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STRATIGRAPHY AND SEDIMENTOLOGY OF LOWER PALEOZOIC FORMATIONS NEAR PRINCE ALFRED BAY, DEVON ISLAND (59B)

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INTRODUCTION

Description of Report Area

The report area at Prince Alfred Bay (Fig. 1) comprises about 750 square miles and is centred about Arthur Pass (name subject to approval) which is in the isthmus connecting Grinnell Peninsula with the main part of Devon Island. The geographic centre of the report area is at Latitude 76°25'W, and Longitude 93°25'N.

The area is dominated by the Douro Range and the Grinnell Range (Fig. 1). The Douro Range was named by Capt. Sir Edward Belcher, C.B. (1855, p. 288). It extends from near the head of Arthur Fiord 30 miles towards the southeast where it merges with a high plateau. A second range that curves westward and northward for about 20 miles from the head of Arthur Fiord is the Grinnell Range (name subject to approval). On the south end of the Grinnell Range is a linear escarpment about 10 miles long, facing northeast and extending as far as a narrow high pass (Rainy Pass, name subject to approval). Another escarpment in the Grinnell Range faces west; it begins on the north side of the pass and continues farther to the north.

Belcher (1855, p. 288) considered that Grinnell Peninsula was separated from Devon Island by a strait which he called Arthur's Strait. This is in fact not a strait but a pass containing three fresh water lakes, two of which Belcher presumably mistook for arms of the sea. The truly marine northern part of Arthur's Strait came to be called Arthur Fiord, and the pass is now named Arthur Pass (name subject to approval).

A glance at the geological map (Map 000) and Fig. 2 will show the marked control that bedrock geology has on the physiography of the report area. The three escarpments, one in the Douro Range and two in the Grinnell Range, are each parallel to the strike of bedrock, and in each the steepest slopes are the

side on which beds are truncated. The ends of the three escarpments, which are the two passes, are the loci of cross-cutting faults. The crests of these escarpments are rather level. They are formed along the edges of upturned strata that strike parallel to them.

Two prominent mesas which constitute Pym Mountain and Anhydrite Mountain (name subject to approval), have their shapes largely controlled by bedrock. Each is capped by a resistant limestone that forms a ledge, because it is underlain by a recessive anhydrite and gypsum unit. Apart from these three escarpments and two mesas the topography is subdued, and slopes gently to sea.

The report area is being modified by the present erosional cycle and no observable remnants of an earlier cycle are present. The area has an overall aspect of maturity because of drainage density (Fig. 1), but many individual streams are not graded; this is the result of incomplete adjustment to bedrock structures. The master streams, such as Sutherland River, tend to run southward through the Douro Range, and were superposed on the bedrock structure, possibly after the latest period of glaciation. The tributaries of these streams commonly flow parallel to the strike of the escarpments and in places form a trellis drainage pattern.

The present erosional cycle appears to typify a polar arid cycle more than a humid cycle. The alluvial fans extending southwest from the Douro Range for example have coalesced in some places to form pediments. The distal ends of these fans have been reworked into beach ridges or berms by wave action in Prince Alfred Bay. Commonly these beach ridges comprise broad bands up to two miles wide. Interaction of glacial rebound and depositional progradation of the shoreline has probably formed these strandplains.

In most of the study area the surface consists of exposed bedrock, felsenmeer, or solifluction material. As a result the area is quite barren and plant and animal life is sparse. Vegetation which consists of the dwarf varieties typical of the Arctic Islands (Porsild, 1957) is mainly restricted to flat low-lying regions where soil has had an opportunity to form. During July and August a great variety of arctic flowers appear, notably Purple Saxifrage, and Mountain Avens (Dryas). Of the land mammals, fox and lemming are the only ones which are common in the area. In the summer of 1971, during which the report area was traversed extensively, the count of other land mammals included 3 muskoxen, 2 wolves, 3 Arctic hare, and perhaps 10 caribou. Sea life on the other hand is prolific. Numerous seals were seen in all surrounding waters, and a herd of some 70 walrus habitually inhabited Arthur Fiord. Polar bears were seen occasionally, and apparently use Arthur Pass as a summer migration route from south to north. Bird life also is abundant, and consists of mainly migratory varieties such as gulls, jaegers, and other small shore birds. A few ptarmigan were seen.

Previous Work

The expedition under the command of Sir Edward Belcher in the years of 1852-53-54 traversed the report area in search of the lost Franklin Expedition. Belcher's party made notes on the geology, applied most of the existing geographical names, and climbed some of the peaks in the region. Fossils collected south of the report area at the mouth of Wellington Channel by other British expeditions of 1850 and 1851 were described by Salter (1853). Fossils collected by the Belcher Expedition on and near Grinnell Peninsula were described also by Salter in an appendix to Belcher's narrative (Belcher, 1855).

The history of geographical discovery and exploration of Devon and other Arctic Islands up to the 1940's is discussed by Taylor (1964). After Belcher, no further geological observations were made in the report area until 1955, when R. Thorsteinsson, assisted by J.W. Kerr studied the Douro Range as part of Operation Franklin, of the Geological Survey of Canada (Fortier et al., 1963). In the course of this work Thorsteinsson (1963) described the geology around Prince Alfred Bay, in an area coinciding with most of the area of this study and named the Grinnell Thrust. He also established a basic Lower Paleozoic stratigraphic nomenclature that included four new formations, the Douro, Devon Island, Sutherland River, and Prince Alfred Formations.

Fossil collections made in 1955 by Thorsteinsson in the Sutherland River Formation of the Douro Range were described by Boucot et al. (1960). Since Operation Franklin, this part of Devon Island has not been the subject of any published geological studies until the present writers began their studies in 1971. Two short reports of field work have been published earlier (Kerr and Morrow, 1972; Kerr, Morrow, and Savigny, 1973). Much of the material contained herein is from the Ph.D. thesis written by Morrow at the University of Texas (Morrow, 1973). Previous discussions of the geology of Grinnell Peninsula were restricted to field observations made during reconnaissance mapping projects. Lithologic descriptions were extensive enough only to characterize map units as formations.

Objectives and Methods

The primary objectives of this report are: (a) to define more rigourously the lower Paleozoic formations that crop out in the Prince Alfred Bay area; (b) to discern the stratigraphic relations between these formations and between lithofacies within formations; (c) to suggest depositional models that account

for the attributes and distribution of these facies; and (d) to decipher the tectonic history of this area.

Secondary objectives include: (a) a description of diagenetic phases and a history of diagenesis, and (b) an evaluation of the economic potential of these lower Paleozoic formations.

Data from 9 measured sections and field mapping of the surrounding area (Fig. 1) provided basic information for this study. Formations in this sequence were subdivided into lithofacies with the aid of many cut and polished slabs and 293 thin sections stained with Alizarin Red-S. Alizarin Red-S provided routine discrimination of calcite versus dolomite in the method of Friedman (1959). X-ray diffraction powder patterns (Appendix I) served to confirm petrographic mineral identifications and to identify trace minerals such as clays.

X-ray fluorescence determinations of strontium and manganese were performed for 40 samples from the Allen Bay Formation and for 3 samples from the Devon Island Formation (Appendix II). Operating procedures and the theory of X-ray fluorescence have been outlined in many standard texts, such as that by Adler (1966). Several statistical techniques, notably trend surface analysis, were used to analyze X-ray fluorescence data. A trend surface program by O'Leary, Lippert and Spitz (1966), modified for use on the CDC6600 computer at the University of Texas at Austin, generated the trend surfaces.

Stable oxygen and carbon isotope determinations were obtained for 9 samples from the Allen Bay Formation from a Nuclide mass spectrometer.

Acknowledgements

The field phase of this study was conducted in the summer of 1971, and the writers are grateful to the other members of the field party for their capable contributions. The members of the party included R.E. Smith, A. Isherwood and J. Irish, geological assistants; G. Doat, and L. Kristjansson, pilots; the late R. Lanigan, engineer; L. Herchak, cook; and A. Doyle, radio operator.

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M.J. Copeland, B.S. Norford, A.W. Norris, R. Thorsteinsson and T.T. Uyeno of the Geological Survey of Canada made the formal identifications and datings of all fossil material in this study, apart from the algae.

STRATIGRAPHY

Introduction and Tectonic Setting

Six geological provinces occur in the Canadian Arctic Islands, and their aerial distributions are shown in Figure 3. The granitic and gneissic Canadian Shield exposed in the south and east underlies rocks of the younger provinces. Overlying and flanking the Shield is a broad expanse of relatively thin and undeformed late Proterozoic and lower Paleozoic sediments, the Central Stable

Region. The remaining four provinces constitute a continental margin type mobile belt that has a history of geosynclinal and orogenic development extending from late Proterozoic time to the present day.

The mobile belt is composed of three distinct geosynclines that developed one above the other. Sediments which formed the strata discussed in this report accumulated in the oldest of the three, the Franklinian Geosyncline. This elongate geosyncline contains rocks from late Proterozoic to Late Devonian age and has been divided into two parts. The southeastern part is the Franklinian Miogeosyncline which is separated from the age-equivalent Central Stable Region by a flexure. Gradual uniform subsidence across the miogeosyncline led to the development of a thick blanket of carbonate rocks on the miogeosynclinal shelf. Terrigenous sediments accumulated contemporaneously as slope deposits in a band along the northwest side of the Franklinian Miogeosyncline. The juncture between these slope deposits and the miogeosynclinal shelf deposits is shown on Figure 4 as a facies boundary (Thorsteinsson and Tozer, 1970). This juncture was also a line of flexure (Trettin, 1972) during deposition of the Franklinian Miogeosyncline. Northwest beyond the Franklinian Miogeosyncline on Ellesmere Island are the deep basinal terrigenous sediment infill and volcanic assemblages of the coeval Franklinian Eugeosyncline (Fig. 3). The outer slope of the Franklinian Miogeosyncline led down to the Hazen Trough (Trettin, 1972), a deep trough-shaped basin that was part of the Franklinian Eugeosyncline.

A younger geosyncline in the mobile belt is the Sverdrup Basin, a thick successor basin of Carboniferous to early Tertiary age. The Sverdrup Basin rests unconformably upon the deformed Franklinian Geosyncline and had its history terminated by the late Cretaceous to middle Tertiary Eurekan Orogeny. A Cenozoic geosyncline that is parallel to the earlier depositional basins

occupies the continental margin to the northwest, and overlaps the older provinces. Part of this geosyncline is above sea level as the Arctic Coastal Plain, whereas the rest of it extends down the continental slope and overlies oceanic crust.

The Boothia Uplift and the Cornwallis Fold Belt (Fig. 3) comprise a linear tectonic element that trends north, cutting diametrically across the miogeosyncline and stable region. The Boothia Uplift is an extension of the exposed crystalline rocks of the Canadian Shield and periodically was uplifted. The Cornwallis Fold Belt is composed of overlying strata in which north trending folds predominate. These resulted from periods of activity along the uplift. The three main pulses of uplift and folding of the Cornwallis Fold Belt took place in Devonian time, two in Early and one in Late Devonian time.

A synopsis of the formations cropping out in the report area is shown in Table I. The column includes a long and thick sequence of lower Paleozoic rocks extending from Middle Ordovician through Late Devonian time, and within which there are no major depositional breaks. A younger unit of uncertain age, that very tentatively is assigned to the Eureka Sound Formation, is part of an entirely different and younger sedimentary regime. ¶ The report area was part of the Franklinian Miogeosyncline during the entire period of deposition of Paleozoic rocks. This area lies on the predominantly carbonate side of the lower Paleozoic facies boundary in Figure 4. The Allen Bay, Cape Storm and Douro Formations, which are predominantly carbonates, have a shaly limestone equivalent, the Cape Phillips Formation on the other side of the facies boundary. The Cornwallis Fold Belt is very nearby to the west, and the uplift and deformation of that belt had an effect on Lower Devonian and younger rocks of the report area. Facies patterns in the Sutherland River, Prince Alfred, and Disappointment Bay Formations reflect the influence of the nearby Cornwallis Fold Belt as a sedimentary source.

The unconformities in Devonian rocks, which overstep westward, also are features marginal to the uplifted fold belt. The report area has a structural history of great complexity that resulted in a complicated array of folds and faults (Map 000). The area is dominated by a southeasterly trending anticlinal structure that has been breached by thrusts, notably the Grinnell Thrust (Thorsteinsson, 1963) and offset laterally by steep cross faults. It is part of the larger Douro Structural Wedge named by Fortier, (1963, Fig. 1) that extends from the western limit of the study area to and including all of Colin Archer Peninsula. The Douro Structural Wedge is an anomalous feature that warrants detailed analysis. This report deals with sediments that were deposited prior to deformations that produced the Douro Structural Wedge and associated structures, and for this reason the description and interpretation of structural features is left to a later paper. The exposure of lower Paleozoic rocks along the hanging walls of southeast trending thrusts provides a unique opportunity to examine what is essentially a dip section through the Franklinian Miogeosyncline.

Cornwallis Group

The oldest unit cropping out in the report area is the Cornwallis Group, which contains three formations. The Cornwallis originally was set up as a formation by Thorsteinsson and Fortier (1954), and a more comprehensive description was later given by Thorsteinsson (1958). Kerr (1967) elevated the Cornwallis to group status and erected three formations, including the Bay Fiord, Thumb Mountain and Irene Bay Formations in ascending order. All three are present in the report area but the Irene Bay is thin and discontinuous, and has been combined with the Thumb Mountain Formation on the geological map (Map 000).

Bay Fiord Formation

The Bay Fiord Formation is the lowermost formation of the Cornwallis Group. At its type section on central Ellesmere Island Kerr (1967) reported the formation to be 1,650 feet thick, and of Middle Ordovician age (about Ashby to Wilderness). At the base is 1,000 feet of limestone and anhydrite, argillaceous, fine grained, thin bedded, medium grey, weathering yellow grey. This grades upward to thinly bedded medium dark green, non-calcareous, shaly siltstone and shale, 650 feet thick.

The Bay Fiord Formation is exposed in three belts of outcrop in the report area. In the southern end of the Grinnell Range the formation is badly contorted and fault bounded on either side for most of its length. It comprises the core of a faulted anticline and is partly intrusive. An unfaulted contact with the overlying Thumb Mountain Formation is exposed in only one locality in this structure (Section 8), and this contact is conformable. Uppermost beds of the Bay Fiord Formation in this section are slightly dolomitic shale and siltstone, thin to medium bedded, greenish grey on both fresh and weathered surfaces. Underlying parts of the

formation that are more strongly contorted are limestone, thin bedded slightly greenish grey on fresh surfaces, weathering bright green, often mottled. Gypsum and anhydrite are exposed 5 miles to the northwest along strike. These rocks probably represent a still lower part of the Bay Fiord Formation which has intruded into the upper part.

The Bay Fiord Formation occurs in a second belt along the southwestern lower slopes at the base of the Douro Range northeast of Prince Alfred Bay. Because the unit is extremely recessive, exposures are very poor except for an excellent cross-section in Reid Creek, the best exposure, that was first reported by Thorsteinsson (1963), as part of the then undivided Cornwallis Formation. The oldest rocks of the Bay Fiord Formation exposed here are highly contorted gypsum-anhydrite, with minor shale, mudstone, and dolomite interbeds. This unit crops out over a breadth of about 1,000 feet, and is underlain by the Grinnell Thrust (Map). The main displacement on the Grinnell Thrust took place on a thin zone at the base resulting in a stratigraphic separation of about 6,000 feet. Devonian carbonate rocks comprise the footwall. At the base of the thrust exotic blocks of the underlying Devonian limestone footwall are incorporated into the contorted evaporite unit in the hanging wall. Contortion and brecciation of the gypsiferous unit due to its proximity to the fault precluded obtaining an accurate measure of thickness; however, the breadth of outcrop would suggest that it originally was at least several hundred feet thick.

The upper part of the Bay Fiord Formation is moderately recessive, thin-bedded, sooty-textured dolomite, and mudstone, that commonly displays greenish hues on fresh and weathered surfaces. Although there is no complete section of the Bay Fiord Formation exposed in the study area, it is

nevertheless clear that the sequence in the formation includes a gypsum-anhydrite unit that is overlain by the argillaceous and dolomitic mudstone. This succession is similar to the type section to the north on Ellesmere Island (Kerr, 1967) and to the south on Cornwallis Island (Thorsteinsson and Kerr, 1968).

The upper part of the Bay Fiord also is exposed in the cores of anticlines near Sections 1 and 2 southeast of the Douro Range (Map).

Thumb Mountain and Irene Bay Formations

Distribution, Thickness and Age

The Thumb Mountain and Irene Bay Formations have their type sections on central Ellesmere Island where they were named by Kerr (1967). At the type section the Thumb Mountain is 1,500 feet thick, and consists of buff-forming limestone, of Middle and Late Ordovician age. The Irene Bay Formation at the type section is 270 feet thick. It is a limestone with recessive weathering argillaceous interlayers, and is of late Ordovician age. It was shown by Kerr (1967), that the thickness of the Irene Bay Formation varies markedly, largely due to the gradual disappearance of the shaly interlayers. Where the shaly interlayers are absent and the Irene Bay Formation is thin, the Thumb Mountain Formation is correspondingly thicker. This same phenomenon exists in the present study area (Fig. 5), where the Irene Bay Formation is present locally, as a shaly facies which grades into the Thumb Mountain Formation. Because the Irene Bay Formation is thin and local, and grades into the Thumb Mountain Formation, the two formations are mapped (Octi on Map) and discussed together. The presence of the corals Bighornia sp. and ?Lobocorallium sp. (identified by B.S. Norford) in a sample taken 55 feet below the top of the Thumb Mountain Formation at

see Appendix V

Section 9 (GSC Loc. No. C-11939) suggests a Richmond age for the Irene Bay Formation and part of the Thumb Mountain Formation.

These formations crop out widely in the report area, but only two complete sections of this interval occur (Sections 7 and 8, Fig. 5). In some incomplete sections the base of the Thumb Mountain Formation is either unexposed or is disrupted by the Grinnell Thrust Fault. In others minor thrust faults splayed from the hanging wall of the Grinnell Thrust have increased the thickness of the Thumb Mountain Formation by repetition.

In the two unfaulted sections the intervals including the Thumb Mountain Formation and the Irene Bay Formation have a similar thickness, being 505 feet thick at Section 7 and 577 feet thick at Section 8 (Fig. 5). But even where it is possibly repeated or reduced tectonically, the thickness of the combined Thumb Mountain and Irene Bay Formations is fairly constant at 500 to 700 feet, approximately the same as the complete unfaulted succession. This similarity may indicate that most of the movement on the Grinnell Thrust Fault zone occurred below the Thumb Mountain Formation in the Bay Fiord Formation. Consequently, thrusting may have had very little effect on the apparent thickness of the Thumb Mountain Formation.

In the report area the Thumb Mountain Formation is typically a grey or brown, medium to thick bedded, commonly fossiliferous micrite that is more resistant than the overlying Allen Bay Formation or the underlying Bay Fiord Formation. On airphotos it is uniformly dark

grey. In many places it exhibits distinctive randomly oriented vermiform mottlings about 2 inches long, that are light grey to brownish orange.

Lithostratigraphy

Two distinct lithofacies comprise the Thumb Mountain Formation in the study area. The limestone lithofacies constitutes Sections 2, 7, and 8 and the upper part of Section 9 (Fig.5). It is brownish grey bioclastic limestone that is medium to thick bedded throughout, with rather uneven bed surfaces (Pl.Ia).

The basal 240 feet of Section 9 contains several 30- to 80-foot-thick intervals of thin to medium bedded brown dolomite (Pl.Ib) that are interbedded with medium bedded brownish grey limestone. Because this sequence more closely resembles the rest of the Thumb Mountain Formation than the underlying gypsiferous Bay Fiord Formation, it is named the dolomite lithofacies of the Thumb Mountain Formation. Fieldwork by the authors during the summer of 1972 revealed the presence of the dolomite lithofacies over most of Grinnell Peninsula.

