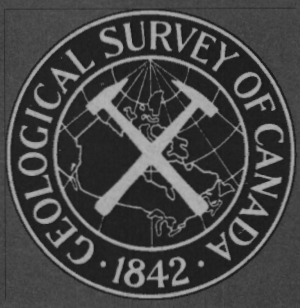

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ORDOVICIAN AND SILURIAN FORMATIONS OF ANTICOSTI ISLAND, QUEBEC

Thomas E. Bolton

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INTRODUCTION

Anticosti Island, situated in the northern half of the Gulf of St. Lawrence within 20 miles of the Quebec mainland, is about 140 miles long and at least 32 miles wide at its widest place near the middle of the island. It may be reached either by regular or chartered flights from Rimouski or Gaspé, Quebec; or via scheduled sailings of the M.S. Anticosti from Quebec City, Rimouski, or Gaspé, to Port Menier, through arrangements with the owners of the island—Consolidated Paper Corporation Limited of Montreal.

Most of the western and northeastern parts of the island are between 300 and 700 feet high. The highest land—up to more than 1,000 feet—is in the southeastern part of the island, extending from Jupiter River east to Shallop River; this region is characterized by rugged, immature topography and dendritic, swift, southward-flowing rivers with deep valleys. The northern and northeastern parts of the island, in contrast, have more mature northward-flowing rivers that are much longer and meander across wide flood plains bounded by gently sloping valleys in their lower reaches. Jupiter River is the only truly navigable stream and all others must be traversed on foot (see Marie-Victorin, 1938; Wilson, 1942; Rousseau, 1950)[1].

The island is composed of relatively undeformed limestone formations of Ordovician and Silurian age. These outcrop in eastward-trending belts, with the strata dipping southward towards the Gulf of St. Lawrence. Previous investigations of these rocks have been confined principally to shoreline traverses and short trips into the interior on a few of the major rivers. The ground cover is such that exposures were limited to these locations. In recent years much of the interior of the western half of Anticosti Island has been made more accessible through the construction of many miles of logging roads by the paper company. The main and secondary roads referred to in this report are shown on the map of Anticosti Island that accompanies a paper by Bolton and Lee (1960).

Field Work and Acknowledgments

This report summarizes field work initiated in 1957 along Salmon River in the eastern part of the island and continued in

[1] Names and dates in parentheses are those of publications listed in the References.

the western half in 1958. It also incorporates information from surveys undertaken in 1941 along Jupiter River by J.F. Caley and F.H. McLearn, and in 1942 along the coast between Oil River and Southeast Point by H.W. Fairbairn. The rock units recognized on the island and the lateral variations present are described here; detailed palaeontological studies are in progress.

Competent field assistance was provided in 1957 by W.W. Williamson, J.R. Wood, and D.H. Watkinson, and in 1958 by P.K. Lee. Permission to undertake geological field work on Anticosti Island was kindly granted by the Consolidated Paper Corporation Limited; the assistance and advice of C.G. Savage, J.T. Smith, and C. McCormick are gratefully acknowledged.

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STRATIGRAPHY

Exposed on Anticosti Island is the most complete sequence of Upper Ordovician and Silurian strata in eastern North America. Schuchert and Twenhofel (1910) and Twenhofel (1914, 1921, 1928) divided the Ordovician strata into, in ascending order, the Macasty, English Head, Vauréal, and Ellis Bay Formations, and divided the Silurian strata into the Becscie, Gun River, Jupiter, and Chicotte Formations. Basically these units were adopted in the present study, although a precise definition of the contacts bounding the various formations was in many cases difficult to formulate; each of Twenhofel's formations was primarily a grouping of faunal zones and not necessarily a distinct rock unit. Most contacts were arbitrarily chosen, but once defined, an effort was made to apply the same criteria wherever possible. The most accurate and most easily recognized contact is that between the dense to fine-grained limestones of the Vauréal and the lower, green or blue-grey shales of the Ellis Bay Formation. The Ellis Bay Formation itself is the most distinctive of all the units with its various green shales, nodular limestones, bioherms, and overlying dense limestones—lithological units that persist over most of the island. A second useful and well-defined contact is that which separates the green, nodular Becscie shales from the overlying brown, dense limestones of the Gun River Formation.

All structural determinations and estimated thicknesses are based on these particular elements. The calculated and observed strikes range between N70 and N85° W and the dips between 1/2 and 2° SW. Rapid variations in strike and dip were noted over local biohermal developments in both Vauréal and Ellis Bay strata. There the dips range between 3 and 7° SW, with quaquaversal dips from 18° SW to 18° NE, and strikes between N60 and N45° W.

