleontology, vol. 33, pp. 727-769.

Crickmay, G.W. (1930) Structure and stratigraphy of Matapedia valley, Quebec (abstract); Bull. G.S.A., Vol. 41, pp. 116-117.

Jones, I.W. (1938) Mount Alexander map-area, Gaspé Peninsula; Que. Bur. Mines, Ann. Rept. for 1936, pt. D. pp. 3-26.

McGerrigle, H.W. (1942) Manuscript, Que. Dept. Nat. Resources.

(1946) A revision of the Gaspé Devonian, Trans. Royal Soc. Canada, 3rd series, Sec. IV, Vol. XL, pp. 41-54.

(1950) The geology of eastern Gaspé; Que. Dept. of Mines, G.R. 35.

(1953) Gaspé peninsula; Que. Dept. of Mines, Geol. Map No. 1000.

(1959) Madeleine River area, Electoral district of Gaspé-North; Que. Dept. of Mines G.R. 77.

Northrop, S.A. (1939) Paleontology and stratigraphy of the Silurian rocks of the Port Daniel - Black Cape region, Gaspé; G.S.A. spec. pap. 21.

Schuchert, C. and Dart, J.D. (1926) Stratigraphy of the Port Daniel - Gascons area of southeastern Quebec; Geol. Surv. Canada, Mus. Bull. 44.

Skidmore, W.B. (1958) Preliminary report on Honorat West area, Bonaventure electoral district; Que. Dept. of Mines, P.R. No. 366.

(1964) Gastonguay-Mourier area, Gaspé-North, Gaspé-South and Bonaventure counties; Que. Dept. of Natural Resources, G.R. No. 105.

APPENDIX

Fossil Localities

Matapedia group

F. 6. Grey, slightly silty limestone, Reboul-Nord river, 5 3/4 miles northeast of main forks:
Loxobucania? sp.

Clemville formation

F. 1. Debris of dark greenish-grey siltstone, on road to Falls Gully lake, on west edge of area, 4,000 feet south of Bonaventure river:
Stegerhyncus? sp.
bryozoan.

F. 2. Greenish grey siltstone, west edge of area, 2,000 feet from southwest corner; on brook from Chagrin lake:
Grammysia cf. *triangulata*

F. 3. Greenish grey, calcareous siltstone, 6,000 feet up brook entering Garin brook from south, 2,000 feet above mouth:
Eocoelia hemispherica

F. 7. Greenish grey, calcareous shale, just outside east edge of area, about 5 miles from southeast corner:
cf. *Zaphrentis stokesi*
Plectodonta sp.
Goniostrophia sp.

F. 9. Greenish grey siltstone and silty shale, north-flowing brook, 4,000 feet from east edge of area, 5 miles from south edge:
Leptaena "*rhomboidalis*"
schizophorid ?

F. 15. Dark grey siltstone, 1,300 feet up east branch of brook entering Garin brook from south, 2,000 feet above mouth:
Eocoelia hemispherica
rhynchonellid

La Vieille formation

F. 5. Grey, argillaceous limestone, at forks 5,200 feet up brook entering Garin brook from south, 12,000 feet east of its mouth:
Atrypa "reticularis"
Howellella sp.

F. 13. Nodular limestone, Duval-Est brook, 14,500 feet above mouth:
Syringopora bifurcata

F. 14. Grey, smooth to shaly limestone, Duval-Est brook, 11,000 feet above mouth:
Howellella sp.
Unidentified brachiopods

Bouleaux formation

F. 11. Grey, finely crystalline, silty limestone, southeast-flowing brook, 5,000 feet from east edge of area, 10,500 feet from south edge:
Favosites cf. hisingeri

F. 12. Nodular limestone, same locality as F. 11:
Heliolites interstinctus

West Point formation

F. 4. Dark grey, fossiliferous limestone; hillside, 2,300 feet southwest of Garin brook, 2,700 feet north of Duval river:
Favosites sp.
bryozoan

F. 8. Interbedded smooth, grey limestone and grey, calcareous siltstone, north-flowing brook, 3,500 feet from east edge of area, 4 1/4 miles from south edge:
Favosites sp.
rhynchonellid

F. 10. Grey, fossil-fragment limestone, 7,000 feet up brook entering Garin brook from southeast, 6 3/4 miles east of Bonaventure river:
Favosites forbesi

F. 16. Debris, dark grey limestone, 10,000 feet up brook entering Garin brook from east, 7 miles east of Bonaventure river:
Protathyris ? sp.

ALPHABETICAL INDEX