LIMESTONE LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal allochems and biogenic constituents

Skeletal allochems constitute a major part of the limestone lithofacies of the Thumb Mountain Formation. Almost all of this material is bioclastic debris with an average grain size of less than 1 mm; however this lithofacies also contains some large, unfragmented *in situ*

colonial corals, large macluritid gastropods, and large straight cephalopods scattered throughout it. Commonly 3 or more different skeletal grain types occur together and are rather homogeneously distributed in samples of the Thumb Mountain Formation. Individual skeletal grains have a nearly random orientation (Pl.Ic), except for large gastropods and cephalopods, whose long dimensions are parallel to bedding.

Algae - Calcareous algae of various types are very abundant in the limestone lithofacies. Elongate globular cyclocrinitids which are probably green algae (*Chlorophycophyta*) of the family Dasycladaceae (Nitecki, 1970) are the most common variety. They appear to resemble *Cyclocrinites pyriformis* (Bassler). Fragments of cyclocrinitids occur sparsely or abundantly in association with all other common varieties of benthonic epifauna. Several horizons contain abundant packed, unfragmented cyclocrinitid dasyclad algae (Pl.Id). These relatively unabraded algae are probably a biocoenosis.

Much less abundant than dasycladacean algae is the Codiacean green alga *Garwoodia*. It commonly occurs as spheres 0.5 mm in diameter, composed of branching tubes radiating from the sphere centers (Pl.IIa). Large colonies of *Receptaculites* which may also be algae forms (Nitecki) are scattered throughout but are most common in the upper part of the Thumb Mountain Formation and in the Irene Bay Formation.

Pelmatozoans and ostracodes - Pelmatozoan and ostracode fragments (Pl.Ic) are very abundant and occur in association with all other skeletal grain types (Fig.5).

Gastropods and brachiopods - Gastropod (e.g. *Maclurites*)(Pl. Ic) and brachiopod fragments are moderately abundant in this facies (Fig. 5).

Corals - *In situ* colonies of colonial corals (e.g. *Catenipora*, *Favosites* and *Syringopora*) are sparsely scattered throughout this facies. Some solitary corals (e.g. *Bighornia*, *Lobocorallium*, *Calapoecia*, and streptelasmid corals) also occur.

Minor constituents - Trilobite, bryozoan, echinoid and cephalopod fragmental debris form minor contributions to the fauna of this facies (Fig. 5).

Non-skeletal allochems

Pellets - Pellets are the most abundant single constituent of the limestone lithofacies. Under the microscope they are almost invisible in transmitted light and therefore must be viewed in reflected light. They are slightly ellipsoidal and commonly well sorted, with an average length of 0.10 mm, ranging from about 0.05 to 0.15 mm. Most are densely packed (Pl. IIb) but they also occur sparsely scattered in micrite. Variations in pellet concentrations from densely packed to sparse occurs within some thin sections.

Most researchers (e.g. Logan, 1969) who have studied modern carbonate environments suggest that micritic pellets are formed by intraformational reworking of aragonite muds by burrowing and scavenging organisms--worms, mollusks, crustaceans, and fish. The fine particles are ingested, passed through the alimentary tract, agglutinated with organic mucous and extruded as soft faecal droppings.

Other mechanisms of pellet formation that have been proposed include intraformational reworking by mechanical agents and synsedimentary precipitation, accretion and agglutination (Illing, 1954). Lack of associated current structures argues against an intraformational reworking origin for pellets of the limestone lithofacies. A continuing process of precipitation, accretion and agglutination would produce pellets with poor rather than good sorting, as individual pellets presumably would be at different stages of development at any given time.

Gastropods, ostracodes, marine polychaete worms and a host of other invertebrates produce pellets in modern environments (Logan, 1969; Shinn, Lloyd, and Ginsberg, 1971). Almost all these organisms produce pellets much larger than the pellets observed here.

Ostracodes probably produced most of the pellets in the limestone lithofacies of the Thumb Mountain Formation. Modern ostracodes produce pellets about 1/4 the length of the animal itself (Delorme, per. comm.), and this is the approximate size relationship of ostracodes to pellets in the limestone lithofacies.

Intraclasts - Intraclasts in the limestone lithofacies occur only in Sections 9 and 8 and are absent in Sections 7 and 1. These intraclasts have the same lithology as the host rock and therefore probably have a local origin.

Most intraclasts in the limestone lithofacies are restricted to small areas less than 0.5 cm across. Rounded or angular, poorly sorted intraclasts, less than 1 mm long, are scattered or loosely packed in these areas (Pl. II C). Most of the micrite matrix between intraclasts

has been recrystallized to microspar. These intraclast-bearing areas of microspar and other microspar patches without intraclasts commonly have vague boundaries but some have sharp borders, and a few have circular to oval outlines (Pl. IId) several millimeters wide. The association of these features suggests that the activity of burrowers and bottom feeders disaggregated the sediment. The motion of burrowers may have induced caving of burrow walls. Conceivably these caved portions could have been rolled between the burrowing organism and the burrow walls to form partly rounded or bundled intraclasts.

A zone of relatively large, blocky but rounded, poorly sorted intraclasts ranging in size from 0.1 to 10 mm occurs in the middle of Section 9. These clasts float in a biopelmicrite matrix that has largely recrystallized to microspar. The orientation of matrix pellets and skeletal material forms vague flow lines that are parallel to clast outlines. These suggest that intense burrowing isolated unburrowed lumps in the sediment. Once formed, these unburrowed lumps tended to be pushed aside and rounded in the otherwise soft, already burrowed sediment. Continual disaggregation of lime mud by burrowers increased the permeability of the sediment rendering it more susceptible to aggradational recrystallization than unburrowed lime mud.

Orthochemical Constituents

Micrite and micrite-derived microspar forms the matrix of the limestone lithofacies. Current velocities during deposition of the limestone lithofacies probably were too slow to winnow micritic lime

mud. Equant calcite spar cement occupies some primary pores in burrow centers and in corals, ostracodes, and gastropods.

Terrigenous Constituents

Terrigenous constituents other than clay minerals occur in the limestone lithofacies only in the upper part of Section 8. Here sparse quartz and microcline silt are scattered throughout (Fig. 5). The quartz and microcline silt ranges in grain size from 0.02 mm to 0.07 mm. Common unstrained quartz (Folk, 1968, p. 70) predominates with lesser amounts of quartz silt with slightly undulose extinction.

Thin curving and branching seams of green argillaceous illite clay occur in the uppermost beds of Sections 1 and 7, and near the top of Section 8 (Fig. 5). X-ray patterns (Appendix 1) indicate the presence of some chlorite clay here also.

Sedimentary Structures

Sediment-reworking organisms produced uneven bedding surfaces, broken, disoriented bioclasts, in places arranged in vague flow lines, and occasional distinct burrows. Well-preserved burrows (e.g. Pl. IIId) probably were the result of burrowing after the sediment had lithified somewhat. Burrowing may also have resulted in small pockets of rounded poorly sorted intraclasts. Most flow lines (Pl. IIIa) and burrow features are approximately parallel to bedding. Most workers (e.g. Rhoads, 1967) have found that subtidal burrowers characteristically form shallow horizontal burrows. Dolomitization along burrow paths and flow

lines formed the characteristic orange-brown mottling in the limestone lithofacies. Similar mottled limestones commonly have been referred to as burrow-mottled limestones (Laporte, 1969). Apart from structures produced by burrowing, sedimentary structures are absent in the limestone lithofacies. Burrowing may have obliterated any previously formed physical sedimentary structures.

DOLOMITE LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal allochems and biogenic constituents

Biogenic material is present almost entirely as bioclastic debris in the dolomite lithofacies. This debris forms less than 15 per cent of dolomite lithofacies and has an average particle size of less than 1 mm. Part of this debris is much less than 0.5 mm in diameter so that taxonomic identification is impossible. The dolomite lithofacies has a much lower diversity of taxa than the limestone lithofacies (Fig. 5). Commonly only 1 or 2 taxa occur in a given sample.

Pelmatozoans - Crinoid fragments are the most abundant skeletal constituent in both limestone and dolomite beds in the dolomite lithofacies. Monocrystalline dolomite replaced the monocrystalline calcite of crinoid fragments in dolomitized beds.

Ostracodes - Ostracodes are the second most abundant skeletal constituent in both dolomite and limestone beds of the dolomite lithofacies.

Gastropods - Gastropods are common in limestone beds but are absent in dolomite beds. This may be the result of the ease with which gastropods lose their skeletal structure during recrystallization to low Mg calcite (Land, 1967). No relicts of gastropods would remain after dolomitization if early neomorphism obliterated their skeletal structure.

Brachiopods - Brachiopods are common but not abundant in limestone beds and are present as ghosts in dolomite beds.

Algae - The denser, finer crystalline dolomite laminae in the thin-bedded dolomite and the "bird's eye" fenestrate fabric of some dolomite beds suggest the previous presence of blue-green algae.

Non-skeletal Allochems

Pellets - Pellets are abundant in pelmicrite beds within the dolomite lithofacies. These pellets have the same attributes as pellets of the limestone lithofacies and presumably have the same origin. Packed pelletal remnants of the same dimensions as pellets in the limestone beds occur in thin laminae 3 mm to 1 cm thick, of coarser crystalline dolomite interlaminated with laminae of finer crystalline dolomite.

Intraclasts - Limestone beds of the dolomite lithofacies contain rounded intraclasts of pelmicrite, up to 0.5 mm long, in thin (2 to 3 mm thick) lenticular graded beds of well sorted intrapelsparite (Pl. III b). These beds are scattered between beds of biomicrite and pelmicrite. Some coarser intraclasts resemble the compound grains or grapestone (Illing, 1954) forming at present in the Bahamas. Illing

(1954, p. 44-45) found that these allochem aggregates are formed by a process of accretion on the shallow Bahama Banks in the presence of weak to moderate currents.

Orthochemical Constituents

Micrite is the matrix between pellets in the pelmicrite limestone beds in the dolomite lithofacies. Sparite which is present as matrix between allochems in the thin lenticular graded beds of intrapelsparite interbedded with beds of pelmicrite near the base of Section 9, attests to some current winnowing during deposition. Dolomite spar infills bird's eye vugs in some beds of the dolomite lithofacies.

Sedimentary Structures

Limestone beds in the dolomite lithofacies contain the previously discussed, thin, current-deposited lentils of intrasparite in a bio-pelmicrite groundmass (Pl. III b).

The thin- to medium-bedded dolomite sequences, occurring as large pods, tens of feet thick and hundreds of feet wide, contain many structures indicative of a peritidal origin. Mudcracks (Pl. III c), and fenestrate fabric (Pl. III d) are abundant. Some indistinct vertical burrows and mudcrack flakes also are present. Thin beds of mudcracked dolomite and partly dolomitized limestone contain pseudomorphs of calcite after gypsum (Pl. III b). These features are almost entirely restricted to the intertidal and supratidal areas of modern carbonate tidal flats (Shinn, Lloyd, and Ginsburg, 1971; Shinn, 1968; Kendall and Skipwith, 1969). Vertical burrows are most common in intertidal areas of tidal flats (Rhoads, 1967).

DIAGENESIS OF THE THUMB MOUNTAIN FORMATION

Microspar and Pseudospar

Aggradational recrystallization, or neomorphism, of micrite to microspar and pseudospar is a common diagenetic phenomenon that affected the limestone lithofacies. Following Folk (1965), calcite with crystal sizes less than 6 microns is termed micrite, whereas microspar ranges in crystal size from 6 to about 30 microns and pseudospar is formed of crystals coarser than 30 microns.

In thin section, microspar is scattered throughout as single crystals, as isolated clusters of crystals and as discrete comparatively large oval patches (Pl. IVa) that are several millimeters to centimeters long. Many oval patches display an increase in microspar crystal sizes towards their centers (Pl. IVa) such that pseudospar occupies the centers of some patches. Somewhat less recrystallized patches (Pl. IVd) are recognizable preserved burrow forms. Perhaps the more strongly recrystallized coarser crystalline oval patches also represent burrows. The reworked, disaggregated lime mud in burrows was probably much more porous and permeable than the surrounding, less disturbed and more lithified sediment. Solutions inducing early diagenesis could reasonably be expected to have been preferentially channelled through these burrowed, and more permeable pathways in the sediment. Fresh or brackish water were the most probable agents of diagenesis as recrystallization of lime mud (micrite) to microspar and pseudospar requires the removal of intercrystalline magnesium ions (Folk, 1974). Possible stages of the recrystallization of a typical Thumb Mountain burrow to microspar and

pseudospar are shown in Fig. 6 . This hypothesized early invasion of burrowed Thumb Mountain sediments by groundwater of low ionic strength implies that fresh groundwater, possibly derived from the Canadian Shield to the south, invaded the Thumb Mountain Formation during its deposition.

Some patches of pseuodspar are associated with local concentrations of bioclastic debris, particularly crinoids. Bioclasts appear to have been nucleation centers for recrystallization. Some radially oriented bladed pseudospar formed rims surrounding individual bioclasts.

In places, degradational recrystallization has affected crinoid ossicles. Some ostracode, gastropod, algae and other skeletal debris have themselves recrystallized to pseudospar. Some gastropods, however, appear to have been steinkerns that were later infilled with calcite spar, as the calcite crystals forming the spar exhibit many characteristics indicative of precipitation from solution (Bathurst, 1958; and Folk, 1965).

Dolomite

Dolomitization was the most widespread diagenetic event affecting the Thumb Mountain Formation in the report area. Thumb Mountain dolomite has several common modes of occurrence. These are listed in order of decreasing abundance:

(1) As small irregular patches and crystals scattered throughout groundmass;

(2) In completely dolomitized beds;

(3) As lenticles in areas of abundant solution seams and stylolites;

(4) In round to oval areas in thin section up to 1 cm long.

Dolomite occurs abundantly in the limestone lithofacies in small scattered patches. These patches contain subhedral dolomite crystals up to 0.4 mm in diameter, individually scattered or in small aggregates, or dolomicrite. Commonly dolomicrite envelops larger dolomite crystals. This may indicate that aggradational recrystallization of dolomicrite patches formed larger dolomite crystals.

Some bioclasts have been selectively dolomitized, particularly high-magnesian varieties, such as crinoid or algal fragments which can supply magnesium for their own partial dolomitization (Schlanger, 1957).

Finely crystalline (1.05 to 0.10 mm) hypidiotopic* dolomite occurs in irregular lenticles (Pl. IVb) parallel to bedding in most limestone lithofacies. These lenticles are bounded by and contain abundant clay seams along which some solution seams and stylolites have developed. Recrystallization of high-magnesian calcite to low-magnesian calcite in Thumb Mountain limestone may have provided the magnesium ions necessary for dolomitization in areas of clay seams. Many of these dolomitized areas coincide with concentrations of high magnesian bioclasts such as crinoid ossicles, and are generally more abundant in densely bioclastic limestones.

* Crystal fabric terminology after Friedman (1965)

In thin section hypidiotopic dolomite with an average crystal size of 0.10 mm occupies round to oval areas, 2 or 3 mm to 1 cm long in the limestone lithofacies. Some areas are partly or completely surrounded by microspar and pseudospar (Pl. IVC) which suggests that they are probably preserved burrows similar to those described in the previous section. Recrystallization of micrite to microspar and pseudospar apparently released magnesium ions for subsequent partial dolomitization of these recrystallized areas. Slow fresh groundwater flow may now have removed this recrystallization-derived magnesium rapidly enough to avoid dolomitization of parts of some burrows (Fig. 5).

The xenotopic and hypidiotopic dolomite of completely dolomitized, dolomite lithofacies beds ranges in crystal size from 0.05 to 0.20 mm. Primary textural features of most dolomitized beds are obscured; however, some bands of coarser dolomite contain relics of pellets. Also remnants of bioclasts, particularly crinoids, are present. Some late diagenetic "plumose" dolomite (Morrow, 1970) with curved cleavage infills some vugs of leached bioclasts. Evidently the predolomitization lithology of these beds was similar to that of their companion limestone beds. A variety of sedimentary structures (see page) in these dolomitized beds indicate that they were deposited on tidal flats. Many modern carbonate tidal flats are penecontemporaneously dolomitized because of the commonly extreme increase in the mMg^{+}/mCa^{+2} of surface and near-surface waters occupying the tidal flat. This is thought to occur because of the rapid extraction of Ca^{+2} from solution by the precipitation of Ca^{+2} bearing phases such as aragonite and gypsum (Deffeyes, *et al.*, 1964).

Silica

Only a small amount of authigenic silica occurs throughout the limestone lithofacies of the Thumb Mountain Formation. Almost all this silica has replaced biogenic material. Lutecite, a microcrystalline quartz variety with fibrous texture, megaquartz and equant microcrystalline quartz are the main varieties. Perhaps decay of organic matter in biogenic material produced a low pH locally, which favored the replacement of biogenic carbonate by lutecite. This mode of occurrence for lutecite suggests that it is not as reliable an indicator of evaporites as has been proposed by previous workers such as West (1964) and Folk and Pittman (1971).

Spherules of length-fast chalcedony 0.12 mm in diameter are scattered sparsely throughout the pelmicrite groundmass of one sample from Section 9. Length-fast chalcedony indicates formation in a relatively low pH environment (Folk and Pittman, 1971).

Pyrite and Limonite

Almost all Thumb Mountain limonite is pseudomorphous after pyrite. Both minerals are very abundant as authigenic crystals and crystal aggregates up to 1 cm long in biogenic material. Finely crystalline pyrite and limonite less than 0.02 mm in diameter are scattered uniformly throughout a groundmass of pelmicrite in the limestone lithofacies.

Limonite and pyrite are absent in current-deposited graded beds of intrapelsparite. Many dolomitized beds in the dolomite lithofacies

contain laminated sequences. Alternating laminae several millimeters thick of fine (0.05 mm) and coarse (0.15 mm) crystalline dolomite form these laminated intervals. The coarse crystalline dolomite contains packed pelletal ghosts with relatively unvacuolized interpellet dolomite and very little pyrite or limonite. The fine crystalline dolomite is densely vacuolized and contains abundant limonite and pyrite. This suggests that the coarse crystalline laminae were comparatively "clean" well washed intrapelsparite or pelsparite, whereas the finer crystalline laminae were relatively "dirty" pelmicrite.

Limonite is also concentrated in solution seams and between large calcite pseudospar crystals in recrystallized areas.

Calcite

Some calcite has replaced dolomite-forming dolomite pseudomorphs. This dedolomitization origin of calcite is attributed to surface weathering (De Groot, 1967; Evamy, 1967).

Blocky calcite spar of about 0.15 mm crystal size infills late fractures and complementary shears in veins up to 0.05 cm wide. The stresses that produced regional folding probably formed these fissures.

Depositional Model for the Thumb Mountain Formation

The limestone and dolomite lithofacies of the Thumb Mountain Formation formed in somewhat different environments. Criteria provided by studies of depositional environments of modern carbonates (Ginsburg,

1957; Newell and Rigby, 1957; Deffeyes *et al.*, 1964; Illing *et al.*, 1965; Shinn, 1968 and Shinn *et al.*, 1969) indicate that the limestone lithofacies was deposited in a sheltered subtidal environment, whereas the dolomite lithofacies was deposited in supratidal, intertidal and shoaling subtidal environments.

The evidence that points to a subtidal origin for the limestone lithofacies is bioturbation from horizontal burrowing (Rhoads, 1967), relatively high faunal diversity (Walker and Laporte, 1970), and the abundance of unwinnowed micrite. Moreover, widespread bioturbation, unwinnowed micrite, the lack of reworked grains, and the dark organic-rich and pyritiferous aspect of the limestone lithofacies, indicate a protected, subtidal environment with little current activity.

Dark pyritiferous limestones also form in open marine waters with good circulation if the rate of accumulation is rapid. In such a case in the open marine environment organic matter on the seafloor is buried too rapidly for oxidation and instead it is preserved in the sediment. In this case the pH and Eh values in the sediments bear little relation to the values in the normal marine water above the depositional interface (Moretti, 1957). However, the uncompressed pellets and undeformed bioclasts in the limestone lithofacies indicate that lithification preceded any significant compaction (Zankl, 1969). This implies that, unless lithification was abnormally rapid, sediment accumulation in the limestone lithofacies was relatively slow. Therefore, organic matter and pyrite in the limestone lithofacies probably reflect deposition from a poorly oxygenated sea of restricted circulation

rather than rapid deposition producing reducing diagenetic conditions below the depositional interface.