Ordovician

Macasty Black Shale

Large quantities of black, highly bituminous shale, loose along the beach between English Head and Macasty Bay, were assigned to the Macasty Formation by Schuchert and Twenhofel (1910, p. 693). Although no black shale was exposed on the island, these workers believed that the Macasty Formation was present beneath the waters of the Jacques Cartier passage immediately north of the island, only a short distance beneath the oldest outcropping Ordovician strata.

Many large well-rounded pebbles and cobbles of black bituminous shale were collected along the shore at Grand Ruisseau and smaller pebbles were taken from the beach gravels of Petite Macasty Bay. In addition, flat smooth fragments of graptolitic black shale up to 10 inches in diameter were found in the glacial deposits of the western half of the island (Bolton and Lee, 1960, p. 70). The graptolites Climacograptus typicalis var. magnificus Twenhofel, Orthograptus sp., and didymograptids, the brachiopod Leptobolus insignis Hall, the cephalopod Geisonoceras sp., and the trilobite Triarthrus becki var. macastyensis Twenhofel, were found in association in many of the Macasty shale samples.

English Head and Vauréal Formations

Twenhofel (1928, pp. 23, 38) defined the lowest exposed Ordovician strata—the English Head Formation—to consist of 228 feet of alternating blue, grey, and green shales, and argillaceous and other fossiliferous limestones with abundant intraformational conglomerates throughout. He designated the exposures in and about English Head at the west of the island as the type section. The uppermost 86 feet of the formation, however, was described from strata exposed between English Head and Macasty Bay. The top of the formation was considered to be a 6-inch bed of fine-grained, subcrystalline limestone whose upper surface was covered with Saerichnites abruptus Billings. This 'track bed' was traced by Twenhofel from Baie Ste. Claire east about 75 miles to Observation Cliff.

The name Vauréal Formation (Twenhofel, 1921, pp. 4, 5; 1928, pp. 23, 43) was proposed for lithologically similar strata that follow the English Head without lithologic or stratigraphic break, and the incomplete 541-foot-thick section on Vauréal River was designated the type (Twenhofel, 1921, p. 4). Twenhofel determined that 730 feet of strata separated the English Head and Ellis Bay on the exposures along the coast between Baie Ste. Claire and Junction Cliff at the western end of the island, and over 900 feet separated these formations in the northeastern shore exposures. Accordingly, the minimum thickness of the combined English Head and Vauréal would be 958 feet.

The 'tracks' or Saerichnites abruptus are present at many horizons along the tidal-flat exposures at both Macasty Bay and the stratigraphically higher Petite Macasty Bay. Twenhofel's 'track bed' exposed 'at the back' of Baie Ste. Claire is stratigraphically about 480 feet above the Macasty 'track beds' and at least 445 feet below the Vauréal - Ellis Bay contact at Junction Cliff. Other track beds were found at an elevation of 60 feet on Trois Ruisseaux, at Bay Martin throughout 50 feet of strata, at the 50-foot elevation on Oil River, and at the 450-foot elevation in exposures east of the Oil River bridge, well up in Vauréal strata. Since a single bed does not exist, this feature cannot be used to define a formational boundary.

No definite lithological separation is possible between the northern exposures of 'English Head' and Vauréal strata. The 80 feet of rock exposed in the lower reaches of Oil River commences at the mouth of the river with a thin unit of grey fine-grained limestone with much conglomerate, composed of angular pebbles up to 8 by 6 inches in size, and interbedded shale. This unit passes upward into blue-grey shale with fine-grained limestone nodules, lenses, and interbeds up to 8 inches thick. The strata overlying a 'track bed' located at an elevation of 50 feet consists of bluish grey, fine-grained limestone with limestone pebbles and grey shale interbeds; this is the base of Twenhofel's Vauréal at this locality. Grey shales and interbedded limestone similar to those on Oil River form a 45-foot exposure to the east on the Havre Girard road, and to the west in the shore cliff on the Havre du Brick road. Farther west on Trois Ruisseaux, a 65-foot unit could be equivalent to the 'English Head'. It consists of argillaceous limestone, dense to fine-grained limestone with shale partings, and blue-grey shale with limestone interbeds and nodules, with a track bed at the top. These 'track-bed' and/or poorly

lithologically defined contacts are presumed to be equivalent. Each contact is between 900 and 925 feet below the base of the Ellis Bay Formation. Thus the exposed thickness of the English Head and Vaureal Formations seems to be more than 1,000 feet.