Dasycladacean algae can grow in water up to 300 feet deep (Nitecki, 1970) although the abundance of dasycladacean algae throughout the limestone lithofacies may indicate that water depths during deposition were less than 30 feet (Johnson, 1961). Green algae grow most readily in shallow water because of their light requirement. The common occurrence of unfragmented dasyclad thalli (Pl. Id) suggests that they grew in quiet water.

The dolomite lithofacies contains sequences of alternating supra- and intertidal beds. Mudcrack polygons in brown to rust coloured dolomite, thinly interlaminated algal dolomicrite and pelletal finely crystalline dolomite are common features in this facies. Salinity-tolerant taxa such as ostracodes and gastropods are the only fauna in this facies.

These peritidal dolomite sequences occur in large pods. Possibly these pods are fossil carbonate mud mounds that had built up to sea level. Intrapelsparite lenticles occur in the limestone between these penecontemporaneously dolomitized mud mounds. Currents evidently were sufficiently strong to rework the pelletal lime mud into intraclasts. This may be the result of flow constriction of water from the open ocean between shoals in intershoal channels.

The model for deposition of Middle to Lower Upper Cambrian carbonates in the eastern Great Basin outlined by Kepper (1972) accounts for many of the features displayed by Thumb Mountain lithofacies.

Carbonate mud banks, that now are preserved as large dolomite pods in the northwestern part of the report area, restricted circulation in the southeastern lagoonal area (Fig. 7), where bioturbated biopelmicrite containing abundant dasyclad thalli accumulated. Application of this depositional model to Thumb Mountain lithofacies implies the existence of open shelf limestone facies north and land south of this area.

Evidence from Ellesmere Island supports this facies tract interpretation for the Thumb Mountain Formation and shows that it may have regional importance. Kerr (1968, Fig. 5, lines C and B) published two correlation diagrams of the Thumb Mountain Formation from southern Ellesmere Island consistent with this facies tract interpretation. The lines of section of these correlation diagrams are perpendicular to depositional strike of the Franklinian Miogeosyncline, which, in southern Ellesmere Island, trends north-south (Fig. 4). In Kerr's southernmost correlation diagram, line C, the Thumb Mountain Formation of Section 30 contains several hundred feet of dolomite. This may be an interval of shoal deposits similar to those in the Thumb Mountain Formation of Grinnell Peninsula. Section 30 occupies an intermediate position between possible shelf lagoon nonargillaceous and mottled limestones in the eastern sections 32 and 34 and the open shelf silty and argillaceous limestones of the Thumb Mountain Formation and the anomalously thick Irene Bay Formation in Section 36 west of Section 30. Kerr (1968, p. 51) found it impossible to differentiate the Irene Bay Formation shale from the silty Thumb Mountain Formation in some western parts of his report area. Consequently he recognized that the Thumb Mountain and Irene Bay Formations in

westernmost sections in his report area on Ellesmere Island, such as Section 30, were deposited offshore in deeper water closer to the Franklinian Eugeosyncline.

Thorsteinsson (1958) and Thorsteinsson and Kerr (1968) noted the occurrence of dolomite intervals in the Thumb Mountain Formation of Cornwallis Island. The Thumb Mountain Formation of southern and eastern Bathurst Island is largely dolomitized (Kerr, *in press*). These workers suggested that the Thumb Mountain dolomite on these islands is a late diagenetic feature related to the unconformity at the base of the Disappointment Bay Formation where it overlies the Thumb Mountain Formation. However, part of this dolomite could be penecontemporaneous shoal dolomite similar to that on Grinnell Peninsula. This would seem particularly true for Thumb Mountain dolomite in areas where the Disappointment Bay Formation is absent.

The shaly Irene Bay Formation overlies the Thumb Mountain Formation on Ellesmere, Bathurst and Cornwallis Islands. This may reflect a brief period of relatively deep submergence and drowning of the Thumb Mountain shelf-lagoon complex after deposition of the Thumb Mountain Formation. On Devon Island the Irene Bay Formation is discontinuous and less shaly than that on nearby islands. This suggests that submergence was less pronounced on Devon Island than on nearby islands after Thumb Mountain deposition.

ALLEN BAY FORMATION

Distribution, Thickness and Age

The Allen Bay Formation was named by Thorsteinsson and Fortier (1954), and described more fully by Thorsteinsson (1958), its type section being at Allen Bay near Resolute on Cornwallis Island. Thorsteinsson (1963) also mapped the Allen Bay Formation in the Douro Range, within the present report area. He estimated the thickness to be 3,700 feet, and noted that the formation consisted of mainly dolomite, but contains some limestone and dolomitic limestone, particularly in the upper and lower parts. Most of what Thorsteinsson (1963) assigned to the Allen Bay Formation is mapped as such herein; however, the uppermost part which is limestone is assigned now to the Cape Storm Formation of Kerr (in press).

The very late Llandovery age of the base of the Cape Storm Formation indicates that the Allen Bay Formation encompasses most of the Richmond and Llandoverian Stages (Table I).

The Allen Bay Formation is present throughout the study area (Map) and conformably but sharply overlies the Thumb Mountain Formation. Thicknesses of complete measured sections of the Allen Bay Formation range from 1,532 feet to 2,846 feet (Fig. 8). In the central part of the area as in Sections 2, 7, and 8, the Allen Bay Formation has a fairly constant thickness of approximately 1,900 feet. In the northwest, Section 9, the formation is at least 1,532 feet thick. In the southwest, Section 1, the formation has its greatest thickness of 2,846 feet. It appears that the Allen Bay Formation has not been disturbed by bedding-plane thrusts, such as those that affected the Thumb Mountain Formation. The Allen Bay Formation is relatively recessive weathering between the more resistant Thumb Mountain and Cape Storm Formations, and commonly streams flow along strike in the lower part.

LITHOSTRATIGRAPHY

The Allen Bay Formation is composed of two distinct lithofacies, the massive-bedded, and the medium-bedded lithofacies. The massive-bedded lithofacies is the more common (Pl.IVd), being medium to coarsely crystalline (sucrosic), medium to dark brown dolomite. Fairly abundant stromatoporoids characterize some beds of this lithofacies. Commonly they are white weathering and easily visible (Pl.IVe). Dolomite of this facies emits a fetid, petroliferous odor when struck.

The medium-bedded lithofacies is less common in the Allen Bay Formation, being medium- to thick-bedded, light to medium brown, finely to medium crystalline dolomite. Stromatolites and stromatolitic undulations (Pl.Vq) occur throughout the dolomite of this lithofacies. Rocks of this lithofacies are more compact, less porous and less petroliferous than are rocks of the massive-bedded lithofacies.

Most measured sections of the Allen Bay Formation are comprised of intervals of both lithofacies (Fig.8). Commonly there are thick intervals of the massive-bedded lithofacies, 1,000 to 2,800 feet thick, and the medium-bedded lithofacies occurs as relatively thin intervals, between 50 to 500 feet thick.

The lack or absence of medium-bedded lithofacies in Sections 8 and 1 may be a consequence of the relatively poor exposure at these sections. There may in fact be intervals of the medium-bedded facies in sections 1 and 8.

Ignoring Sections 1 and 8, which are poorly exposed and therefore inadequately sampled, and Section 3 which is incomplete, the number of intervals of the medium-bedded lithofacies consistently decrease from

northwest to southeast. The number of intervals decreases from 4 in Section 9, to 3 in Section 7, and finally to 2 in Section 2 (Fig. 8).

MASSIVE-BEDDED LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

Dolomitization has destroyed all but the coarsest structural elements of most fossils in the massive-bedded lithofacies. Only the gross external shapes of leached bioclasts remain. Some dolomitized biogenic material can be observed only in thin section.

Stromatoporoids. Tabular stromatoporoids are the most widespread and abundant biogenic constituents in the massive-bedded lithofacies, and in places form reef-like masses of stromatoporoid biolithite (Pl.IVe). These massive-bedded intervals of stromatoporoid biolithite could not be seen to terminate laterally in outcrop. Several stromatoporoid-bearing intervals that occur in the lower parts of Sections 1 and 2 may be physically continuous units as indicated on Figure 8. However these stromatoporoid biolithites do not appear to exhibit any degree of correlation between more widely spaced sections such as Sections 7, 8 and 9.

"Other Faunal Constituents". Colonial corals such as *Favosites* are moderately abundant whereas solitary horn corals are rare. Both types of coral generally occur in association with stromatoporoids. Crinoid fragments are abundant in some beds, and commonly are associated with brachiopods in a pelletal matrix. Brachiopods are common in some beds either alone or in association with pelmatozoans or stromatoporoids. Orthoceroid cephalopods occur in at least one bed in Section 2.

Nonskeletal Allochems

Pellets

Remnants of pellets, represented by dense concentrations of inclusions are common in much of the dolomite of the massive-bedded lithofacies. They are closely packed, and the individual pellets average 0.15 mm across (Pl.Vb). It is possible that dolomitization destroyed the original pelletal texture in some dolomite of the massive-bedded lithofacies that contains no visible pellet remnants.

Intraclasts

The massive-bedded lithofacies contains remnants of intraclasts that are marked by a profusion of inclusions (Pl.Vb). They are rounded, have a botryoidal or oval outline, are up to 0.5 mm in diameter, and generally occur in a packed pelletal matrix. The continuous size gradation from the smaller pellets and intraclasts to the larger botryoidal outlines of many intraclasts suggests that a high proportion of the intraclasts may be compound grains of bahamite of Illing (1954).

Terrigenous Constituents

Thin sections and insoluble residues of the massive-bedded lithofacies contain no terrigenous constituents; however, X-ray powder patterns (Appendix I) show the presence of trace amounts of quartz.

Sedimentary Structures

The only sedimentary structure discernible in the massive-bedded lithofacies is thick to massive continuous bedding. This suggests that beds in this facies accumulated subtidally. Bioturbation of pre-existing limestone may have obliterated sedimentary structures in these beds.

MEDIUM-BEDDED LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

The medium-bedded lithofacies contains less diverse, and less abundant fauna than does the massive-bedded lithofacies. Almost all biogenic material present consists of salinity-tolerant organisms, such as algae and ostracodes.

Stromatolites

At some intervals in northwestern sections (Fig. 8) there occur algal stromatolites that are of the LLH-C type of Logan, Rezak, and Ginsburg (1964). Stromatolites are almost certain indicators of intertidal conditions (Logan, Rezak, and Ginsburg, 1964), although they have been found to exist in some shallow subtidal areas (Gebelein, 1969). Wisps of dark brown organic material that may be remnants of mucilaginous mats of blue-green algae are abundant in the medium-bedded lithofacies.

Ostracodes

At one horizon in the medium-bedded lithofacies remnants of ostracode shells are discernible in a dolomitized matrix of interlaminated intrapelmicrite and intrapelsparite. Ostracodes probably were more numerous than the preserved numbers would suggest.

Pelmatozoans

Crinoids occur in one bed of the medium-bedded lithofacies, in Section 9 in association with possible wisps of blue-green algae.

Nonskeletal Allochems

Pellets

Pellets are preserved as ghosts in the medium-bedded lithofacies, where they are packed, and more common than in the massive-bedded

lithofacies. Pellets have the same attributes in both lithofacies.

Intraclasts

Intraclasts in the medium-bedded lithofacies are composed of dolomite that is more finely crystalline than the groundmass, and they are elongate parallel to bedding. These seem best interpreted as penecontemporaneously dolomitized mud crust rip-ups in a matrix that is dolomitized later (Germann, 1969). Such early dolomitization of calcite mud crusts is common in modern supratidal environments, and is coincident with early lithification (Shinn *et al.*, 1965, p. 117). Germann (1969) suggested that the original micrite matrix of these clasts was introduced from a subtidal site by storm-induced suspensions.

Sedimentary Structures

Structures in the medium-bedded lithofacies include alternating thin laminae of inferred micrite, intrapelmicrite, and intrapelsparite (Pls. Vc and Vd), and stromatolite-like laminations. These structures, in conjunction with elongate dolomicrite intraclasts, and some fenestrate fabric indicate an inter- to supratidal depositional environment. Some finely laminated sequences contain features (Pl. Va) that strongly resemble the algal mat-overfolds on modern tidal flats described by Davies (1970). The stromatolitic rocks contain laminations formed by the alternation of laminae of finely crystalline dolomite containing abundant inclusions with laminae of coarser crystalline dolomite containing few inclusions.

Diagenesis of the Allen Bay Formation

Dolomite

The Allen Bay Formation is made up almost entirely of diagenetic dolomite. However the dolomite of the medium-bedded lithofacies is somewhat different from the dolomite of the massive-bedded lithofacies. The density of inclusions, the amount of disseminated limonite and the variation in dolomite crystal size and crystal habit are criteria which permit discrimination of the predolomitization sedimentary fabric of both the medium-bedded and massive-bedded lithofacies.

The medium-bedded lithofacies consists of two varieties of dolomite. The more abundant variety which occurs in thin to medium beds is hypidiotopic and medium crystalline with an average crystal size of about 0.20 mm, similar to that shown in plate Vb. Relict pellets and intraclasts appear as distinct clots of inclusions. The clear, inclusion-free dolomite between these allochem ghosts probably has replaced sparry calcite cement.

Laminated dolomite (Pl.Vc) a less common variety also forms a significant part of the medium-bedded lithofacies. Typically the laminations are formed by the alternation of finely crystalline laminae with medium crystalline laminae (Pl.Vd). Individual laminae are less than a millimeter thick. Dolomite crystals in finely crystalline laminae contain abundant inclusions whereas crystals in medium crystalline laminae are largely without inclusions. In thin section oval areas of particularly dense concentrations of inclusions in both finely and medium crystalline laminae indicate the former presence of pellets (Pl.Vd).

Stromatolitic undulations which commonly occur in intervals of laminated dolomite indicate that they originated on a tidal flat. Probably pellets and micrite adhered to mucilaginous mats of blue-green algae to form algal bound pelmicrite laminations. These laminae were then penecontemporaneously dolomitized to finely crystalline dolomite while they were exposed on the tidal flat surface as has been documented for modern algal mat-covered carbonate tidal flats. (Illing *et al.*, 1965; Shinn *et al.*, 1965). Inundations on the tidal flats would cause pellets and other grains to be washed up and spread over the tidal flat surface. Cementation and dolomitization of these porous grainstone sheets may have formed the inclusion-free medium crystalline dolomite laminae that contain pellet remnants.

The massive-bedded lithofacies consists almost entirely of medium crystalline, hypidiotopic dolomite. Some of this dolomite contains abundant dolomicrite inclusions. Micrite was probably the precursor of this dolomite type. The remainder of the dolomite in the massive-bedded lithofacies contains packed pelletal remnants with relatively inclusion-free interpellet areas (Pl.Vb). Dolomitization of poorly washed intrapelsparite may have formed this variety of dolomite.

Medium crystalline hypidiotopic dolomite in which the original rock fabric has been completely obliterated is also present in both the Medium and Massive-Bedded Lithofacies. This type of dolomite contains fewer inclusions than the previously discussed varieties of dolomite. Fluid inclusions in this type of dolomite tend to be contained within single crystals. The outlines of these areas with abundant inclusions generally are parallel to the borders of crystals containing them. Aggradational

recrystallization of the original replacement dolomite by a process similar to recrystallization in limestones (Folk, 1965) would yield a cleaner dolomite with fewer inclusions and vacuoles. Also it would explain the partial parallelism of outlines of vacuolized areas with surrounding crystals as the result of crystal face boundary migration during dolomite recrystallization.

Point counts of dolomite crystal sizes tend to affirm some of the foregoing deductions concerning dolomite in both the medium- and massive-bedded lithofacies. Point counting was performed on a suite of 20 thin sections, 10 from the massive-bedded lithofacies and 10 from the medium-bedded lithofacies.

The standard deviation (Sd) of dolomite crystal size point counts of medium-bedded lithofacies dolomite is consistently greater than that of the massive-bedded lithofacies for any given mean crystal size ($\bar{X}$) (Fig. 9). This effect is due to differences in dolomite crystal sizes between individual laminae in the peritidally deposited laminated dolomite that characterizes much of the medium-bedded lithofacies. The more homogeneous dolomite of the subtidally-deposited massive-bedded lithofacies has a smaller standard deviation of crystal sizes.

Idiotopic dolomite or dolomite formed of predominately euhedral crystals is uncommon in the Allen Bay Formation. In some rocks with abundant bird's eye, idiotopic dolomite crystals line the periphery of individual calcite-filled bird's eye vugs. Similarly, idiotopic dolomite partly infills and surrounds moldic porosity in dolomitized stromatoporoid biolithites.

Lack of primary fabric disruption indicates that little, if any, volume change occurred in conjunction with dolomitization. Most porosity in the Allen Bay Formation is relict primary porosity. The remaining porosity is the result of bioclast leaching leading to moldic porosity and some intercrystalline porosity.

Calcite

Most calcite in the Allen Bay Formation occupies small vugs and intercrystalline porosity in the dolomite, as coarsely crystalline secondary infillings in both the massive- and medium-bedded lithofacies. In places calcite apparently has partly replaced dolomite crystals in dolomite vug-infillings (Pl.VIb) and thus qualifies for the term "dedolomitization" calcite that was suggested by Evamy (1967). The origin of this calcite may best be explained by the exposure of Allen Bay dolomite to surface weathering conditions. Near-surface conditions of weathering cause dolomite to dissolve incongruently to calcite (De Groot, 1967). A small amount of the calcite present in the Allen Bay Formation occurs as tiny inclusions of undigested calcite in individual dolomite crystals.

Limonite and Organic Matter

Minute limonite grains with associated organic matter are disseminated sparsely throughout most of the dolomite of the Allen Bay Formation. This association is particularly common in finer crystalline dolomite that is inferred to have been micrite. It is probable that the limonite is an oxidation product of what originally was pyrite, that had formed within micrite in a reducing diagenetic environment. Such an environment for pyrite formation in lime muds resulted partly from the presence of organic matter.

Silica

Anhedral authigenic megaquartz infills part of the porosity in the dolomite of one bed in Section 7. The presence of abundant dolomite inclusions in part of this megaquartz suggests that the quartz also has partly replaced some of the surrounding dolomite.

Depositional Model For The Allen Bay Formation

The distribution of lithofacies within the Allen Bay Formation is a complex stratigraphic problem that cannot be resolved exactly by this study. The most reasonable assumption is that the medium-bedded lithofacies occurs as discrete noncontinuous lithosomes (Fig. 8), rather than as laterally continuous beds.

Several points that are important to a depositional model are:

(1) Within the massive bedded lithofacies there are three subtidal microfacies that are distinct commonly: A dolomitized stromatoporoid biolithite; a dolomitized crinoid brachiopod biopelmicrite; and an unfossiliferous dolomitized pelmicrite (Fig. 8). These microfacies commonly cannot be traced from section to section with confidence except between the closely spaced sections 1 and 2.

(2) With the medium-bedded lithofacies there are two peritidal microfacies that commonly are distinct; a dolomitized interlaminated pelmicrite and intrapelsparite containing birdseye structure; and a dolomitized stromatolite biolithite. It appears that neither of these phases can be correlated between sections.

(3) The number of intervals of the medium-bedded lithofacies intercalated between intervals of the massive-bedded lithofacies appears to decrease southeastward (Fig. 8).

The laminar and hemispherical stromatoporoids in the stromatoporoidal biolithite phase may have formed broad, low mounds (Fig. 10). In northwestern sections, such as sections 7 and 9, dolomitized stromatoporoid biolithite occupies intervals that are commonly less than 50 feet thick. Several of these intervals are capped by intertidally deposited dolomite, for example in units 55 to 59 in section 9. Southeastern sections such as 1 and 2 contain correlative stromatoporoid-bearing intervals up to 200 feet thick.

Intertidal microfacies developed on top of stromatoporoid mounds towards the northwest, possibly as the result of shoaling of mounds (Fig. 10). Most individual Allen Bay stromatoporoid mounds probably did not exceed 1/2 mile in breadth. Well documented ancient stomatoporoid mounds less than 250 feet thick are commonly also less than 1/2 mile wide (Dumestre and Illing, 1967). However, the inferred correlation of stromatoporoid-bearing intervals in Sections 1 and 2 may indicate that some Allen Bay mounds were several miles across.

Stomatoporoid mounds in the Allen Bay Formation probably are elongate parallel to depositional strike, at some steep angle to the line of section in Figure 10. Dolomitized crinoid brachiopod pelmicrite and dolomitized pelmicrite are off-mound equivalents deposited contemporaneously in slightly deeper water around growing stromatoporoid mounds.

The increase in abundance of intertidal intervals northwestward in the Allen Bay Formation suggests that water depths in which the Allen Bay accumulated were shallower near the shelf edge than farther inland. Stromatoporoid mounds in the northwest nearer the shelf edge aggraded to sea level more readily than those in the southeast part of the area. Consequently, the northwest part of the area was a region of carbonate shoals whereas the area

to the southeast may have been predominantly a shelf-lagoon in somewhat deeper water (Fig. 10).

On the west and northwest parts of Grinnell Peninsula, Cape Phillips Formation shaly limestone is the facies equivalent of carbonates of the Allen Bay Formation (Fig. 10). The very continuous even, thin and laminated bedding of Cape Phillips shaly limestone and its abundance of dark brown non-calcareous organic material indicate that it was deposited largely below wave base in less well oxygenated water.

Slump structures (Pl. VIc) and allochthonous blocks of limestone (Pl. VId) occur scattered throughout the Cape Phillips shaly limestone exposed along the south coast of Sheills Peninsula on southwestern Grinnell Peninsula. Similar features have been observed by Trettin (1972) in the Cape Phillips Formation exposed on Ellesmere Island. These occurrences indicate that the Cape Phillips Formation is predominately a slope deposite (Fig. 10) as suggested by Trettin (1972) rather than a basin floor deposit.

The integrated facies tract interpretation of Allen Bay-Cape Phillips deposition presented in Figure 10 is similar to type II of Wilson's (1974) spectrum of carbonate-platform margins. In both reconstructions an area occupied by stromatoporoid mounds or knoll reefs as they are designated by Wilson (1974) separates a landward shelf-lagoon from the open ocean. Most knoll reefs may have grown only above wave base although it is possible that some grew a little farther downslope at depths of a few tens of feet (Wilson, 1974). If Wilson's type II model is applicable to the Allen Bay Formation, it may be assumed that the average seaward depositional slopes did not exceed 5 degrees and that seas were fairly calm during Allen Bay deposition.

Geochemical Aspects of the Allen Bay Formation

The Allen Bay Formation was the object of several geochemical investigations during the coarse of this study. The trace element concentrations of strontium and manganese in 40 samples and the stable isotope concentrations of oxygen and carbon in 9 samples were determined. Samples were chosen so as to contain as little biogenic material as possible. The purpose of these investigations was to verify the identification of lithofacies within the Allen Bay and to provide more insight into its diagenetic history. Previous workers (e.g. Weber, 1964; Cameron, 1969; and Chester, 1965) have arrived at somewhat different conclusions concerning the significance of trace element distributions in carbonates. In a recent review of the subject, Till (1971) concluded that parameters concerned with the carbonate fraction such as strontium concentrations are not likely to be useful environmental indicators in ancient rocks due to the large changes in their values effected during diagenesis whereas certain trace metals such as manganese give an energy index for the rock, as these elements are contained almost entirely in the clay mineral and non-calcareous organic matter fraction. The results of this study corroborate Till's deductions concerning strontium and manganese in carbonate rocks.

Strontium

Specimens that were analyzed for stontium were grouped by facies. Their average strontium values are shown in Table II. From this table there appears to be no correlation of raw strontium values with facies type. Strontium values from peritidal facies (Fig.11) were compared with values from subtidal facies by using a "t" test, and this indicated that there is no significant difference in the strontium content of these facies at a 5 per cent level of significance (i.e. 95% level of confidence). Instead, strontium values tend to increase upwards in each section (Fig.12), with slightly higher values in the northern sections. First and second degree trend surface analyses confirm the observation of a northward and upward increase in strontium values (Fig.13). Higher degree trend surfaces were made, but do not alter or improve significantly on the first and second degree trend surfaces. This is indicated by the insignificant increments between the correlation coefficients of successively higher degree trend surfaces (Table III). Therefore, the upward increase in strontium values, with somewhat higher values in northern sections, is the basic trend in strontium values.

Residuals from the first degree trend surface of strontium values from peritidal facies are not significantly different from those from subtidal facies at a 5 per cent level of significance (Table IV). Therefore, the regional trend in strontium values does not mask a local variation in strontium that might be due to facies differences. Instead local variations in strontium appear to be random.

Weber (1964) suggested that almost all the strontium in carbonate rocks is absorbed on the clay mineral fraction, and, therefore, the

strontium distribution reflects the clay mineral distribution within carbonate rocks. However, the correlation of manganese with clay mineral content is more firmly documented than that of strontium (Till, 1971). Also the distribution of manganese in the Allen Bay Formation is more readily explained if manganese is held in clay or is complexed in organic matter.

It has been suggested (Kinsman, 1969; Cameron, 1969) that the strontium distribution in carbonate rocks reflects their diagenetic history. Kinsman (1969) argued that carbonate-rich pore fluid percolating continuously through aragonitic pelletal lime muds similar to the original Allen Bay sediments would dissolve the strontium-rich aragonite mud and precipitate relatively strontium-deficient sparry calcite in the downflow direction. Continuation of this process would result in a calcite limestone in which strontium values increase in a downflow direction. The absolute values of strontium in such a limestone would depend mainly on; the proportion of aragonite to calcite in the original sediment; and on the composition, period of flow, and flow rate of the pore fluid. He estimated that more than 10^5 pore volumes would be required to pass through a limestone of average strontium content (5,000 ppm) and with 30 per cent porosity to lower the strontium content to less than 350 ppm. Kinsman's deductions are the consequence of the unequal partitioning of Sr^{+2} ions between calcite and the liquid from which the calcite is precipitating such that (mSr^{+2}/mCa^{+2}) calcite = 0.14 (mSr^{+2}/mCa^{+2}) liquid (Kinsman and Holland, 1969).

Early formation waters of the Allen Bay Formation may have come from one of two possible sources. Compaction pressure may have expressed

large amounts of pore water from the shale of the Cape Phillips Formation into the laterally equivalent Allen Bay Formation. However, pore water from the Cape Phillips Formation probably would have had nearly marine salinity, and likely could not have produced the diagenetic changes that occurred in the Allen Bay Formation.

Alternatively, large amounts of fresh continental groundwater may have invaded the Allen Bay Formation. The strontium trend surface contours in Figure may then be interpreted as approximations to fossil equipotential lines that were oriented perpendicular to a net low salinity groundwater flow from the southeast. This groundwater flow may have passed northwestward and upward through the Allen Bay Formation from the continental area to the southeast as illustrated in Figure 10. Probably the Irene Bay shale, which underlies the Allen Bay Formation, formed an effective floor for fresh groundwater that percolated seaward through Allen Bay sediments. This restriction on the downward extent of groundwater flow may have resulted in a greatly exaggerated seaward extent of fresh groundwater flow in the manner shown in Figure .

Mannheim (1967) and Kohout (1967) found that fresh continental waters intrude marine sediments off the eastern coast of Florida for distances of over 100 kilometers. Consequently extensive circulation of fresh continental waters within the Allen Bay Formation could have occurred during its sedimentation as well as long afterward.

Dolomitization of Allen Bay sediment is an expectable result of such a large scale and continued flow of fresh pore water. As Hanshaw et al. (1971) and Badiozamani (1973) have pointed out a reduction of pore water salinity such that the ionic strength of the pore water is between

5 to 30 per cent that of sea water will favour dissolution of the host limestone and subsequent precipitation of dolomite provided sufficient magnesium is available for dolomitization.

Dolomitization of the Allen Bay Formation may have resulted from the continued solution and reprecipitation of carbonate minerals in the formation during the passage of magnesium-rich continental waters. Sonnenfeld (1964) suggested that meteroic groundwater which has traversed igneous and metamorphic terrains is enriched in magnesium, and consequently capable of dolomitizing limestone sequences. Chemical analyses of groundwater on the Precambrian Shield in Canada, however, show a persistent preponderance of Ca^{2+} over Mg^{2+} (Brown, 1967). Garrels (1967) proposed that the greater abundance of Ca^{2+} than Mg^{2+} in groundwater of igneous and metamorphic terrains is due to the greater abundance of plagioclase, the major Ca^{2+} contributor, over biotite and horneblende, the major Mg^{2+} contributors.

Water of the shelf-lagoon is another possible source of magnesium. This water may have been slightly enriched in Mg^{2+}, through continual precipitation of aragonite. Downward seepage of this brine into Allen Bay lime mud may have brought it into contact with northwestward and upward flowing continental fresh waters (Fig 10). Dolomitization of Allen Bay lime muds would occur along the brackish zone produced by the mixing of these two fluid phases.

Manganese

As with strontium, manganese concentrations show no correlation with facies type at a 5 per cent level of significance (Table V). Similarly manganese residual values from the third degree trend surface (Table VI) show no correlation with facies type at a 5 per cent level of significance.

Trend surfaces on manganese values (Fig. 14) display markedly different patterns than those on strontium (Fig. 13). This contrast may indicate that fluid movements which may redistribute strontium within the Allen Bay Formation did not control the distribution of manganese. Manganese must, therefore, be held in clay minerals and organic matter rather than in carbonate minerals. This agrees with the conclusions reached by Till (1971) concerning manganese.

Degens (1965) noted that the modern oceans are great reservoirs of manganese and that the manganese concentration of seawater is a function of depth. Continual replenishment of water on the shelf on which Allen Bay sediments accumulated by water from the open ocean to the northwest where shaly Cape Phillips sediments accumulated may have occurred if the local evaporation rate exceeded the local rate of precipitation plus the rate of surface runoff. Clay minerals transported southeastward from the open ocean across the shelf may have been intercepted either in quiet subtidal environments or on tidal flats, as part of a suspension-lag deposit. Progressively less clay would remain in suspension as each influx of oceanic water migrated southeastward. Also free manganese ions in the oceanic water that travelled southeast across Allen Bay sediments may have formed complexes with organic matter on tidal flats and in subtidal areas.

Consequently, manganese content at a particular point in the Allen Bay Formation is an index to the proximity of the Cape Phillips shale. The wedge-shaped pattern of second and third degree manganese trend surfaces (Fig. 13) records a single transgression and regression within the Allen Bay Formation.

The Devon Island Formation is shaly limestone that probably is a southeastern tongue of the Cape Phillips Formation. The Devon Island Formation has a relatively high average content of manganese (Appendix II). This is consistent with the hypothesis that manganese in the Allen Bay Formation is held in clays and organic matter, and that it is derived from areas where Cape Phillips shaly limestone accumulated.

Stable Isotope Distribution in the Allen Bay Formation

Any hypothesized large-scale movement of fresh continental groundwater that redistributed stontium in the Allen Bay Formation would also have affected the distribution of oxygen and carbon isotopes. Accordingly three samples from each of the three sections used in trend-surface analyses of strontium values were analyzed for stable isotopes of carbon and oxygen (Fig. 15).

The oxygen isotope distribution (Fig. 15) shows a pattern that is similar to that of strontium (Fig. 13). The δO^{18} values (Appendix III) are higher towards the northwest and increase upwards in individual sections. Apparently the circulation of continental groundwater through the Allen Bay Formation as shown in Figure 7 preferentially enriched the southeastern and lower part of the formation with O^{16}. Northwest sections, farther seaward from the ancient fresh water recharge area, were less affected by the flow of continental groundwater and consequently show higher δO^{18} values than southeastern sections (Fig. 15).

The distribution of carbon isotopes does not appear to reflect a definite trend (Fig. 15). Degens (1965) notes that biogenic CO_2 in soil gases has a δC^{13} of -24 and atmospheric CO_2 has a δC^{13} of about -8. So

it may be assumed that continental fresh water which invaded the Allen Bay Formation was enriched in C^{12}. There would have been dissolved CO_2 in any continental water that invaded the Allen Bay Formation, but apparently the amounts were insufficient to significantly affect the distribution of carbon isotope ratios of the dolomite. The slightly higher average value of δC^{13} in the northwest section (Fig. 15) may indicate that it received a lower contribution of C^{12}, because it was farther away from the fresh water recharge area to the southeast.

The distribution of stable oxygen isotopes, and to a lesser extent the distribution of stable carbon isotopes, supports the theory that continental fresh water from the southeast invaded and aided dolomitization of the Allen Bay Formation during its deposition.

Cape Storm Formation

Distribution, Thickness and Age

The Cape Storm Formation was named by Kerr (in press) for its type section near Cape Storm on the south coast of Ellesmere Island. The type section is near 645 feet thick and contains two members, a lower cliff-forming, partly dolomitized limestone member, and an upper member of thin bedded dolomite and silty dolomite grading upward to interbedded dolomite and limestone.

The age of the Cape Storm Formation is Silurian, ranging from late Llandoverian to early Ludlovian stages (Table I). This conclusion is based partly on the probable late Llandovery age of two faunal collections near the base of the Cape Storm Formation in Section 4. B.S. Norford considers the faunal collection at GSC Locality C-11915, 11 feet above the base of the Cape Storm Formation, to indicate a probable late Llandovery age. This collection is composed of Clathrodictyon sp., Synamplexoides cf. S. varioseptatus (Stearn), ?Favosites sp. and an indeterminate rugose coral. Also, he considers that the faunal collection at GSC Locality C-11917, 156 feet above the base of this formation in Section 4, indicates a probable very late Llandovery age or a possible early Wenlock age. This collection is composed of Palaeocyclus sp., Cystihalysites sp., Favosites sp., ?Favosites sp., a stromatoporoid and heliolitid and solitary corals (Appendix V). The early Ludlovian age of the top of the Cape Storm Formation is inferred from the early Ludlovian age of the base of the overlying Douro Formation (Smith, 1973).

The Cape Storm Formation is well exposed in most measured sections in the report area (Fig. 16) and apparently was deposited throughout the entire report area. In all exposures it conformably overlies the Allen Bay Formation (Fig. 17). The Cape Storm Formation is itself overlain conformably

by the Douro Formation in all but the most northerly Section. At this Section, Section 9, it is overlain unconformably by undivided Devonian carbonate rocks (see Map), and presumably the Douro also was removed by intervening erosion.

Thicknesses of the Cape Storm Formation in the report area vary widely, largely as a result of original thickness differences, and partly also from intra-Devonian erosion. Thicknesses of sections that have their original depositional thickness range from 712 feet (Section 5) to 2,776 feet (Section 1). The most northerly section of the Cape Storm Formation is the thinnest in the area (Section 9). It is 613 feet thick, with an unknown thickness having been removed by Devonian erosion.

The Cape Storm Formation commonly is thin to thick, evenly-bedded limestone with some dolomite interbeds. Thicker beds are dark grey to light greyish-yellow pelmicrite or intramicrite, whereas thinner beds are light greyish-yellow to yellowish-orange dolomite. Where dolomite interbeds are common, the Cape Storm Formation displays pronounced differential weathering; otherwise it weathers uniformly. On airphotos it appears as a sequence of alternating thin, light and dark grey continuous bands.

Lithostratigraphy

Three lithofacies were differentiated in the Cape Storm Formation of the report area (Fig. 16), a limestone intraclast lithofacies, a stromatolite lithofacies, and a dolomitic pelmicrite lithofacies. The first two lithofacies are similar in lithology and stratigraphic position to the lower member, and the third is similar to the upper member of the Cape Storm Formation of the type area on southern Ellesmere Island.

The dolomitic pelmicrite lithofacies is present in all sections of the Cape Storm Formation (Fig. 16). It forms all of the relatively thinner sections (Sections 3, 5, and 8), and the upper parts of remaining sections. This facies typically composed of thin to medium beds of greyish yellow, finely crystalline dolomite (Pl. VIe), interbedded with intervals of thin- to thick-bedded, fossiliferous pelmicrite (Pl. VIIa).

The limestone intraclast lithofacies occupies approximately the lower one-third of the Cape Storm Formation in Sections 1, 2, and 7 (Fig. 16). Most of this lithofacies is made up of grey to greyish yellow weathering, thin to thick beds (Pl. VIIb), of fossiliferous intrapelsparite and intrapelmicrite. This lithofacies also forms most of the Cape Storm Formation over central and western Grinnell Peninsula.

The stromatolite lithofacies is restricted to the lower part of Section 9, where it is characterized by massive beds of yellowish grey and light grey weathering stromatolite biolithite.

THE DOLOMITIC PELMICRITE LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

Fossil material in this facies occurs as bioclastic debris. Most of this facies is relatively unfossiliferous, with less than 5 per cent bioclasts; however, some beds are quite fossiliferous, containing as much as 25 per cent bioclasts. Individual laminae ~~of~~ or lentils within these bioclast-rich zones may contain up to 60 per cent bioclasts.

This facies has a low faunal diversity, containing only ostracodes and gastropods, organisms that are tolerant of a wide range of salinity in modern environments.

Ostracodes. Ostracode bioclasts of the genus *Leperditia* are the most abundant and ubiquitous skeletal grain type in the lithofacies. At many horizons this is the only taxon present, but when other taxa are present ostracodes are present as well. Articulated ostracode shells occur scattered in a sparse pelmicrite matrix in some beds; however, more commonly, ostracode fragments occur in discrete lenses of disarticulated shell fragments or are scattered throughout a packed pelmicrite or pelsparite matrix (Pl. VIIc).

Ostracode bioclasts are almost the only fossil material present in the beds of finely crystalline dolomite in the dolomitic pelmicrite lithofacies.

Gastropods, Pelmatozoans and Brachiopods. Gastropods, crinoids and brachiopods each occur sparsely scattered throughout most sections that pass through this facies. They form a small but noticeable part of the preserved fauna.

Other Constituents. Other faunal constituents of this facies include trilobites, corals, stromatoporoids, bryozoa, fish, cephalopods and stromatolitic algae. These occur only rarely.

Allochemical Constituents

Pellets. Pellets are a very common constituent of the dolomitic pelmicrite lithofacies. They occur in poorly washed pelsparite (Pl. VIIc) and packed to sparse pelmicrite. Pellets average 0.12 mm in length and in most places are moderately well sorted.

In most samples pellets are associated with ostracode bioclasts, and this suggests that in this facies, as in the Thumb Mountain Formation, the pellets are fecal products of ostracodes. Ostracode-bearing samples invariably contained pellets. Of the 88 samples that contain a pelletal matrix, 71 also contained ostracodes.

Intraclasts. Intraclasts in this facies are restricted to a few beds of intrapelmicrite. The intraclasts range in size from 0.05 mm to 0.4 mm, and are similar to intraclasts in the limestone intraclast lithofacies.

Orthochemical Constituents

Micrite. Micrite is the most abundant orthochemical constituent in this facies and ranges from undolomitized to nearly completely dolomitized. This micrite constitutes the matrix material, of biopelmicrite that was

deposited in quiet or gently reworked subtidal environments. It also constitutes the matrix material of the relatively unfossiliferous, less somewhat more dolomitized pelmicrite that was deposited in intertidal environments.

Sparite. Biopelsparite with equant spar cement is abundant in some beds, indicating some current winnowing of lime mud.

Terrigenous Constituents

Quartz silt (Pl. VIIIc) with subsidiary microcline, orthoclase, and sericite (Appendix I) occurs throughout the dolomitic pelmicrite lithofacies. The silt content ranges from less than 5 per cent to 50 per cent, but appear to average about 5 per cent (Fig. 18). This silt commonly is disseminated uniformly throughout in most beds. At some finely laminated intervals, however, variations in silt content partly define the laminae (Pl. VIIId).