The lowermost 200 feet of the Vauréal part of this sequence in the Oil River exposures consists of blue-grey to reddish grey or brown, fine-grained to dense limestone with abundant intraformational conglomerate and interbedded grey shale, grading upward into grey shale with limestone interbeds or nodular limestone. This sequence is overlain by thin- to thick-bedded, brown, dense limestone and/or grey, fine-grained limestone with shale interbeds, partings, and nodular limestone. Organic concentrations (bioherms?) composed principally of large and small colonies of Palaeophyllum vaurealensis Twenhofel with a few favositids, Catenipora sp., and Streptelasma angulatum (Billings), overlain by irregularly bedded, grey and brown, dense to granular limestone with shale partings were recognized on Oil River, upstream from the junction of the East Branch and along the main highway west of Oil River between 625 and 650 feet above the base. Other concentrations were outlined farther east; at the main highway and Jupiter River road junction, on the Jupiter River road near the crossing of East Branch of Oil River at 125 to 135 feet below the Ellis Bay contact; and to the west on the main highway 6 1/2 miles from Port Menier, 165 feet below the Ellis Bay contact. Quaquaversal dips, presumably over bioherms, were noted in exposures along the main highway at its junction with the Bay Martin road east of Lac Ste. Marie, 500 to 525 feet above the base of the Vauréal, and in exposures more than 1 mile west of, and 3 miles east of, the Jupiter River road junction.

The upper beds of the Vauréal are principally thin-bedded, grey-blue to brown-weathered, fine-grained to granular limestone with much intraformational conglomerate, and some lenses or interbeds of brown, dense to semilithographic limestone with greenish argillaceous partings. The clay content increases as the Ellis Bay contact is approached and the uppermost beds are almost a nodular limestone. The Vauréal - Ellis Bay relationship was studied at six localities: at Junction Cliff; in a creek bank southeast of Port Menier airstrip; on the Ste. Marie River road near the fire tower; on the Jupiter River road 2 miles south of the main highway; in exposures on a tote road east of the Jupiter River road; and 1.8 miles south of the main highway on a tote road starting 3 miles east of the Jupiter River road junction. The contact is conformable and is drawn between argillaceous limestones and alternating green fossiliferous shales and thin beds of pale grey to brown nodular limestones characteristic of Twenhofel's lowest Ellis Bay zone.

In the Salmon River area, the green shales of the basal Ellis Bay are about 1 3/4 miles upriver; in the interval between these shales and the coastal sections that extend from the mouth of Salmon River east to Battery Point, at least 60 feet of Vauréal argillaceous limestone is exposed. In all some 90 feet of thin- to thick-bedded, grey-brown argillaceous limestone with lenses of grey-brown granular limestone and interbedded grey shales form Harvey Point to the west of Salmon River. The shale content is higher in these sections than in the upper Vauréal strata exposed in the western half

oi Anticosti Island. According to Twenhofel (1928, p. 43), sandy shale and impure limestone are characteristic of the upper Vauréal beds exposed farther east on the west side of Point Joseph.

Fossils are sporadic throughout the English Head - Vauréal strata, with the greatest concentrations in the shales or argillaceous limestones. The argillaceous 'English Head' beds of Oil River and region are characterized by an abundance of pelecypods—Cyrtodonta anticostiensis (Billings), Cyrtodontula sigmoidea (Billings), Rhytimya emma (Billings)—and the crinoid Dendrocrinus minutus Springer. The Vauréal fauna as herein defined would include the fauna from the type section of the English Head Formation. This fauna was considered to be of Upper Ordovician Covingtonian age by Sinclair (1956, p. 1734) rather than of Richmond age as determined by Twenhofel (1928, p. 63). A facies relationship may be the answer to many of the similarities and anomalies that are present in the Vauréal and 'English Head' faunas.

Ellis Bay Formation

In the Junction Cliff - Ellis Bay area at the western end of Anticosti Island, the Vauréal is overlain by a thick sequence of blue and grey shales with interbeds of argillaceous limestone and units of bluish grey limestone and shale. Distinctive nodular shale and limestone units are present in the middle of this sequence, and biohermal limestones can be identified in the upper part. This sequence of rocks, at least 200 feet thick, was combined in the Ellis Bay Formation by Twenhofel (1928, pp. 24, 47). The 300-foot-thick section assigned to this formation at the northeastern end of the island, in contrast, contained units of quartz sandstones up to 20 feet thick. The top of the formation represented the Ordovician-Silurian boundary. As the succeeding deposits began with conglomerates and as many of the surfaces were ripple-marked, Twenhofel (1928, p. 25) concluded that there was either a break in deposition or a decided shallowing of the waters at the close of the Ordovician.

Composite sections of the Ellis Bay were measured at these localities during the present investigation: at the west end of the island, both between Junction Cliff and Cape Henry and along the eastern shore of Ellis Bay from Port Menier to beyond Bear Cape (180 to 240 feet thick); inland south along the Ste. Marie River road (175 feet thick) and the Jupiter River road (190 feet thick); and in the east along Salmon River (315 feet thick). An additional section, more than 200 feet thick, was compiled south along the tote road 3 miles east of the Jupiter River road junction.

The amount of shale present in the Ellis Bay at any one stratigraphic level varies considerably, although certain horizons appear fairly constant. In all exposures, the basal unit consists of from 22 to 40 feet of green and grey shale with nodular limestone and thin interbeds and lenses of grey argillaceous limestone. The overlying strata vary vertically and laterally from thin- to thick-bedded, blue-grey, fine-grained limestone with intraformational conglomerates, to brown, dense to semilithographic limestone with argillaceous partings, to green, calcareous shale interbeds and units with nodules and lenses

of blue-grey to grey, fine-grained argillaceous limestone. Shale units up to 10 feet thick are present between 45 and 75 feet above the base of the formation southeast of Petite Lac Ste. Marie, a distinctive 8-foot-thick green nodular shale-limestone unit is exposed at two localities on the Jupiter River road 45 feet above the base, and an abundance of shale partings, interbeds, and nodular units characterize the Salmon River sections 50 to 90 feet above the base. A distinct, fossiliferous, green nodular limestone-shale unit, which apparently corresponds to Twenhofel's 12-foot-thick 'zone 7' as defined at Point Laframboise and on Ellis Bay east of Port Menier, was recognized in all sections studied. It is 17 feet thick and lies 120 feet above the base of the Ellis Bay Formation on the Ste. Marie River road southwest of Petite Lac Ste. Marie, 7 feet thick and 105 feet above the base on the Jupiter River road 2 1/2 miles south of the East Branch of Oil River, 13 feet thick and 138 feet above the base on the tote road 3 miles east of Jupiter River road junction, and up to 18 feet thick and between 110 and 125 feet above the base on Salmon River.

Nearly structureless, isolated bioherms, up to 10 feet high and 7 feet wide, are present at Point Laframboise and on the west side of Ellis Bay, 175 feet above the base of the Ellis Bay Formation. The thin-bedded limestones underlying these bioherms generally are bowed down, and concentrations of grey and green shale were noted directly underneath, in hollows along the irregular edges, and within these organic masses. Many small colonies of halysitids, heliolitids, and favositids characterize these structures. Draping and resultant quaquaversal dips are evident in the thin-bedded limestones overlying these bioherms, up to 5 feet above their crests. Similar warping above and below the bioherms was evident in another biohermal complex exposed along Salmon River, between 6 and 8 miles upriver. These masses, also 175 feet above the base, are between 100 to 180 feet long, with a maximum length of 370 feet, and 5 to 12 feet high, with a maximum height of 17 feet. They are composed of grey to brown, fine- to medium-grained argillaceous limestone with many large and small colonies of Palaeophyllum vaurealensis Twenhofel, heliolitids, favositids, halysitids, rugose corals, and stromatoporoids. Laterally the bioherms pass into 3 to 5 feet of thick-bedded, brown, dense limestone. Beds near the edge of the masses are commonly fossiliferous, argillaceous, and contain much limestone conglomerate. A small coral concentration overlying the uppermost nodular unit on the Ste. Marie River road, and large Palaeophyllum colonies combined with some suggestion of draping 30 feet below the Becscie contact on the Jupiter River road, were the only other possible biohermal complexes identified during the present survey. Twenhofel (1921, p. 6) reported the presence of a 4-foot-thick coral-reef limestone in the Vauréal River exposures, but this is only 77 feet above the base of the Ellis Bay Formation.

Above the biohermal zone, the 50 to 120 feet of strata that forms the uppermost Ellis Bay comprises mainly thick- to thin-bedded, brown, dense to semilithographic limestones with interbeds of blue-grey, fine-grained to granular limestone. Lenses or beds of limestone conglomerate, some reddish tinged, are abundant in the upper part of this unit. One thin sandy bed was found near the top of the formation in the Salmon River sections. About 12 miles east, in contrast, the Cape James section as described by Twenhofel and Fairbairn is predominantly sandstone.