Sedimentary Structures

Much of the dolomitic pelmicrite lithofacies is formed of intervals of thin- to medium-bedded, smoothly bedded, partly dolomitized pelmicrite and pelsparite. These intervals appear to be burrow-mottled in many places (Pl. VIIIa). Fenestrate fabric, shrinkage cracks (Pl. VIIIb), and crinkled algal mat-like laminae containing small teepee structures (Pl. VIIIc) occur in some of the more dolomitized thin beds. These features have been recognized in exposures of Holocene inter- and supratidal sequences and on modern carbonate tidal flats (e.g. Shinn et al., 1969; Davies, 1970).

Beds containing redeposited mudclasts (Pl. VIIId) overlie mudcracked beds (Pl. VIIIe) in some parts of these thin-bedded intervals. It seems possible that the mudclasts were reworked during storms from the underlying mudcracked bed. Shinn et al. (1969, p. 1216) have illustrated similar sequences in which mudcracked layers alternate with layers containing mudclasts from the supratidal marsh area of Andros Island.

Between the thin- to medium smooth-bedded intervals occur intervals, a few feet to a few tens of feet thick, that contain thin to medium very discontinuous anastomosing and lenticular bedding (Pl. VIe). Faint small-scale trough cross-laminae are discernible in some of these beds. In these lenticular beds scattered concentrations of ostracode shells that are concave upward indicate deposition by lower flow regime small-scale ripples (Clifton and Boggs, 1970). Large-scale inclined bedding also occurs in these intervals as shown in Plate VIe. Partly dolomitized biopelsparite, biointrapelsparite and packed biopelmicrite are the dominant lithologies.

LIMESTONE INTRACLAST LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

Stromatoporoids. Tabular and hemispherical stromatoporoids (Pl. IXa) are abundant in this lithofacies, particularly in the lower parts of Sections 1, 2, and 7 (Fig. 16), where at some horizons they form biolithite in association with abundant corals.

Corals. Colonial corals have a similar distribution to stromatoporoids, but are less abundant. Sparse solitary corals occur at some horizons.

Other Constituents. Crinoids, ostracodes (Pl. IXb), gastropods, and brachiopods form a small but significant part of the faunal content of this facies and are present in most beds. A few trilobite bioclasts also occur in this facies.

Non-skeletal Allochems

Intraclasts are the most abundant allochemical constituents in this facies. They range from 1.2 mm in diameter which is pellet size, to 3 cm in diameter and commonly are poorly sorted (Pl. IXb).

The petrographic classification of grain types that occur on the present day Great Bahama Banks put forth by Purdy (1963a) adequately describes most, if not all, nonskeletal allochems in the limestone intraclast lithofacies. It is more satisfactory for petrographic study of grain types than the morphologic grain classification of Illing (1954). Pellets (Pl. IXc), fragmented pellets, micrite of "mud" aggregates (Pl. IXc), and grapestone, are common associates in the packed intrapelmicrite pelmicrite and poorly washed intrapelsparite of this facies.

Angular fragments of pellets are common in this facies (Pl. IXb). Unfragmented pellets, about 0.12 mm long, occur less commonly. Purdy (1963a) suggested that angular pellets were formed by the breakup of very friable pellets by the action of intermittent bottom currents, or by the movement of organisms such as crabs.

Mud-aggregates are 1.2 mm to 2.5 mm long (Pl. IXc) and are present in small amounts at most horizons of intrapelmicrite. Grapestone is abundant in poorly washed intrapelsparite and less abundant in intrapelmicrite. Grapestone grains (Pl. IXc) have a size range similar to that of mud-aggregates and are difficult to discriminate petrographically from mud-aggregates.

Grains with an apparently reniform surface morphology were tabulated as grapestone.

Coated botryoidal grains (Pl.IXd) and large, rather tabular intraclasts (Pl.Xa), also commonly occur together. Coated botryoidal grains range from 0.1 mm to 1.5 mm (Pl.IXd) in this lithofacies, and were named by Purdy (1963a). Some of the larger botryoidal grains (Pl.IXd) are composed of several generations of small botryoidal grains.

The larger, tabular intraclasts (Pl.Xb) are up to 35 mm long but most are less than 5 mm long. These clasts may be beachrock eroded from subaerially exposed islands. Consequently the dark laminations (Pl.Xq) parallel to these clasts, may represent algal laminations. The clast shape, predominantly tabular, reflects the textural anisotropies in the original sediment. The limestone intraclast lithofacies of Sections 1 and 2 contain more large tabular intraclasts than in Section 7.

The association of these large clasts with botryoidal grains suggests another possible origin for some large intraclasts in the limestone intraclast lithofacies of Sections 2 and 7. Large tabular limestone flakes up to 60 mm long, consisting mainly of ooids, botryoidal grains, and grapestone grains, were found in grab samples from the Bahama Banks (Purdy, 1963a, p. 348-349). He suggested that these flakes were forming on the sea floor in areas of low current strength in the same manner as grapestone grains, and show submarine lithification. These crusts like those reported in the Bahamas, are composed of ooids, botryoidal grains, and grapestone grains, and are differentially cemented with an amorphous rind-like layer at the depositional interface.

It is possible then, that some large tabular intraclasts in the limestone intraclast lithofacies of the Cape Storm Formation originated from

contemporaneous submarine lithification, in a manner similar to the lime crusts of the Great Bahama Banks. Laminations in these clasts may reflect periods in which submarine cementation varied in intensity. Purdy (1963a) and Illing (1954) found that the beachrock or cayrock of islands on the Great Bahama Banks is cemented by calcite spar. Thus the lack of calcite spar may indicate a lime crust origin rather than a beachrock origin for some clasts. However, most of these tabular intraclasts undoubtedly are beachrock.

Orthochemical Constituents

Interstitial micrite is abundant in the limestone intraclast lithofacies, in pellet, mud aggregate, and grapestone-bearing pelmicrite in intrapelmicrite, and in poorly washed intrapelsparite. A large part of this micrite may have formed from the disaggregation of originally friable pellets.

Interstitial sparry calcite cement occurs in predominantly botryoidal-grain and large intraclast-bearing intrasparites and intrapelsparites. This reflects the relatively high current strengths in areas where coated botryoidal grains were deposited.

Terrigenous Constituents

Very fine sand with a mean grain size of 0.10 mm occurs scattered very sparsely throughout the limestone intraclast lithofacies. This terrigenous material constitutes 5 per cent of the facies (Fig. 18). It consists of quartz sand and accessory microcline, and orthoclase sand.

Sedimentary Structures

Thin to medium lenticular and anastomosing bedding typifies botryoidal grain- and grapestone-bearing intervals. Faint crossbeds can be discerned in some of these intervals. Medium to thick bedding (Pl.VII b) characterizes intervals containing predominantly pellets, mud aggregates and grapestone grains. Some of these beds are bioturbated.

Massive beds which contain beachrock clasts occur only in the limestone intraclast lithofacies of Sections 1 and 2. Small trough crossbeds are scattered throughout these beds.

STROMATOLITE LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

The stromatolite lithofacies has low faunal diversity and abundance. Stromatolites which represent almost all the biogenic material (Fig.16), are commonly the laterally-linked hemipheroidal LLH variety of stromatolites which Logan, Rezak and Ginsburg (1964) defined, and considered to indicate parts of intertidal flats protected from wave energy. The bioclastic material of this lithofacies consists of ostracodes and gastropods, both salinity-tolerant organisms.

Non-skeletal Allochems

Pellets comprise almost all non-skeletal allochems, and exhibit the same characteristics as they do in lithofacies discussed earlier. Commonly they occur in thin lenticles of pelmicrite and pelsparite (Pl.X c) that are defined by algal laminae. A few grapestone and botryoidal grains are sparsely scattered throughout pelsparite in this facies.

Orthochemical Constituents

Micrite and calcite spar are both common as interstitial material in the Stromatolite lithofacies. This reflects the wide range of energy conditions of the tidal flats in which this lithofacies was deposited.

Terrigenous Constituents

Terrigenous material is nearly absent from the Stromatolite lithofacies (Fig. 18). The small amount present is sparsely scattered quartz silt that is uniformly distributed.

Sedimentary Structures

Stromatolites of the LLH-S variety [i.e. laterally-linked hemispheroidal, but spaced (Logan, Rezak and Ginsburg, 1964)] occur in beds of 0.5 feet thickness, and together form a sequence of three foot thick massive beds. The amplitude of the stromatolite domes in these beds is on the average about four inches. A few horizons are bioturbated and some are mudcracked (Fig. 16).

Diagenesis of the Cape Storm Formation

Dolomite.

Dolomite is present in varying amounts in all three lithofacies of the Cape Storm Formation. The dolomitic pelmicrite lithofacies is largely dolomitized, but the limestone intraclast and stromatolite lithofacies are only partly dolomitized (Fig. 18).

Dolomicrite and hypidiotopic finely crystalline dolomite are the most common dolomite varieties in the Cape Storm Formation and are particularly abundant in the dolomitic pelmicrite lithofacies. These two dolomite types occur finely interlaminated with each other at many horizons,

in conjunction with stromatolites and shrinkage cracks (Fig.16). These very fine crystalline tidal flat dolomites may have formed penecontemporaneously with deposition of aragonite, for typically they preferentially replace inter-pellet and inter-intraclast micrite (Pl.IXd). This has been reported by Deffeyes, Lucia, and Weyl, (1964), on modern carbonate tidal flats on the island of Bonaire.

A similar pattern of dolomitization also was reported by Murray and Lucia (1967) in the Turner Valley Formation of Alberta. They argued that downward seepage of magnesium-enriched brines from tidal flat areas had dolomitized underlying subtidally-deposited pelmicrites and intrapelmicrites. The inter-pellet and inter-intraclast micrite was preferentially dolomitized as brine solutions would flow preferentially between pellets and intraclasts because of relatively greater porosity and permeability. The finely crystalline dolomite occurring between pellets appears to have formed by aggradational recrystallization of dolomicrite or dolomitization of microspar.

Finely crystalline dolomite also has partly replaced some intraclasts in intrapelsparite beds (Pl.XIa). Truncation of individual dolomite rhombs by the surface of some intraclasts may indicate that this dolomite at least partly originated prior to or during the reworking of these intraclasts on the sea floor.

Finely to medium crystalline dolomite has partly replaced the calcite spar and pseudospar between intraclasts and pellets in some intrasparites and intrapelsparites (Pl.XIb). This type of dolomite forms less than 15 per cent of the rock in which it occurs, consequently it may have formed from the magnesium liberated by calcite recrystallization. Therefore, this is a later generation dolomite than that within most intraclasts.

A small amount of relatively unvacuolized dolomite occurs as dolomite spar, lining secondary porosity, or in original vug porosity such as in bird's eye texture.

Calcite.

Calcite of the microspar and pseudospar varieties (Pl. IXc) occurs in pelmicrite and intrapelmicrite, having formed by the recrystallization of micrite. The centers of some intraclasts also have been recrystallized to pseudospar (Pl. XIa), and a thin rind of recrystallized calcite borders some intraclasts (Pl. XIb). Purdy (1963a) noted the occurrence of calcite recrystallization rinds around grapestone grains from the Bahama Banks. Consequently the calcite recrystallization rinds observed here may have developed penecontemporaneously with deposition rather than after cementation. However, Ginsburg, Schroeder and Shinn (1971) have shown that modern reef sediments undergo synsedimentary cementation with aragonite crusts that also resemble the calcite rinds around these clasts.

Some spar in intrasparites appears to have replaced parts of some intraclasts (Pl. XIc) with a late replacement texture like that named the caries type by Folk (1965).

Limonite and Pyrite.

Minute limonite grains (0.01 mm diameter), pseudomorphous after pyrite, occur scattered throughout all facies of the Cape Storm Formation. They tend to be more abundant in pelmicrites and intrapelmicrites than in intrapelsparites. Their relative abundance probably depends on the biogenic content, the Eh of the depositional environment, and on the rate of deposition of the original sediment.

Silica.

Length-fast chalcedony has replaced biogenic material in a few places. The development of length-fast rather than length-slow chalcedony may have resulted from a process suggested by Folk and Pittman (1971), in which length-fast chalcedony is favoured because of certain organic acids that were produced by the degradation of organic matter.

Depositional Model for the Cape Storm Formation

Depositional environments of the three lithofacies that comprise the Cape Storm Formation may be inferred from their characteristic sedimentary features. Analogues for almost all the sedimentary features in these facies may be found in modern depositional environments.

The limestone intraclast lithofacies contains abundant compound and coated grains that are essentially identical to those described by Illing (1954) and Purdy (1963 a and b) from the Great Bahama Banks. Newell and Rigby (1957) and Newell et al. (1960) showed that the conditions essential for the growth of coated grains is where sea water supersaturated with calcium carbonate is subjected to relatively great current agitation. In the Great Bahama Banks these conditions occur where there is tidal flow construction over shoals at the edge of the banks (Fig. 19). Coated grains form on these shoals which are commonly less than seven feet below low tide level. On the bank area behind the shoals, grapestone and pellets accumulate as uncoated grains in a carbonate blanket. This is because tidal flow is attenuated by hydrodynamic friction across the bank towards Andros Island (Purdy, 1963b; Ball, 1967) although some oolitic grains are transported back across the Bahama Banks by spillover lobes (Ball, 1967). In other modern carbonate-forming environments, such as the Trucial Coast in the Persian Gulf, oolitically-coated

grains also occur in offshore shoals (Kendall and Skipwith, 1969; Loreau and Purser, 1974) but extensive deposits of grapestone are lacking in these areas. Consequently environments of deposition across the Great Bahama Banks appear to be closer modern analogues to the environments of deposition in which the limestone intraclast lithofacies formed (Fig. 19) than are those in the Persian Gulf.

The stromatolite lithofacies is characterized by LLH-S stromatolites that have been reported to occur in upper intertidal parts of modern carbonate tidal flats (Kendall and Skipwith, 1969). In their environmental classification of stromatolites, Logan, Rezak and Ginsburg (1964), also considered that LLH-S stromatolites populated protected areas on tidal flats. The presence of dessication features, and a restricted salinity tolerant associated fauna, also indicate that the stromatolite lithofacies had a tidal-flat origin.

The dolomitic pelmicrite lithofacies has many thinly bedded intervals, with mudcracks, bird's eye structure, and algal laminations that indicate a tidal-flat origin. The intercalated thick intervals of small scale crossbedded, lenticularly and discontinually bedded pelmicrite and pelsparite in this facies possibly could be channel-bar deposits of tidal flat flood and ebb channels. Shinn et al. (1969) have noted that the channel-bar deposits in the large tidal flood and ebb channels traversing the tidal flats of Andros Island can be faintly crossbedded and contain inclined, poorly developed discontinuous bedding. Small ripples produce the small-scale crossbeds in modern tidal channel bars. The anastomosing beds in this facies may then be the preserved forms of similar ripples.

The dolomitic pelmicrite lithofacies also contains thick featureless, bioturbated beds, that probably formed in quiet subtidal environments, between emergent areas characterized by tidal flat deposits and shoal areas farther offshore. However, some burrowed beds may represent intertidal pond deposits within the tidal flat area or even tidal channel deposits in tidal channels that crossed the tidal flat.

Silt may have accumulated in the dolomitic pelmicrite lithofacies (Fig. 18), because of the near absence of current agitation during deposition. Conversely the near absence of terrigenous silt in the limestone intraclast lithofacies may be the result of relatively high current agitation which kept silt-size material in suspension during deposition.

Application of a Bahama-type facies tract model (Fig. 19) to the Cape Storm Formation in the area around Grinnell Peninsula results in a regional depositional model, with a broad platform area of subtidal shoals occupying most of Grinnell Peninsula, and emergent tidal-flat areas to the southwest (Fig. 20) at the beginning of Cape Storm deposition assuming the base of the Cape Storm Formation is a synchronous surface. Verification of this model for deposition of the Cape Storm Formation will require a petrographic study of the Cape Storm Formation on central and western Grinnell Peninsula although field work by the authors in 1972 indicates that the limestone intraclast lithofacies and its dolomitized equivalent occupies most of Grinnell Peninsula. One section on southwest Grinnell Peninsula shown as Section 10 on Figures 16 and 19, was measured by the authors in 1972. This section is 2,378 feet thick and, although it has not been studied petrographically, it appears to be formed entirely of thick bedded limestone intraclast lithofacies and dolomitized limestone intraclast lithofacies. It is overlain unconformably by undivided Devonian carbonates and hence may have been thicker than 2,378 feet.

The slope beyond the outer platform in this Arctic example contains the Cape Phillips shale. Trettin (1972) estimated that the Cape Phillips shale accumulated on a slope of approximately 5/1. In the Bahamas the bathymetric slope immediately seaward of the very shallow water carbonate sands is also about 5/1. Thus the edge of the Bahama-type platform on which

Cape Storm carbonates accumulated, is delineated by its lateral facies contact with shale of the surrounding Cape Phillips Formation (Fig. 20).

The fact that the limestone intraclast lithofacies is overlain by the dolomitic pelmicrite lithofacies wherever the limestone intraclast lithofacies is present (Fig. 16) suggests that areas of tidal-flat deposition expanded at the expense of subtidal shoal areas during deposition of the Cape Storm Formation.

Douro Formation

Distribution, Thickness and Age

The Douro Formation was named by Thorsteinsson (1963), and its type section in the Douro Range is principally limestone 1,300 feet thick. From its faunal content and identical lithology, Thorsteinsson (1963) correlated the Douro Formation with Member A of the Read Bay Formation of Cornwallis Island. Thus the Douro Formation was considered to range in age from Middle Silurian (Wenlockian) to early Late Silurian (early Ludlovian). Kerr (in press) redefined and modified the Silurian succession in and surrounding the study area, and erected the new Cape Storm Formation. The type section of the Douro Formation and its boundaries in the study area, however, were left as originally designated by Thorsteinsson. The age of the Douro Formation was regarded by Kerr (in press) to be somewhat younger than previously thought, and it is now dated as belonging to the Ludlovian and lower Pridolian Series of the Silurian (Table I), based on datings by Smith (1973).

Complete sections of the Douro Formation that have not been reduced by erosion range from 311 feet thick in Section 4 to a maximum of 1,179 feet thick in Section 5, and the pattern of thickness variations shows

two maxima. The considerable thickness variations in the Douro Formation are similar to thickness variations in the underlying Cape Storm Formation. The conformable contact with the underlying Cape Storm Formation tends to be gradational. The distinctive, smooth, light yellowish grey weathering, thin beds of the dolomitic pelmicrite lithofacies of the Cape Storm Formation pass gradationally upwards to the lumpy medium greenish grey, thin to medium limestone beds of the Douro Formation.

In contrast the upper conformable contact with the overlying Devon Island Formation is very abrupt. In Section 3, where the upper contact is exposed, silty thinly bedded, black, organic-rich shale and limestone of the Devon Island Formation overlies greenish grey, thick bedded limestone of the Douro Formation (Pl.XId).

The Douro Formation contains an unburrowed dolomitic lithofacies and a burrowed limestone lithofacies in the report area (Fig.21). The unburrowed dolomitic lithofacies is composed largely of thin to medium bedded, greenish grey dolomitic limestone. Commonly these beds have lumpy bed surfaces due to an abundance of subspherical atrypellid brachiopods. Scattered wisps of silty argillaceous material impart a greenish hue to this facies.

The unburrowed dolomite lithofacies forms the lower part of the Douro Formation (Fig.21). Intra-Devonian erosion has removed the Douro Formation altogether from Section 9, and has reduced the thickness at Section 8 such that only a lower part of the formation is present.

Where the burrowed limestone lithofacies is present, it occupies the upper part of the Douro Formation (Fig.21). It is commonly a dark greyish green, medium bedded, fossiliferous limestone. The greater abundance of illite and sericite in this facies compared to that in the unburrowed dolomitic lithofacies produces a correspondingly darker green colour.