The Ellis Bay - Becscie contact is difficult to recognize as there is only a very gradual change in lithology from one unit to another. On Salmon River the contact delineated near the top of the major falls about 12 miles above the mouth was defined more on the lowest occurrence of the bryozoan Phaenopora superba (Billings) and a change in faunal content than by any marked lithological differences. Thus defined, the position of this contact could vary easily from section to section. Nevertheless, the occurrence of this bryozoan coincides with the minor differences in lithology associated with this contact in the western exposures. The actual contact recognized in the Ste. Marie River road 1.4 miles southwest of Petite Lac Ste. Marie is reasonably precise. Dense to fine-grained limestone with abundant reddish tinged conglomerate is overlain by even, thin-bedded, pale grey to blue-grey granular limestone with much conglomerate. A similar lithologic sequence was recognized in the Jupiter River road sections.

The fossiliferous lower shales and higher dense limestones of the Ellis Bay Formation are characterized by an abundance of the brachiopods Vellamo diversa (Shaler), Dinorthis (Plaesiomys) anticostiensis (Shaler), Hindella umbonata (Billings), H. prinstana (Billings), Hesperorthis laurentina (Billings), and Plectatrypa marginalis (Dalman), and the trilobite Chasmops anticostiensis Twenhofel. The nodular shale units also contain the brachiopods Parastrophinella reversa (Billings), Leptaena spp., and Sowerbyella spp., the gastropods Hormotoma gigantea (Billings), Lophospira? papillosa (Billings), and Subulites ellisensis Twenhofel, and the cephalopod Billingsites anticostiensis (Billings). Pockets of Leptaena sp. and Parastrophinella reversa occur throughout the limestones overlying the biohermal zone.

Silurian

Becscie Formation

At least 200 feet of yellowish grey, compact and granular limestones with argillaceous partings and thin shale bands overlies the Ellis Bay Formation along the southwestern and eastern coasts of Anticosti Island. These rocks were assigned to the Becscie River or Becscie Formation by Twenhofel (Schuchert and Twenhofel, 1910, p. 705; Twenhofel, 1928, pp. 25, 54), with the type section in Becscie River bay. The basal beds of this initial formation of the Silurian contained an abundance of limestone pebbles and boulders and showed other evidence of very shallow conditions, so that the strata were thought to lie disconformably on those of the Ellis Bay.

The Becscie Formation was examined in the Ste. Marie River road (lower 40 feet) and Jupiter River road (265 feet thick), as well as in the Jupiter River valley (uppermost 160 feet) and Salmon River valley (more than 230 feet). There was no evidence in any of those sections of a major structural or depositional break separating the Becscie from the underlying Ellis Bay or the overlying Gun River Formation. In its western exposures the Becscie is principally a

thick- to thin-bedded, pale whitish grey to blue-grey, fine-grained to granular limestone with an abundance of intraformational conglomerate throughout, some reddish tinged limestone and lenses of thin-bedded, dense limestone. A pale buff to whitish grey conglomerate is present in the basal beds of the Ste. Marie River road section like that noted in the base of the Becscie on Salmon River.

In its western exposures, there is little shale in the lower half of the Becscie. There is a gradual increase upward of shale partings and in the amount of argillaceous material present in the grey, fine-grained limestones exposed in the Jupiter River road section. The uppermost 23 to 29 feet of Becscie in this section is composed of fossiliferous green shale with limestone nodules to nodular limestone. A similar unit was described by Twenhofel in the upper Becscie at the east end of the island. The Becscie - Gun River contact is arbitrarily drawn at the top of this shale unit. Lithologically, the limestones are similar in the Becscie exposures along Salmon River. Thin- to thick-bedded, brown and grey, fine-grained to granular fossiliferous limestones with conglomerate alternates with brown, dense nodular limestone in the middle of the formation, and the shale content increases upward more than in the west.

The Becscie is locally extremely fossiliferous. Colonies of the bryozoan Phaenopora superba (Billings) are abundant throughout the formation and concentrations of the brachiopod Virgiana barrandei (Billings) commence about 15 feet above the base. The algae Cyclocrinus and coral colonies are very numerous in the argillaceous beds on Salmon River. The Clinton ostracods Bolbineossia and Zygobolba were found in argillaceous limestones 60 feet below the Gun River contact in the Jupiter River section. According to Ulrich and Bassler (1923, p. 369) the genus Zygobolba appears for the first time in the basal zone of the Gun River Formation, below the Z. anticostiensis zone.