Lithostratigraphy

UNBURROWED DOLOMITIC LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

The unburrowed dolomitic lithofacies has a fauna of great abundance but low diversity, the brachiopod *Atrypella* (Pl. XIIa) (identified by B.S. Norford) being the predominant element in this fauna. Intervals composed almost entirely of closely packed articulated and disarticulated atrypellid brachiopods alternate with sparsely fossiliferous intervals. These intervals are several inches to several feet thick. Minor constituents in the fauna include other brachiopod types, crinoids, ostracodes, solitary corals, colonial corals (including *Favosites* and *Syringopora*, identified by B.S. Norford), echinoids, bryozoa, and trilobites (Fig. 21). They occur sparsely scattered throughout largely atrypellid-bearing intervals.

Nonskeletal Allochems

Pellets, the most abundant allochem type in the unburrowed dolomitic lithofacies, occur in pelmicrite and pelsparite (Pl. XIIb). Some parts of this facies are very pelletal, whereas other parts are poor in pellets (Fig. 21). Where pellets are most common ostracodes are abundant, and conversely wherever ostracodes occur, pellets are also present. This relationship does not appear to apply for any other faunal element. It is probable that these pellets are ostracode fecal material, as the ones in the Cape Storm and Thumb Mountain Formations appear to be.

Some beds within dolomitized intervals, particularly certain horizons in the entirely dolomitized sequence of Section 8, contain packed pelletal ghosts (Pl. XIIc). These pelletal ghosts have ~~teh~~ the same size range as undolomitized pellets, from 0.05 to 0.12 mm in length.

Intraclasts are uncommon in the Douro Formation. A few scattered biopelmicrite intraclasts occur at one horizon in Section 1 (Fig. 21). No limestone intraclasts were observed in other sections of this facies. Angular clasts of dolomite, commonly tabular (Pl. XIId), occur in the finely crystalline dolomite of Section 8. These dolomitized intraclasts are distinguishable from the dolomite groundmass by either coarser or fine crystal size and by a difference in silt content. The more coarsely crystalline dolomite intraclasts contain pelletal ghosts.

Orthochemical Constituents

Micrite is almost the sole orthochemical constituent of this facies, and occurs in either biomicrite or biopelmicrite (Fig 21). Equant calcite spar occurs as a cement in the few occurrences of biopelsparite within this facies. The preponderance of micrite reflects low energy conditions of deposition.

Terrigenous Constituents

The rocks of the unburrowed dolomitic lithofacies contain about 5 per cent of very fine terrigenous sand with an average grain size of 0.08 mm. This sand is predominantly quartz with accessory microcline, orthoclase and fine sericite (Appendix 1). Some beds in Section 1 depart somewhat from this generalization, where terrigenous silt and fine sand may form more than 50 per cent of the rock. This indicates a southeastern terrigenous source area, which very likely was the exposed Precambrian metamorphic and igneous terrain of the Canadian Shield.

Illite or sericite also is a large contributor to the terrigenous content of the unburrowed dolomitic lithofacies, and locally may form up to 10 per cent of the rock. Commonly it occurs as thin, green, shaly

partings, between beds and as thin curvilinear green wisps within beds. This constituent is responsible for the overall green hue of the Douro Formation. Some chlorite is also present (Appendix 1).

Sedimentary Structures

Low-angle festoon crossbedding is common in Section 1 and is present also at scattered intervals in Section 2 (Fig. 21). This crossbedding (Pls. XIIIa and XIIIb) occurs in medium bedded to massive beds of very silty rocks. The long directions of individual troughs trend northwestward (Pl. XIIIb) and the direction of transport inferred from crossbedding attitudes is northwest. Crossbeds are not present in northern sections. The distribution of crossbeds and direction of transport support the conclusion reached from the distribution of clastics, that there was a southern terrigenous source area.

Most of the unburrowed dolomitic lithofacies is formed of thin to medium beds that are discontinuous and lumpy, and are defined by thin green argillaceous seams. The abundant articulated and disarticulated atrypellid brachiopods form lumpy bed surfaces.

All sections of this facies contain a few intervals, 5 to 10 feet thick, of thin to medium bedded, smooth bedded, finely crystalline calcareous dolomite (Pl. XIIIc). Typically these intervals are finely laminated and are mudcracked, with some planar fenestrate fabric (Pl. XIIb). Commonly they are interbedded with brachiopod-rich beds (Pl. XIIIc).

BURROWED LIMESTONE LITHOFACIES

Allochemical and Biogenic Constituents

Skeletal Allochems and Biogenic Constituents

The predominant biogenic constituent of the burrowed limestone lithofacies is an assortment of articulated brachiopods, the most abundant being *Atrypella* (identified by B.S. Norford). Although they are predominant, brachiopods are not nearly as abundant relative to other faunal constituents in this facies as they are in the unburrowed dolomitic lithofacies. Other common biogenic constituents of this facies are pelmatozoans, gastropods, ostracodes, solitary corals, colonial corals (such as *Favosites*, *Thamnopora*, *Tabularia* and *Entelophyllum*, identified by B.S. Norford), echinoids, and trilobites, (such as *Encrinurus*, *Cyphoproetus* and *Hemiarges*, identified by B.S. Norford) (Fig. 21). Bryozoa and cephalopods are minor constituents, and occur at only a few horizons. Pyritized fish heads and cephalopods were observed at the top of the Douro Formation in Section 3 (Pl. XIIId).

Most biogenic material is present as abundant unoriented (Pl. XIVa) bioclastic material in the ground mass. However, many of the articulated brachiopods may have remained in growth position (Smith, 1973).

Nonskeletal Allochems

Pellets occur throughout the burrowed limestone lithofacies in both packed and sparse biopelmicrite (Fig. 21). The length of individual pellets is about 0.10 mm on the average, about the same as those in underlying formations. Typically they are ovoid and unfragmented and, like Thumb Mountain pellets, are barely distinguishable from interstitial micrite (Pl. XIVa). No intraclasts occur in this facies.

Orthochemical Constituents

The main orthochemical constituent present in the burrowed limestone lithofacies is micrite, occurring in both biomicrite and biopelmicrite. This indicates that there was low current strength during deposition. Calcite spar occurs in a few beds of poorly washed pelsparite.

Terrigenous Constituents

The clay and clay-like minerals illite, sericite and chlorite constitute more than 10 per cent of this facies. They occur both disseminated throughout and as thin shaly parting seams between beds. Some intervals contain enough illite and sericite to be considered calcareous shale (Fig.21). The dark green colour on fresh surfaces in the rocks of this facies result from the large proportion of illite and sericite. The high proportion of illite and sericite of this facies is further evidence of low current activity during deposition of this lithofacies.

Quartz silt, with accessory microcline and orthoclase, occurs sparsely in this facies.

Sedimentary Structures

Uneven bed surfaces are characteristic of most beds of the burrowed limestone lithofacies. They resemble the lumpy bed surfaces of the unburrowed dolomitic lithofacies. This resemblance is superficial, however, for the uneven bed surfaces in the burrowed limestone lithofacies were produced largely by burrowing (Pl.XIVb), whereas the lumpy bed surfaces in the unburrowed dolomitic lithofacies result from the profusion of atrypellid brachiopods (Pl.XIIa). Atrypellids tend to occur in isolated clusters in the burrowed limestone lithofacies. Burrow mottling (Pl.XIVc) within burrowed beds in this facies appears to conform with bed surface

topography. Intensive burrowing produced a distinctive nodular bedding in many parts of this facies (Pl.XIVb).

A few unburrowed, thick to massive beds (Pl.XId) of biomicrite occur near or at the top of this facies, and are most common in Section 3.

Diagenesis of the Douro Formation

Dolomite. Three modes of dolomite occur in the Douro Formation; as largely or completely dolomitized beds in the unburrowed dolomitic lithofacies; as patchy areas with abundant clay that are elongate parallel to bedding in the burrowed limestone lithofacies; and, to a lesser extent, in the unburrowed dolomitic lithofacies and as vein fillings in both facies.

In the unburrowed dolomitic lithofacies the intervals that are largely to completely dolomitized consist of thin, smooth mudcracked beds, with sedimentary structures that are suggestive of tidal-flat deposition. These beds are characterized by finely to very finely crystalline hypidiotopic dolomite. It seems likely that most of this variety of dolomite formed penecontemporaneously on tidal flats.

Most dolomite in this formation occurs as finely to very finely crystalline hypidiotopic dolomite in clay seams or clay-rich areas within beds that are predominantly limestone. The clay itself may be responsible for this type of dolomitization, having provided the Mg^{+2} ions from montmorillonitic clays during burial, or by the loss of Mg^{+2} ions to the surrounding carbonates from the crystalline structure of clays. The relatively Mg^{+2} deficient clay mineral illite forms the clay fraction of the Douro Formation but it is possible that some of this illite clay had montmorillonite as a precursor.

It is more probable that the source of magnesium for dolomitization of the patchy dolomite areas was from the recrystallization of high magnesian calcite in limestone. Intercrystalline solutions which caused the extensive recrystallization of limestone in the Douro Formation would have been channelled preferentially along clay-rich seams. This is because the clay-rich seams have relatively greater lateral permeability than does the surrounding limestone, so that the rate of fluid flow along clay-rich seams is greater. Because of the Bernoulli effect, there would be a drop in fluid pressure in and near the clay seams, producing a diversion of intercrystalline fluid flow from surrounding limestone areas towards the clay seams. The intercrystalline pore waters probably were of meteoric origin and flowed northward downdip through the Douro Formation.

Vugs and late tectonic veins are filled by medium crystalline idiotopic dolomite which is relatively free of inclusions. This dolomite probably formed by slow precipitation from dilute, magnesium-enriched solutions.

Calcite. Micrite in the Douro Formation has been extensively recrystallized to ragged xenotopic calcite with crystal sizes from 0.02 mm to 0.40 mm. Growth of neomorphic bladed calcite (Folk, 1965), in contact with and perpendicular to shell surfaces, is responsible for much of the ragged appearance of this recrystallization calcite. Relict pellets are common in recrystallized areas.

Pyrite and Limonite. Minute grains of pyrite and of limonite pseudomorphous after pyrite are disseminated throughout the Douro Formation (Pl. XIVq). Pyrite and limonitized pyrite are much more abundant in the burrowed limestone lithofacies than in the unburrowed dolomitic lithofacies, because

the former had a more organic-rich reducing environment of deposition. Masses of concretionary pyrite and limonitized pyrite occur in certain zones that have abundant biogenic material, such as the fish zone at the top of Section 3 (Pl. XIIId).

Depositional Model for the Douro Formation

Figure 21 shows that the unburrowed dolomitic lithofacies initially was deposited landward of the burrowed limestone lithofacies. During deposition of the Douro Formation the boundary between these two facies moved landward with the result that the facies boundary is higher in southeastern sections than in northwestern sections.

The pervasive bioturbation and diverse fauna (Fig. 21) in the burrowed limestone lithofacies suggest that it, like the limestone lithofacies of the Thumb Mountain Formation, accumulated in quiet water of nearly normal marine salinity. This points to the existence of a shallow partly protected shelf or shelf lagoon during deposition of the Douro Formation such that a diverse fauna could flourish and infauna could rework the pelletal lime mud unhindered by current or wave action. Hattin (1971) and Laporte (1969) recently have suggested a similar origin for other laterally extensive burrowed limestone sequences.

Evidently this shelf lagoon expanded during deposition of the Douro Formation and transgressed over dolomitized and mudcracked peritidal deposits of the unburrowed dolomitic lithofacies (Fig. 21). The strongly dolomitized unburrowed dolomitic lithofacies of Section 8 may represent former shelf edge shoal deposits similar to those that existed during deposition of the Thumb Mountain Formation although it is possible that the developement of the unconformity towards the northwest may have caused dolomitization of the

Douro Formation in Section 8.

The low amplitude crossbeds in Sections 1 and 2 (Fig. 21) are similar to those produced by the migration of small-scale ripples on tidal flats as described by McKee (1967). The relatively high proportion of terrigenous silt and clay in Sections 1 and 2 of the Douro Formation suggests that there was a considerable influx of continental fresh water from the Shield area to the southeast during deposition. This fresh water may have helped to maintain normal salinities and so prevented deposition of evaporites or widespread dolomitization.

DEVON ISLAND FORMATION

Distribution, Thickness and Age

The Devon Island Formation was named by Thorsteinsson (1963) and its type section occurs northwest of Ptarmigan Lake, immediately beneath Section 6 of the present report (Map). He reported the formation to be 480 feet thick, consisting of medium dark grey to greyish black calcareous shale, and shale with very minor interbeds of medium dark grey argillaceous limestone. On the basis of graptolites collected near the middle, the Devon Island Formation was tentatively dated as Late Silurian, early and middle Ludlovian. International changes of series designation have since been made at this level in the column and this requires redating of some formations on Devon Island. Thorsteinsson (1963) collected *Monograptus* n. sp., aff. *M. angustidens* Pribyl in the type section of the Devon Island Formation. He (pers. com., 1973) now considers this graptolite to be of latest Pridolian age. In addition, the trilobite *Warburgella rugulosa* (Alth) *canadensis* Ormiston (identified by A.W. Norris) was collected 627 feet from the base of Section 3 and the graptolite *Monograptus fanicus*

Koren (n. sp.)(identified by D.E. Jackson) was collected 335 feet from the base of Section 9 (Fig.22). This indicates a Gedinnian age for the upper part of the Devon Island Formation (see Appendix V). The age of the Devon Island Formation thus is considered here to be late Pridolian to early Gedinnian, based on this fauna and the datings of the overlying and underlying formations (Table 1).

In the Douro Range the Devon Island Formation ranges in thickness from 357 feet at Section 7 to 1,001 feet at Section 3 (Fig.22), the thickness increasing gradually and uniformly to the southeast.

The basal contact with the underlying Douro Formation is sharp and unconformable everywhere. This contact is well exposed at Section 3 where finely laminated, yellow-weathering organic-rich limestone with a distinctive shaly parting of the Devon Island Formation overlies massive grey biomicrite limestone beds of the Douro Formation (Pl.XId). Organic material in the Devon Island Formation is present as wisps of sapropel.

In all sections in the report area from Section 7 southward, the Devon Island Formation is overlain by the Sutherland River Formation with a gradational, conformable contact. From Grove Lake northward in the report area the Devon Island Formation is absent, possibly having been removed by pre-Sutherland River erosion (Map).

Two distinct lithofacies comprise the Devon Island Formation, a laminated lithofacies and a medium-bedded lithofacies. The laminated lithofacies which forms most of the Devon Island Formation is a very organic-rich (sapropelic), dark brown to black, silty, thinly laminated somewhat fissile limestone and dolomite that weathers light yellow (Pl.XId). These attributes have prompted previous references to the Devon Island Formation as shale.

Commonly several thick interbeds of grey fossiliferous limestone form resistant ledges up to 6 inches thick but otherwise outcrops of laminated lithofacies weather uniformly. It appears on airphotos as a notably recessive medium grey unit.

The medium-bedded lithofacies occurs at the top of the Devon Island Formation and increases in thickness towards the southeast. It is characterized by medium yellowish brown and dark brown, thin to medium bedded, silty, organic-rich (sapropelic) dolomite. This facies cannot be distinguished readily from the laminated lithofacies on airphotos.

Lithostratigraphy

LAMINATED LITHOFACIES

Allochemical Constituents of the Laminated Lithofacies

Skeletal Allochems

This facies of the Devon Island Formation generally is unfossiliferous. A few horizons in the lower part of the lithofacies contain abundant graptolites, *Monograptus transgrediens* (identified by R. Thorsteinsson) and *Monograptus fanicus* (identified by D.E. Jackson) (Fig.22). Other faunal elements that occur sparsely are fish fragments, pelmatozoans, brachiopods (such as *Camarotoechia, Lingula, Mesodouvillina, Lavena, Gypidula, Orbculoidea, Spinulicosta,* and *Coelospira* - identified by A.W. Norris), ostracodes, trilobites including *Warburgella rugulosa* and *Encrinurus arcticus* (identified by A.W. Norris), and echinoid fragments.

The ledge-forming solitary beds of biopelmicrite and biomicrite that occur, scattered sparsely throughout this facies contain abundant large brachiopods including disarticulated *Rhidpidium, Meristella,* and *Spinatrypa* (identified by B.S. Norford), with lesser amounts of frag-

mented corals, pelmatozoa, ostracodes, trilobites and echinoderms (Fig. 22). Current action appears to have oriented the bioclasts in these beds (Pl. XIVd) parallel to bedding.

Nonskeletal Allochems

Pellets and pellet fragments (Pl. XVa) occur in many beds of the laminated lithofacies. Somewhat larger intraclasts up to 0.25 inches in length, occur sparsely scattered throughout the solitary medium beds of biopelmicrite that punctuate this facies. Many of these intraclasts have a pelletal fabric Rounded pelmicrite limestone blocks occur near the base of Section 3 (Pl. XId). Shaly limestone beds are draped over these blocks (Pl. XId). These blocks are considered to have had an allochthonous origin.

Orthochemical Constituents

The major orthochemical constituents of this facies are micrite and sapropel. No other orthochemical constituents are evident. However, interpelletal pseudospar is abundant and some of it may be partly primary sparry calcite cement. The predominance of micrite and organic matter indicates deposition under somewhat reducing conditions of low turbulence.

Terrigenous Constituents

The laminated lithofacies is composed of about 10 per cent silt, made up of subangular common quartz and sericite (0.02 to 0.10 mm), with minor microcline and orthoclase (Pl. XVb). In Section 2 the silt and sand content reaches 25 per cent, near the base of this facies.

Illite and sericite are also commonly occurring constituents of the laminated lithofacies (Appendix I). Flakes of sericite are visible in Plate XVa.

Sedimentary Structures

The most striking sedimentary structure of the laminated lithofacies is its extremely regular, almost varve-like, laminated appearance (Pl.XVc). These laminae are defined by vertical alternations in the concentration of very dark brown wisps of bituminous organic matter (Pl.XVa) and range from one millimeter to one centimeter thick. The lighter coloured laminae contain coarser silt and less organic matter than the dark laminae (Pl.XVd). At many places, the lower contacts of lighter laminae overlying darker laminae are erosional, with minute cut-and-fill structures (Pl.XVd). Some laminae contain faint internal crossbedding and contorted bedding (Pl.XVd). The only other sedimentary structure in this facies involving more than single laminae is the sedimentary drape of laminae over the allochthonous limestone blocks at the base of Section 3 (Pl.XId) and the solitary, resistant ~~limestone~~ medium limestone beds.

MEDIUM-BEDDED LITHOFACIES

Allochemical Constituents

Skeletal Allochems

Brachiopod and pelmatozoan fragments are scattered sparsely throughout the few solitary argillaceous limestone beds in the medium-bedded lithofacies. These limestone beds resemble the lumpy, discontinuously bedded limestones of the Douro Formation. Dolomite beds of this lithofacies are unfossiliferous (Fig.22).

Non-Skeletal Allochems

Remnants of pellets, about 0.10 mm in length, are common in dolomite of this facies. They occur as relatively opaque concentrations of inclusions in a more transparent background of dolomite. Sparsely scattered pellets also occur in limestone beds of this facies.

Orthochemical Constituents

Micrite and sapropel are probably the only orthochemical constituents of the medium-bedded lithofacies. They indicate a relatively quiescent site of deposition. Sapropel is considerably less abundant in this facies than in the laminated lithofacies which may indicate more oxygenated conditions for deposition of sediments of the medium-bedded lithofacies. Much, if not all the dolomicrite and finely crystalline dolomite of this facies, has probably recrystallized from micrite.

Terrigenous Constituents

The terrigenous content of the medium-bedded lithofacies is somewhat coarser than that of the laminated lithofacies. Most samples of the medium-bedded lithofacies contain more than 10 per cent terrigenous silt and clay. Beds of dolomite-cemented fine sandstone occur at the base of this facies in Section 2 (Fig. 22). Subangular unstrained normal or common quartz with accessory sericite, orthoclase and microcline are the most common terrigenous minerals in this facies.

Sedimentary Structures

Some trough crossbedding was observed in this facies at Section 2 (Fig. 22). Individual troughs are poorly exposed but appear to be about 2 feet across and have an amplitude of six inches.