Gun River and Jupiter Formations

A sequence of thin-bedded, ash-grey to yellowish white fossiliferous limestones grading upward into inter-bedded compact limestone and shale with abundant coral colonies or 'reefs' and intraformational conglomerates is exposed along the south shore from Point Ste. Anne east to within 1 mile of Jupiter River. These limestones were combined in the Gun River Formation by Schuchert and Twenhofel (1910, p. 708) and Twenhofel (1928, pp. 25, 56). The type locality was designated as Gun River, and the formation described as being between 308 and 343 feet thick.

Rocks overlying the Gun River on the south coast, from west of Jupiter River east to near Southwest Point and at 'The Jumpers', were assigned to the Jupiter River or Jupiter Formation (Schuchert and Twenhofel, 1910, p. 713; Twenhofel, 1928, pp. 26, 58); the high cliffs about the mouth of Jupiter River were designated the type. As defined, the Jupiter differed from the Gun River in the even character of its bedding and the absence of conglomerates. Thin-bedded, ash-grey and reddish grey limestone with interbeds and partings of grey

fossiliferous shale graded upward into light green, blue or grey, calcareous fossiliferous shales and soft limestones, capped by compact limestone. In the eastern exposures, an extensive coral reef succeeded by limestones was described from near the base of the Jupiter Formation. Thickness was estimated at 593 feet.

The Becscie - Gun River contact, as defined during the present survey on the Jupiter River road and in the Jupiter River valley 14 to 22 miles above the river mouth is transitional. A basal 1-foot bed of grey argillaceous limestone is overlain by between 14 and 16.5 feet of even-bedded, brownish grey, dense to semilithographic limestone with vertical jointing. This brown limestone and the green shale-limestone contact were the only truly distinctive horizon markers recognized in the entire Silurian sequence. Buff-weathered, brown arenaceous (?) limestones with abundant intraformational conglomerate but lacking organic 'reefs' are characteristic of the upper half of the formation, and the uppermost 100 feet consists mainly of thin-bedded to platy, grey crystalline limestones with thin interbeds and partings of green, calcareous hard shale and some intraformational conglomerate. The highest occurrence of intraformational conglomerate, about 6 miles from the mouth of Jupiter River, may mark the contact between the Gun River and Jupiter Formations.

The equivalents of Jupiter zones 1 to 5 that are exposed on the lower reaches of Jupiter River and in the coastal cliffs east and west of the mouth consist, in ascending order, of alternating thin-bedded, grey, dense limestone and soft grey shale; thin-bedded, greenish grey, compact, dense, calcareous shale to argillaceous limestone with thin lenses of crinoidal limestones; green soft shale; cliff-forming, bluish grey, compact, dense, conchoidal-fracturing, calcareous shale; and limy shale or shaly limestone. Thickness of the combined Gun River and Jupiter Formations is at least 1,000 feet.

Both the Gun River and Jupiter are highly fossiliferous. In addition to the great profusion of corals, the formations are characterized by an abundance of the brachiopods Brachyprion leda (Billings), B. robustum Twenhofel, Coelospira hemispherica (Sowerby), Fenestriorostra glacialis (Billings), Hyattidina congesta junea (Billings), Triplesia anticostiensis Twenhofel, Virgiana barrandei (Billings), the trilobite Phacops orestes Billings, and numerous species of the ostracod Zygobolba.

Chicotte Formation

Along the southern shore of Anticosti Island, between Southwest Point and Rivière du Pavillon, heavily bedded, grey and white, coarsely granular, crystalline and crinoidal 'inter-reef' limestones and massive 'coral-reef' limestones overlie the Jupiter Formation with sharp contact. These were designated the Chicotte Formation, the type section being on and in the cliffs westward from Chicotte River. Beds are extremely undulating with dips up to 25°S in the coastal exposures. Total thickness is estimated at 73 feet.

Pleistocene

The glacial and marine post-glacial deposits of Anticosti Island have recently been described by Bolton and Lee (1960). A thin veneer of glacial deposits covers all the land above the 250-foot elevation. This glacial till is composed mainly of pebbles and cobbles of limestone, similar in lithology to the underlying bedrock, embedded in a clay or silt matrix. Small amounts of flat smooth fragments of black shale (Macasty) and boulders of Precambrian rocks, ranging from acidic to basic in composition, are also present in the till. Glacial striations, scalloping, and fluting were recognized in some areas. In the western half of the island a discontinuous sheet of stratified sediments containing marine fossils blankets the island below the 250-foot elevation. From limited observations in the eastern half, it was concluded that the upper limit of post-glacial marine inundation was 250 feet. During this inundation a major marine channel extended across the island from Bay Martin on the north coast southward down the complete length of the present Ste. Marie River valley. Abandoned shoreline features rim many of the present embayments along the north coast of the island, and at least two series of abandoned shorelines could be delineated in the western end.