Bed thickness in this facies ranges from thin bedded in the lower part to medium bedded in the upper part. Discontinuous laminae within these beds reflect alternations in organic and silt content and silt sizes. Light-coloured laminae contain more and coarser silt. The basal contacts of light-coloured laminae display small-scale cut and fill. At many horizons these millimeter thick internal laminae are contorted and crossbedded.

Diagenesis of the Devon Island Formation

Dolomite

The Devon Island Formation has been extensively dolomitized. Figure shows that the degree of dolomitization increases upwards from undolomitized beds of silty organic-rich, micrite and pelmicrite in the lower part of the laminated lithofacies to the thin and medium-bedded dolomite in the medium-bedded lithofacies and the upper part of the laminated lithofacies towards the top of the formation. Most of this dolomite is hypidiotopic, contains abundant inclusions and is finely crystalline (Pl.XVIa). Sizes of the dolomite crystals vary between individual dolomitized laminae, and appear to depend directly on the grain size of the original sediment making up the laminae.

The preservation of rhombic crystal forms and the presence of relict pellets indicate in situ dolomitization rather than deposition of detrital dolomite. The dolomitization of the upper part of the Devon Island Formation may have been induced by a northwestward flow of continental fresh water through the formation, in a manner similar to that suggested for Allen Bay dolomite. Possibly the hydraulic head of this continental water was not great enough to allow it to displace marine pore water in sediments which were deposited below wave base in deep water.

Calcite

Some micrite in limestone lamina in the laminated lithofacies appears to have recrystallized to pseudospar but, it is difficult to observe clearly matrix between grains. This is a common feature of deep water detrital limestones (Wilson, 1969).

Coarsely crystalline bladed pseudospar is abundant in the isolated medium beds of biopelmicrite that are scattered throughout the laminated lithofacies. The blades of pseudospar typically are perpendicular to the walls of the shell fragments (Pl.XIVd).

Pyrite, Limonite, and Organic Matter

Thin wisps of brown sapropel are abundant parallel to bedding. Pyrite and limonitized pyrite are extremely rare but occur as minute grains at a few horizons. An environment where abundant degraded organic matter or sapropel is preserved but little pyrite has been formed was named "gyttja" by Krauskopf (1967). He suggested that in this environment, the supply of noncalcareous organic matter is large so that some of it is preserved, but is insufficient to deplete the surrounding sediment of oxygen, to a level in which pyrite could form by reduction of iron.

Silica

The only diagenetic silica present in the Devon Island Formation is length-fast chalcedony, which has partly replaced some bioclasts in the medium beds of biopelmicrite scattered throughout the laminated lithofacies. Length-fast chalcedony formed in these bioclasts rather than length-slow, because of the organic acids that formed during the anaerobic degradation of noncalcareous organic matter, in the manner described by Folk and Pittman (1971).

Depositional Model for the Devon Island Formation

Two terms coined by Rich (1951) have bearing on the Devon Island Formation; a clinoform is a paleoslope below wave base and a clinothem is the deposit laid down on such a slope. Environmental features of clinoforms include the inclination of the clinoform surface, lack of wave caused

disturbances, great and oft repeated variations in sediment supply, deposition dominantly from suspension, density currents periodically flowing down the slope, gravity sliding and intrastratal or interstratal flowage. Undaform, also coined by Rich (1951) is a flat surface or very gentle paleoslope that develops landward of a clinoform. Undaforms occur in shallow water above wave base. Undathems are the deposits laid down on undaforms.

The organic-rich laminites of the laminated lithofacies of the Devon Island Formation resemble deep water shales of euxinic basins. They have varve-like laminations and contain an abundance of dark brown non-calcareous organic matter. A variety of other sedimentary features however, indicate that, although rocks of the laminated lithofacies were deposited in a reducing environment, they were not deposited on a flat basin bottom but rather on a paleoslope below wave base (Fig.23).

The thin laminated bedding of alternating silt and clay sized particles contains current ripples; most laminae have erosional basal contacts and some laminae contain contorted convolute structures. These attributes suggest that individual laminae were deposited from turbidity currents that moved downslope rather than on a flat basin bottom.

Recently Wilson (1969) described microfacies and sedimentary structures in a variety of limestones that were deposited on paleoslopes adjacent to shallower carbonate shelf sequences. The laminated silty micropelletoidal limestones that he described have textures similar to those of laminated dolomites and limestones of the laminated lithofacies. The small-scale cross-laminae, uniform grain size of both carbonate particles and associated quartz grains, and small scale graded bedding suggest that the laminated rocks of the Devon Island Formation were deposited originally as a grainstone, even where individual carbonate grains are not discernible.

The many light coloured laminae with erosional contacts at their base probably were derived from a nearby well oxygenated shelf area and deposited by turbidity currents. The darker laminae containing more sapropelic organic matter probably represent intervals of pelagic sedimentation on the clinoform.

No flute casts or tool marks were seen on bed surfaces in the Devon Island Formation. Their absence may be a consequence of the relative thinness of individual turbid flows that formed individual laminae although very few bed surfaces are well exposed.

The medium beds of biopelmicrite which punctuate the laminated lithofacies appear to have a packed clastic current-oriented internal fabric. This may indicate that they are also turbidity flow slope deposits. Similar beds in the Cape Phillips Formation contain large slump folds (Pl. VIc).

If the laminated lithofacies of the Devon Island Formation is a clinothem then the overlying medium-bedded lithofacies may represent the coexisting undathem deposits that accumulated above wave base. Both the occurrence of trough crossbeds and the comparative lack of sapropel in the medium-bedded lithofacies support this interpretation. Some medium beds of the medium-bedded lithofacies may be more proximal deposits of turbidites that graded down-slope to individual laminae in the laminated lithofacies.

Consequently the contact between the laminated lithofacies and the medium-bedded lithofacies may be the facies junction or boundary between a northward-prograding clinothem and its overlying undathem (Fig. 23). This presumably reflects progradation from the southeast.

The Devon Island Formation is absent from the line of section northwestward from Section 7 (Fig. 24), having been removed by Early Devonian (Gedinnian) erosion prior to deposition of the Sutherland River Formation.

The report area evidently spans the eastern margin of the Cornwallis Fold Belt, and underlying Boothia Uplift at this latitude. This unconformity thus dates a raising of the fold belt and uplift, that was contemporaneous with the earliest Early Devonian uplift that was documented by Kerr and Christie (1965), and Kerr (in press), on the west side of the fold belt on eastern Bathurst Island. An uplift in the western part of the study area tilted the entire sequence downward towards the east at the time of development of this unconformity. This uplift and tilting explains the southeastward tilt along the line of section of the contact between the medium-bedded and laminated lithofacies of the Devon Island Formation and of the base of the Devon Island Formation (Fig.24). Relative downtilting of the Devon Island Formation to the southeast would have rotated the westerly inclined clinothem deposits of the laminated lithofacies towards horizontality (Fig.23). This may also explain the near horizontality of the base of the Devonian System, as defined by the trilobite *Warburgella rugulosa* and the graptolite *Monograptus fanicus*, in Figure 22.

It is possible that downtilting of the Devon Island Formation to the southeast occurred during its deposition as well as afterwards and would have ended the basinward, northwestward advance of the Devon Island clinothem (Fig.23). This constitutes an alternate explanation for the absence of the Devon Island Formation northwest of Section 7.

SUTHERLAND RIVER FORMATION

Distribution, Thickness and Age

The Sutherland River Formation was named by Thorsteinsson (1963); its type section which was designated on Sutherland River is within Section 4 of the present report (Map). The writers found the type section of

the Sutherland River Formation to be 339 feet thick. It overlies the Devon Island Formation with a contact that is conformable and gradational over a few feet. The upper contact with the Prince Alfred Formation in the type section is a disconformity or slight angular unconformity that occurs beneath a dolomite breccia zone. Toward the northwest the Sutherland River Formation gradually becomes unconformable, cutting down through older formations northwest of Grove Lake. The upper contact, beneath the Prince Alfred Formation (Pl. XVIb) also becomes an angular unconformity when traced to the northwest; and northwest of Section 7 the Sutherland River Formation is absent due to pre-Prince Alfred erosion (Map 000). The Sutherland River Formation ranges in thickness from 90 feet in Section 6 to 428 feet in Section 7, the thickness increasing generally southeastward. Irregularities in the unconformable contact between the Sutherland River dolomite and overlying Prince Alfred sandstone apparently accounts for much of the observed thickness variations of the Sutherland River Formation (Fig. 25).

Two distinct laterally equivalent lithofacies comprise the Sutherland River Formation. The fossiliferous dolomite lithofacies occupies the southeastern part of the study area, whereas the unfossiliferous dolomite lithofacies occurs towards the northwest and in part overlies the fossiliferous dolomitic lithofacies (Fig. 25).

Very light grey and light brown finely crystalline dolomite with thin to thick, well developed bedding forms both these facies (Fig. 26). The most apparent differences between these facies that are readily recognizable in the field include the thin to medium bedded, unfossiliferous aspect of the unfossiliferous dolomite lithofacies versus the medium to thick bedded, fossiliferous appearance of the fossiliferous dolomite lithofacies.

The Sutherland River Formation was originally reported as late Silurian in age (Boucot *et al.*, 1960; Thorsteinsson, 1963). Changes internationally at this level in the geological column, along with re-analysis of faunas have resulted in the Sutherland River Formation now being dated as Early Devonian or Gedinnian in age (Berry and Boucot, 1970, p. 228; Klapper *et al.*, 1970).

Lithostratigraphy

FOSSILIFEROUS DOLOMITE LITHOFACIES

Allochemical constituents consist of dolomitized brachiopods, ostracodes, crinoids, gastropods, and other indeterminate shell debris, all of which are sparsely scattered throughout this facies (Fig. 25). Brachiopods and gastropods commonly weather out as molds. The only nonskeletal allochemical constituents of this facies are remnants of pellets (Pl. XVIc).

Sedimentary structures in this lithofacies are limited to undulatory bed surfaces in some crossbedding. Faint, small scale crossbedding occurs at Section 4 (Fig. 25) and may indicate that the undulatory bed surfaces of this facies are the result of small-scale cut and fill. Undulatory bedding is more evident northwestward in this facies (Fig. 25).

The terrigenous content of the fossiliferous dolomite lithofacies is less than 5 per cent. Section 4 contains more terrigenous material than Sections 2 and 3. The amount of terrigenous silt and clay in this facies increases slightly toward the northwest. Angular quartz silt of grain size about 0.05 mm, with subsidiary microcline and sericite, occurs scattered as a trace constituent, either in thin seams or uniformly disseminated throughout the facies.

UNFOSSILIFEROUS DOLOMITE LITHOFACIES

The most abundant allochemical constituents are pelletal remnants that are similar to those of the fossiliferous dolomite lithofacies. These pellet remnants were discerned at several horizons of this facies (Fig.25). Angular tabular clasts of dolomicrite up to 0.5 m long form a breccia at some horizons (Fig.25).

Biogenic material is restricted to a few dolomitized crinoids. Some minute stromatolitic undulations (Pl.XVId) occur in the laminated dolomicrite of Section 7.

Bedding is thinly laminated to medium thickness (Pl.XVIIa). Most of the dolomite of this facies has smooth, planar bed surfaces. Some finely laminated horizons in Sections 6 and 7 contain abundant fenestrate fabric (Pl.XVIIb). A small amount of quartz silt is present in this facies.

Diagenesis of the Sutherland River Formation

Dolomite

Dolomite of the fossiliferous dolomite lithofacies is made up mainly of homogeneous finely crystalline, hypidiotopic dolomite (Pl.XVIc) with an average crystal size of 0.08 mm. Laminae of finely crystalline dolomite occur interlaminated with laminae of dolomicrite a fraction of a millimeter thick in the unfossiliferous dolomite lithofacies. Dolomite of the Sutherland River Formation resembles that of the Allen Bay Formation. Continental fresh water from Shield areas or from the area of the Boothia Uplift may have infiltrated and dolomitized the Sutherland River Formation penecontemporaneously with deposition in a manner similar to that proposed for Allen Bay dolomite.

Limonite, Pyrite and Organic Matter

Minute grains, about 0.01 mm in diameter, of limonite and limonitized pyrite are disseminated sparsely but homogeneously throughout the fossiliferous dolomite lithofacies. Large concretionary limonite masses up to 2 inches wide occur at the base of Section 2 (Fig.25), and have nucleii of biogenic material such as brachiopods or gastropods.

In the unfossiliferous dolomite lithofacies, minute disseminated grains of limonite and limonitized pyrite, though not abundant, are more common in dolomicrite laminae than in the adjacent finely crystalline dolomite laminae. Scattered wisps of sapropelic organic material also occur preferentially in the dolomicrite. These features may indicate the former presence of blue-green algae in dolomicrite laminae..

Depositional Model for the Sutherland River Formation

The predominance of tidal flat features such as bird's eye structure and stromatolites, and the lack of fauna, indicate a peritidal origin for the unfossiliferous dolomite lithofacies. The fossiliferous dolomite lithofacies probably had a shallow subtidal origin as indicated by the presence of benthonic fauna and medium to thick bedding. Crossbedding, which exists in the fossiliferous dolomite lithofacies of Section 4 (Fig.25), may reflect sediment reworking by shallow subtidal currents offshore from tidal flats immediately to the northwest. The location of these two facies indicates that the ancient shoreline lay to the northwest or west and that deeper water was southeastward or eastward.

The distribution of facies within the Sutherland River Formation of the report area evidently was affected by the beginning of Early Devonian uplift of the Boothia Uplift and Cornwallis Fold Belt. Peritidal deposits

constituting the unfossiliferous dolomite lithofacies flanked the uplift in an area of shoaling, whereas subtidal deposits accumulated offshore farther east, and formed the fossiliferous dolomite lithofacies. The truncation of northwest sections of the Devon Island Formation by the overlying Sutherland River and Prince Alfred Formations (Fig.24) indicates that in this area at least, the Boothia Uplift exerted an important sedimentological influence at this time.

Prince Alfred Formation

Distribution, Thickness and Age

The Prince Alfred Formation was named by Thorsteinsson (1963); its type section which was designated on Sutherland River is within Section 4 of the present report area (Map). The writers found the type section of the Prince Alfred Formation to be 172 feet thick. There, it overlies the Sutherland River Formation (Fig. 25) with disconformity or slight angular unconformity, the contact being drawn beneath a dolomite breccia zone. Toward the northwest the basal contact of the Prince Alfred Formation becomes clearly a marked angular unconformity that cuts down northwestward to rest unconformably on the Sutherland River, Devon Island, Douro, and Cape Storm Formations (Map). The formation encroached northwestward onto the uplifted Cornwallis Fold Belt. The thickness of the Prince Alfred Formation increases gradually from 80 feet in the southeast at Section 2 to a maximum of 1,381 feet in Section 8. Northwest the thickness of the Prince Alfred Formation diminishes to 20 feet at Section 9 and still farther northwest it is missing altogether (Map). This marked decrease in thickness occurs as the formation is traced toward and onto Cornwallis Fold Belt. It appears that the sharp decrease in thickness is due, in part, to a northwestward decrease in the original depositional thickness and in part to unconformity prior to deposition of the younger undivided Devonian succession. Table I shows what appears to be a reasonable estimate of the age of the Prince Alfred Formation. Fifteen feet above the base of the undivided Devonian carbonates that overly the Prince Alfred Formation at Section 7 a faunal collection at GSC Locality C-11917A contained cf *Cortezorthis* sp., *Meristella* sp. cf. *M. robertsensis* (Merriam) and cf. *Howellella* sp. which were identified by A.W. Norris and considered by him to indicate a late Siegenian to middle Emsian age. This forms an upper boundary for the age of the Prince Alfred Formation.

The Prince Alfred Formation is broadly separable into two lithofacies in the belt where Sections 1 through 9 were measured. The sandstone lithofacies which constitutes most of the Prince Alfred Formation consists mainly of structureless quartz sandstone that is medium to massive bedded, and

weathers red, pink and orange. The sandstone lithofacies is a thick sequence of generally medium bedded, indurated red beds in and near Section 8 (Pl. XVIIc). Elsewhere in the study area this facies is a much thinner homogeneous yellowish orange or yellow massive sandstone sequence that is moderately to poorly consolidated and recessive weathering.

The Silty Dolomite Lithofacies consists mainly of thin to medium smooth bedded, light grey and greenish grey dolomite. This facies occurs as a tongue within the Sandstone Lithofacies (Fig. 25) dividing it into upper and lower portions in the central and northwestern parts of the study area.

Southwest of the line of section is another area where rocks assigned to the Prince Alfred Formation occur (Map 000). They form a thick sequence of coarse poorly sorted massive bedded conglomerate that commonly weathers brownish orange.

Lithostratigraphy

SANDSTONE LITHOFACIES

Lithology

The sandstone lithofacies consists of very fine sandstone and siltstone. Following the sandstone classification system of Folk (1968) the sandstone (Pl. XVIId) predominantly is submature, dolomite and limonite-cemented impure quartzarenite in which unweathered microcline and sericite are common. X-ray diffraction data (Appendix I) indicates that a small amount of orthoclase is present, evidently unweathered. Also, there is abundant silt-sized detrital dolomite (Pl. XVIIIa) in the sandstone lithofacies. Detrital dolomite grains are scattered between quartz silt grains and are in optical continuity with surrounding dolomite cement. They are rimmed

by limonite. According to Amsbury (1962) detrital dolomite is indicative of continental fluvial environments, for little, if any, well rounded detrital dolomite occurs in marine environments. The absence of biogenic material also suggests that this facies was deposited subaerially.

Sedimentary Structures

In the upper part of Section 8 and in the other sections, this facies is characterized by nearly structureless, massive bedded yellowish orange sandstone. Some festoon trough crossbeds occur in these massive beds towards the top of Section 8 (Fig. 25). Individual troughs are up to 1.5 feet across.

A coarse breccia of reworked Sutherland River dolomite with angular blocks up to 1 foot long occur in the sandstone at the base of the Prince Alfred Formation in Sections 4 and 9 (Fig. 25). Broad, lenticular or pod-shaped bodies up to 30 feet across and several feet thick of dolomite breccia in a yellow sandstone matrix (Pl.XVIIIb) occur near the base of Section 7.

The well exposed dolomite-cemented pink and red sequence of sandstone beds of the Sandstone Lithofacies in the lower part of Section 8 (Pl.XVIIc) are somewhat different than the more massive homogeneous orange sandstone that characterizes this facies in other sections and in the upper part of Section 8. This red bed sequence in the lower part of Section 8 is characterized by planar, thin to massive bedding. Thinner beds tend to be finely laminated (Pl.XVIIIc) and in some places contain ripples (Pl.XVIIIa) and have some coarsely polygonally mudcracked bed surfaces with polygons up to 1 foot across.

Thin, dark reddish brown clay beds, which contain abundant limonite and mica, are interspersed between the thick sandstone beds of Section 8. These beds tend to pinch out laterally as may be seen in Plate XVIIc. Commonly these thin clay beds exhibit a considerable degree of internal deformation (Pl. XVIIIe).

Shallow scour-fills (Pl. XIXa) at the base of some sandstone beds in the lower part of Section 8 contain laminated coarse sandstone. Dark reddish brown disc-shaped mudflakes (Pl. XIXb) are abundant in the coarse sandstone laminae. These mudflakes are up to 0.5 cm long and 0.2 cm thick and contain abundant limonite and sericite. They are similar in lithology to the thin reddish brown clay beds.

A few solitary trough beds occur in the pink sandstone beds of Section 8. Beds in troughs continue without interruption beyond trough confines (Pl. XIXc).

In the southwest corner of the report area (Map 000) only 5 miles west of Section 8 the Prince Alfred Formation is probably more than 2,000 feet thick and strongly conglomeratic (Pl. XXa). Angular pebbles and cobbles of limestone and dolomite up to 6 inches across form the coarsest fraction of these conglomerates. Ordovician and Silurian fossils occur in some of these detrital carbonate fragments. Sandy dolomite forms the matrix. In some places fragments weather out resulting in a "Swiss cheese"-like weathered surface (Pl. XXa). Some coarsely crossbedded intervals occur in these conglomerates.