- APPENDIX -

Composite Section - across Anticosti Island from mouth of Oil River, south down the Jupiter River road and Jupiter River to its mouth.

Lithology	Thickness (feet)	Height Above Base (feet)
Gun River and Jupiter Formations		
Shale, bluish grey, calcareous, compact, conchoidal-fracturing; Monograptus clintonensis	60+	2,292-2,302+
Shale, green to greenish grey, calcareous...	75	
Limestone, greenish grey, compact, dense, argillaceous; some crinoidal limestone, red and green, crystalline, thick-bedded..	10	
Shale, greenish grey, and interbedded limestone, grey, dense, evenly thin-bedded; corals abundant	22	
Limestone, grey, crystalline, irregularly bedded, very fossiliferous; underlain by dense, grey limestone without fossils	30	
Covered interval	180	
Limestone, grey, crystalline, thin-bedded to platy with up to 2 1/2-foot beds to partings of green calcareous shale to nodular limestone; fossiliferous Pentamerus beds; conglomerate, some pieces standing on end in the limestone layers; strike east, dip 2 to 3°S	15	
Limestone, grey and weathering greenish grey, more massive bedded, hard and crystalline with little or no shale in lower half; several conglomerate zones	80	
Limestone, grey, 2- to 8-inch beds, some shale partings and hard nodular calcareous shale to argillaceous limestone near top; conglomerate throughout; fossiliferous	155	
Limestone, brownish grey, fine-grained to dense; conglomerate beds; corals	166	

Lithology	Thickness (feet)	Height Above Base (feet)
Limestone, brown, arenaceous or calcareous sandstone; vertical jointing	19	
Limestone, brownish grey, dense to semilithographic, evenly thin-bedded; vertical jointing; basal 1-foot argillaceous; upper beds more evenly bedded, fine-grained limestone with few pebbles; coral zone near top in more crystalline limestone.	15	
Becscie Formation		
Shale, green, calcareous, to nodular limestone with thin rubbly limestone layers; very fossiliferous.....	20-30	1,465-1,475
Limestone, brown to grey, fine-grained, thick-bedded, argillaceous with green shale partings; shale content increases upward; many corals and stromatoporoids; Virgiana sp.; Zygobolba sp. 15 feet above base.....	50	
Limestone, grey, fine-grained, thin-bedded; much argillaceous partings and conglomerate; lenses of brown granular limestone with Virgiana sp.....	15	
Limestone, grey, thin- to thick-bedded; 3- to 4-foot-thick 'coral reef' 52 feet above base; Virgiana beds; base of section exposed in southwest bank of Jupiter River 1 1/2 miles above '24-mile Lodge'	75	
Covered interval.....	15	
Limestone, grey, fine-grained; some conglomerate and thin lenses of dense argillaceous limestone	40	
Limestone, grey and weathering brown, fine-grained to granular with much conglomerate grading upward into limestone, yellowish grey, fine-grained, evenly bedded with lenses of dense limestone containing abundant conglomerate; Coelospira sp. 10		

Lithology	Thickness (feet)	Height Above Base (feet)
feet above base; Phenopora superba throughout	50	
Ellis Bay Formation		
Limestone, grey and brown-weathering, very fine grained to granular, platy to thick-bedded; some lenses of crystalline limestone; much conglomerate, particularly in fine-grained, grey limestone near upper contact; Palaeophyllum colonies and suggestion of draping; contact 4 miles south of East Branch of Oil River	32	1,200
Limestone, grey, fine-grained in lower part grading upward into grey, buff- to brown-weathering, very fine grained to dense, thin- to thick-bedded limestone; brachiopod concentrations	45	
Limestone, nodular to green shale; some thin-bedded, grey-green argillaceous limestone particularly near top of unit; very fossiliferous — Hormotoma gigantea	7+	
Limestone, grey, fine-grained to dense, thin-bedded, argillaceous, grading upward into grey and weathering brown, dense to semilithographic, thin- to thick-bedded limestone; argillaceous partings and interbeds of grey, fine-grained limestone	46	
Limestone, nodular, grey and weathering buff, and interbedded green shale	6	
Limestone, grey, fine-grained to dense, thin-bedded, argillaceous	4	
Limestone, nodular, grey and weathering brown, fine-grained, argillaceous, with green shale; very fossiliferous	7	
Limestone, grey and weathering brown, dense to very fine grained, thin- to thick-bedded; more argillaceous, fine-grained, thin-bedded limestone near top; abundant brachiopods	20	

Lithology	Thickness (feet)	Height Above Base (feet)
Shale, green or blue-grey, fossiliferous, with nodular limestone; a few thin beds of grey, fine-grained limestone; very fossiliferous	23	
English Head and Vauréal Formations		
Limestone, grey and weathering brown, dense to fine-grained; argillaceous partings and conglomerate throughout; thicker-bedded, blue-grey, fine-grained limestone with corals, overlain by thinner-bedded, brown, dense to semilithographic limestone or fine-grained limestone with conglomerate 27 feet above base (exposure at junction of main highway and Jupiter River road); upper 15 feet argillaceous, nearly a nodular limestone	130	1,010
Limestone, grey and weathering brown, interbedded granular and dense, thick- to thin-bedded; much conglomerate and argillaceous partings; Palaeophyllum vaurealensis colonies near top	20	
Limestone, blue-grey and weathering brown, fine-grained, thick-bedded; argillaceous partings; composite section from this level up derived from rocks exposed on main highway east of Oil River and south on Jupiter River road	60	
Limestone, grey and weathering brown, dense to granular, irregularly bedded; exposed in cliffs along Oil River 2 1/2 miles above bridge	45	
Limestone, yellowish grey to blue-grey and weathering brown, dense, thick-bedded; argillaceous partings; interbeds and lenses of very thin bedded, fine-grained, argillaceous limestone to thicker-bedded, blue-grey, fine-grained limestone with conglomerate and shale, particularly in lower half; strike N45 to N55° W, dip 4 to 7° SW in equivalent beds overlying coralline facies on main highway 3 miles		

Lithology	Thickness (feet)	Height Above Base (feet)
west of bridge; this unit and underlying non-coralline facies also exposed in 100-foot falls on East Branch 2 miles from junction	20	
Limestone, grey, fine-grained to granular, thick-bedded, coralline facies; limestone, brown-weathered, dense, with little shale partings; exposed on Oil River 2 miles above bridge	30	
Limestone, dense, thin- to thick-bedded; some fine-grained limestone with conglomerate; shale partings and interbeds; exposed on Oil River above and below junction with East Branch	15	
Limestone, grey, fine-grained, thick- to thin-bedded; thin units of dense limestone; conglomerate throughout; Saerichnites sp. in basal bed on highway at top of hill east of bridge	10	
Limestone, dense, thick-bedded and inter-bedded grey shale grading upward into dense to fine-grained limestone with shale partings; some conglomerate; exposed on main highway east of bridge and in sections on Oil River between bridge and East Branch	45	
Covered interval	30	
Limestone, brown, dense, with argillaceous partings and lenses up to 6 inches thick of blue-grey, fine-grained limestone; a little conglomerate; exposed on river bank above bridge; strike N70 to N80° W, dip 4 to 7° SW	10	
Covered interval	20	
Shale, grey, grading upward through argillaceous limestone, grey, thin-bedded, into thicker-bedded limestone, grey and brown-weathering, fine-grained to dense with shale interbeds; exposed on main highway uphill east and west from bridge	128	

Lithology	Thickness (feet)	Height Above Base (feet)
Limestone, grey and weathering brown, 1- to 3-inch beds; grey shale partings and interbeds; some shale with nodular limestone; exposed at base of Oil River bridge	20	
Limestone, blue-grey, fine-grained, some nodular with grey and buff-weathering shale	15	
Covered interval	80	
Limestone, grey, fine-grained to dense, argillaceous, nodular and lenticular, and interbedded grey, buff-weathering shale	20	
Shale and nodular limestone; lenses of blue-grey, fine-grained limestone particularly in upper 20 feet	112	
Limestone, grey, fine-grained, lenticular	10	
Shale, grey, with interbedded limestone, grey, fine-grained; a little conglomerate	35	
Limestone, grey, fine-grained, 1- to 6-inch beds, and interbedded grey shale; much limestone conglomerate on bedding surfaces	75	
Shale, blue-grey; nodules, lenses, and interbeds of limestone, grey, fine-grained, thin- to thick-bedded; some intraformational conglomerate, with angular limestone pebbles up to 8 by 6 inches in size in lowest limestone beds; exposed from mouth of Oil River to near second bend, with supplementary 15-foot sections in cliffs at end of Havre Girard and Havre du Brick roads; base 30 feet above lowest Oil River exposures; Saerichnites abruptus at top; north shore 'English Head'	80	

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