SILTY DOLOMITE LITHOFACIES

The silty dolomite lithofacies is a light greenish and reddish grey, thin to medium bedded silty, very finely crystalline dolomite and dolomicrite that is resistant weathering. The dolomite beds at the base of the sandstone breccia pod shown in Plate are essentially the same as beds in the silty dolomite lithofacies. Figure 25 shows the distribution of this facies in the Prince Alfred Formation. This unit occurs as a tongue within the Prince Alfred Formation dividing it into an upper and lower part. This dolomite tongue is assumed to be largely continuous laterally. This facies may pinch out towards the northwest or may simply be truncated by the unconformity at the base of the carbonate sequence overlying the Prince Alfred Formation.

Thinner dolomicrite beds in this facies are typically laminated with laminations 0.5 cm thick. Many laminae contain pelletal ghosts and quartz silt stringers. Fenestrate fabric and discontinuous mudcracks (Pl.XXb) also occur in thinly bedded intervals of this facies. Biogenic material in this facies is restricted to scattered dolomitized ostracode bioclasts.

Diagenesis of the Prince Alfred Formation

Most of the terrigenous detrital silt and sand grains in the Prince Alfred Formation appear unweathered. Fresh microcline grains are ubiquitous. This suggests that the terrigenous sediments comprising the Prince Alfred Formation were rapidly eroded from their source area and also rapidly transported and deposited so as to be exposed only a short time to surface weathering. Limonite forms a thin coating around many of these grains.

Finely to medium crystalline dolomite (Pl. XVIII/4) has cemented the Prince Alfred silt and sandstones. Marine waters periodically inundated continental areas as shown by the occurrence of the Silty Dolomite Lithofacies in Section 8. Consequently marine waters circulated through the Sandstone Lithofacies and may have formed the carbonate cement of this facies. Contact of these marine waters with fresh continental groundwater would have favoured the formation of dolomite rather than calcite (Hanshaw et al., 1972) as a cement. Modern continental alluvial fans tend to be cemented by calcite (Lattman, 1973).

One coarse zone of solution breccia, 35 feet thick, that is discontinuous laterally, occurs at the base of the Dolomite Lithofacies in Section 8. This breccia consists of poorly sorted angular blocks of dolomite of the Dolomite Lithofacies, up to 4 feet in length. The blocks grade crudely upward from smaller to larger sizes. Most of the breccia appears to be grain supporting with a slightly silty finely crystalline dolomite cement. Mossop (1971, pers. com.) observed that roof pendants of dolomite occur at the top of the breccia zone. Burial compaction may have continually expressed fresh pore water from the immediately underlying sandstones up through cracks in the overlying dolomite. These circulating fresh pore waters would eventually dissolve cavities in the overlying dolomite, and blocks of dolomite would work loose from cavity roofs to form a solution breccia.

Depositional Model for the Prince Alfred Formation

The Sandstone Lithofacies of the Prince Alfred Formation appears to be an alluvial fan complex that bordered the eastern side of the uplifted Cornwallis Fold Belt. Figure 27 shows the inferred distribution of sediment

types and of sedimentary processes active during deposition of this alluvial fan complex. Massive conglomeratic debris flood deposits formed on the western or proximal part of this complex whereas the pink sandstones and red mudstones of Section 8 accumulated downslope towards the east.

This model is very similar to, and a counterpart of, the alluvial fan complexes outlined on the western side of the uplift in the Peel Sound Formation of Prince of Wales Island (Miall, 1970), and in the Stuart Bay Formation of Bathurst Island (Kerr, in press), both formations being equivalent in age to the Prince Alfred Formation.

Debris floods and ephemeral braided streams evidently swept coarse gravels eroded from Lower Paleozoic and possibly Precambrian rocks uplifted by the Cornwallis Fold Belt eastward across an alluvial fan complex. This resulted in deposition of a thick sequence of conglomerates containing carbonate cobbles and boulders where the Prince Alfred Formation crops out in the southwest part of the study area (Map 000).

Sheet and stream floods may have deposited the relatively structureless pink siltstone and sandstone beds in the Sandstone Lithofacies in the lower part of Section 8. The position of these deposits in the facies tract model presented in Fig. 27 is consistent with observations concerning similar deposits on modern fans. Bull (1969) in a recent review of the subject noted that laminated and structureless tabular deposits of silt and sand on alluvial fans originated as sheetfloods. He described sheetflood deposits as sheets of sediment that are deposited by surges of sediment-laden water which have spread out abruptly onto the fan surface from the end of a stream channel on the fan. Within this broadly sheet-like surge of sediment-laden water depths of flow are less than one foot in many

ill-defined, rapidly shifting braided distributary channels. These channels are very ephemeral and commonly do not maintain themselves in one place for more than a few minutes during a single episode of flooding on the fan. Miall (1970) compared similar structureless tabular bedded sandstones of the Peel Sound Formation to the horizontally bedded flood deposits recently deposited in Bijou Creek, Colorado, that were described by McKee et al. (1967).

The thin, dark reddish brown clay beds interspersed between the pink sandstone beds of Section 8 may have formed in puddles on the alluvial fan surface during and after the final, waning stages of individual sheet-floods when clays settled out of suspension. Alternatively some of these clay beds may be mudflow deposits. Sheetfloods passing over these clay beds possibly deformed them to produce a contorted fabric in these beds. Plate XVIIIe is a sample of one of these contorted clay beds.

Mudflakes were abraded from these clay beds and were incorporated into sheetfloods that passed over them. These mudflakes (Pl. XIXb) were deposited in the shallow scours at the bases of these sheetflood sandstone beds (Pl. XIXa), presumably farther downflow. Miall (1970, p. 134) reported that mudflakes are also a distinctive feature of the sandstone facies of the Peel Sound Formation, although he did not speculate on their origin.

The form of the few apparent trough crossbeds in the pink sandstone beds of Section 8 may also be explained as a sheetflood phenomenon. Beds in troughs (Pl. XIXc) continue without interruption beyond the trough confines. This is unlike fluvial trough crossbeds where discrete episodes of cut and fill result in the truncation of beds in the trough by overlying beds (Allen, 1965). Instead, the evidence indicates that a body of largely suspended sediment, such as a sheetflood, scoured the troughs. When the shallow sheet-flood slowed, sediment from the sheetflood blanketed trough and intertrough areas simultaneously.

The coarse breccia of reworked Sutherland River dolomite with angular blocks up to 1 foot long, in a sandstone matrix at the base of the Prince Alfred Formation in Sections 4 and 9 (Fig. 25) may reflect the passage of sheetfloods eastward over exposed Sutherland River dolomite.

The silty dolomite lithofacies of the Prince Alfred Formation was probably deposited in peritidal environments bordering the Prince Alfred alluvial fan complex to the east (Fig. 27). The common fenestrate fabric and mudcracks and the lack of biogenic material point to a tidal flat origin for the thinly bedded, finely crystalline dolomite of this facies. Sheetfloods extending from the alluvial fan to the west occasionally reached these marginal marine environments and reworked tidal flat material to form the pods of dolomite breccia in a sandstone matrix (Pl. XVIIIb) that occur near the base of the Prince Alfred Formation at Section 7. Many of these dolomite clasts appear to have been plastically deformed. Slight reworking of these breccia matrix sands as beach deposits in a marginal marine environment may have promoted solution and reduction of iron in grain-coating limonite to form the pale yellowish green colour of most breccia pods. Miall (1970) noted the same bleaching effect where alluvial fan deposits encroached on marine environments in the Peel Sound Formation.

Consequently it is possible that the massive bedded yellowish orange sandstones at Sections 2, 3, 4, 6, 7 and 9 (Fig. 27) may be largely beach or offshore bar sands reworked from sheetflood sands supplied from the alluvial fan complex in the Prince Alfred Formation.

The grain size distributions of seven samples from the sandstone lithofacies are shown as cumulative curves in Fig. 28. These were derived by point counts of grain sizes from thin secitons. The average grain size

correction factor for sieve equivalents of thin section grain sizes amounts to no more than 1/2 ϕ in the 2 ϕ to 5 ϕ size interval (Friedman, 1958). Commonly in this sediment size range specific correction factors fail to yield a better correlation between sample thin section and corresponding sample sieve size grain size distributions. Consequently, thin section grain size data is presented uncorrected in Fig. 28. Superimposed on these Prince Alfred grain size distributions are the bounding cumulative curve grain size distributions of cumulative curves from well sorted water-laid or sheetflood deposits, poorly sorted mudflow or debris flood deposits and deposits with the characteristics of both sheetflood and debris flood deposits that occur in modern alluvial fans in the San Joaquin Valley in California, U.S.A. (Bull, 1963). The well-sorted siltstones and fine sandstones of the Prince Alfred Formation fall almost entirely within the water-laid or sheetflood cumulative curve envelope (Fig. 28) of these modern alluvial fan deposits. This is consistent with a sheetflood origin for the Sandstone Lithofacies of the Prince Alfred Formation. The apparent lack of clay in the Prince Alfred samples may be due to an optical masking effect with the highly birefringent carbonate cement masking any clay minerals present.

The evidence discussed here strongly indicates that the Prince Alfred Formation is largely an alluvial fan complex with associated marginal marine deposits and is possibly genetically related to the Boothia Uplift. It should be noted however that the interpretation of an alluvial fan facies tract extending from west to east (Fig. 27) presented here does not preclude the possibility of other depositional facies tract orientations particularly as the outcrop extent of the Prince Alfred Formation in the report area is rather small.

Tectonic Development and Depositional History

The stratigraphic variety in the sequence of Lower Paleozoic carbonates exposed on Devon Island suggests that there has been a considerable degree of tectonic control of sedimentation. The rather abrupt vertical changes in lithology of the formations comprising this Lower Paleozoic assemblage may reflect similarly abrupt alterations in their respective tectonic settings.

Trettin (1972) proposed a tectonic-sedimentological model for Lower Paleozoic deposits on Ellesmere Island that may be applied with equal facility to Devon Island. The elements of his model that may have influenced deposition on Devon Island are the southeastern shelf and the northwestern Hazen Trough as are shown in Figure 29. The southeastern shelf borders on the Arctic Platform or Stable Region further southeast. Trettin (1972) proposed that a hinge line or line of flexure marked the juncture of the Stable Region with the shelf. Northwest beyond the shelf a clearly defined slope led down to the Hazen Trough.

Rona (1974) has suggested that the hinge-line concept which is commonly employed to account for shelf subsidence is probably not an accurate representation of the true situation. Some uplift of cratons adjacent to areas of subsidence generally, if not always, occurs. Therefore, the concept of a tilt axis rather than a hinge line may provide a better explanation for shelf subsidence that occurred during deposition of most shelf sequences. The concept of a shelf or platform hinge line is retained in the following discussion because there is no evidence to indicate that there was significant uplift of the southeastern Stable Region during

subsidence of the Hazen Trough. Instead, uplift of the Pearya Geanticline (Trettin, 1972) appears to have accompanied subsidence of the Hazen Trough (Fig. 29).

Figure 29 shows how these tectonic elements may have affected sedimentation on Devon Island during most of the Early Paleozoic. Evidently, Grinnell Peninsula was part of the Shelf region during deposition of the Thumb Mountain shown as event 1 (Fig. 29). Subsequently, a brief period of strong rotation about the platform hinge resulted in deposition of the green shale of the Irene Bay Formation. This strong rotation, shown as event 2, probably submerged the shelf-edge shoals (Fig. 29) that existed during Thumb Mountain deposition. The rather shallow, protected shelf lagoon of the Thumb Mountain Formation became an area deeper, more open shelf deposition during event 2. The abundance of large cephalopods and other organisms also indicates the existence of open marine shelf conditions during deposition of the Irene Bay Formation. Basin slope deposits contemporaneous with the Thumb Mountain and Irene Bay Formations occur near Caledonian Bay on Ellesmere Island (Trettin, 1972).

After deposition of the Irene Bay Formation the northwest part of the shelf occupying western Grinnell Peninsula underwent considerable differential subsidence to the northwest, possibly by means of basement faulting, and became part of the Hazen Trough. This is shown in Figure 29 as event 3. Cape Phillips shaly limestone accumulated on the resultant slope whereas relatively clean shallow-water carbonates of the Allen Bay Formation accumulated on the shelf in east-central Grinnell Peninsula and further southeast. The extensive infiltration of continental groundwater

into Allen Bay sediments during deposition may indicate that rotation about the platform hinge was somewhat slower during deposition of the Allen Bay Formation than during deposition of the Thumb Mountain Formation. This conclusion assumes that the rate of groundwater flow during deposition of the Allen Bay was the same as that during deposition of the Thumb Mountain. The inference that rotation about the platform hinge in event 3 was somewhat slower than during event 1 may be indirect evidence indicating that a larger proportion of the subsidence of the Hazen Trough was being accommodated by slope development during event 3.

The disposition of facies within the Cape Storm Formation suggests that the shelf platform did not subside uniformly after deposition of the Allen Bay Formation. Relatively positive elements may have developed within parts of the shelf platform. Positive features intersected the line of section of this study and caused Sections 3, 5, 8 and 9 to be markedly thinner than nearby sections (Fig. 16). Figure 24 clearly shows the influence of these features on the thicknesses of both the Cape Storm and Douro Formations. The fact that most of these thin sections are composed entirely of peritidal deposits of the dolomitic pelmicrite lithofacies is consistent with this interpretation. Figure 20 shows a possible orientation of these features.

Kerr (pers. com.) has found an extensive unconformity at the base of the Cape Storm Formation on western Grinnell Peninsula. In places the Cape Storm Formation rests directly on the Thumb Mountain Formation. This unconformity may be direct evidence that indicates the Boothia Uplift was active immediately after deposition of the Allen Bay Formation. The nearly

contemporaneous nearby positive elements of slightly different orientations may be related to this large uplift.

The limestone intraclast lithofacies which occupies the lower part of the thicker Cape Storm sections indicates subtidal shallow-water deposition (Fig. 19). However, during deposition of the upper part of the Cape Storm the entire area of the Douro Range and eastern Grinnell Peninsula became a region of peritidal deposition. These peritidal deposits are not present in the Cape Storm Formation of central and western Grinnell Peninsula. Instead the limestone intraclast lithofacies appears to form the entire Cape Storm Formation in western Grinnell Peninsula (Fig. 20). The downtilting of the northwestern part of Grinnell Peninsula that caused accumulation of thick sections of limestone intraclast lithofacies may have been accompanied by a somewhat slower rate of subsidence landward to the southeast. Event 4 of Figure 29 summarizes this interpretation of the tectonic history of the Cape Storm Formation.

During deposition of the Cape Storm Formation the platform area became considerably more extensive on Grinnell Peninsula than it had been during deposition of the Allen Bay Formation. On Shiels' Peninsula thick deposits of the Cape Storm Formation overlie slope deposits of the Cape Phillips Formation which accumulated northwest of the Allen Bay Formation. There appear to be no submarine slope deposited rocks equivalent to the Cape Storm Formation on Grinnell Peninsula (Kerr, 1974).

The positive features which influenced sedimentation of the Cape Storm Formation in the Douro Range evidently also affected deposition of the Douro Formation. Persistence of the positive feature under Sections 3 and 4 may explain the relative thinness of the Douro Formation in these sections. However some of the unburrowed dolomitic lithofacies in the lower part of the anomalously thick Section 5 of the Douro Formation may be correlative with laterally adjacent dolomitic pelmicrite lithofacies of the Cape Storm Formation in Sections 4 and 7 as may be seen in Figure . The lithologic similarity of these two facies and their more uniform combined thickness compared to their individual thicknesses is consistent with this possibility.

A return to a more uniform rate of subsidence across the platform area along the line of section shown as event 5 may have led to the recurrence of a shelf lagoon during the later stages of deposition of the Douro Formation. This shelf lagoon transgressed southward depositing sediments over the peritidal deposits of the unburrowed dolomitic lithofacies (Fig.21). These sediments which formed the burrowed limestone lithofacies

eventually filled in and smoothed topographic irregularities caused by the positive features active during event 4.

Following deposition of the Douro Formation the shelf platform apparently subsided abruptly as shown in event 6 (Fig.29). This led to deposition below wavebase of the Devon Island Clinothem (Fig.23) which prograded northwest.

The marked thinning and eventual disappearance of the Devon Island Formation to the northwest reflects the rise of the Boothia Uplift towards the west as shown in event 7 (Fig.29). It may have begun to rise during deposition of the Devon Island Formation.

The Sutherland River Formation accumulated in shallow water during the early stages of the rise of this uplift. Peritidal deposits comprising the unfossiliferous dolomite lithofacies of this formation apparently flanked the Boothia uplift during the early stages of its rise.

Finally emergence of the Boothia Uplift resulted in the construction of an alluvial fan complex and related offshore marine deposits that together comprise the Prince Alfred Formation.

A more definitive characterization of rates of rotation about the platform hinge theoretically could be derived from the calculation of the rates of subsidence of each formation in this sequence. The amount of apparent subsidence that occurred during the deposition of any shelf sequence is its thickness. This involves several assumptions (Rona, 1974):

1. The rate of vertical accumulation is controlled by the rate of subsidence.

2. The available sediment supply is equal to or greater than that required to maintain a profile of equilibrium during subsidence.
3. Sea level remains constant.

The first two assumptions are interrelated and appear to be readily applicable to the shallow water Lower Paleozoic shelf sequence on Devon Island. The probability of the third assumption is more difficult to assess but may be correct because there is no discernible evidence that glaciations occurred during the early part of the Paleozoic Era after the Cambrian Period had ended (Dunbar, 1963).

The factor that severely limits the possibility of obtaining apparent subsidence rates for any Lower Paleozoic sequence is the lack of reliable absolute age dates that can be linked with the biostratigraphic record. Those dates, which appear to have some reliability (Whittington and Williams, 1964) are compiled in Table I. Apart from analytical error, several of these dates are merely reasonable interpolations. In particular, the ages of the base of the Ordovician and Silurian Periods are estimates rather than dated events and possibly could be incorrect by as much as 20 million years. The remaining Devonian ages and Middle Ordovician age which may be applied to the Lower Paleozoic sequence on Devon Island are much more certain.

In view of the scarcity of Lower Paleozoic age dates and their uncertain correlation with the biostratigraphic record it is impractical to attempt to derive subsidence rates for individual formations by interpolated dates. Instead it is more reasonable to derive apparent subsidence rates

from those portions of the sequence that fall between established dates. The only part of the Lower Paleozoic sequence on Devon Island that falls between definite dates occurs between the upper part of the Allen Bay Formation and the upper part of the Devon Island Formation, a thickness of about 1170 metres, which represents a time span of about 60 million years (Table I). This thickness is derived in the following manner from Section 7 near Reid Creek:

Upper part of Allen Bay Formation above base of Silurian System, say	1,000 feet
Cape Storm Formation	2,255 feet
Douro Formation	455 feet
Devon Island Formation below base of Devonian System, say	100 feet
Total	3,810 feet (1170 m)

The thickness of the portion of Devon Island Formation from Section 7 was derived by means of the extrapolation of the inferred base of the Devonian System from Sections 3 and 4 to Section 7 (Fig. 22).

This total thickness of 1170 meters indicates an average apparent subsidence rate of about 1.95 cm per 1000 years during the Silurian Period. This is also a typical value for the rate of subsidence of most parts of the North American continental margin during both the Cenozoic and Mesozoic Eras, Emery and Uchupi (1974, Fig. 324) found that almost all parts of the North American continental shelf had subsidence rates of between 1.0 and 4.0 cm per year during these eras.

Economic Considerations

The marine sequence of this area contains good source beds in the shaly and sapropelic limestones of the Cape Phillips and Devon Island Formations. Also the very bituminous dolomitized stromatoporoid-bearing intervals of the Allen Bay Formation are probably good source beds.

Subsurface occurrences of uncemented oolitic shoal sands in the limestone intraclast lithofacies of the Cape Storm Formation or of poorly cemented sandstone of the Prince Alfred Formation would be particularly favourable as reservoir beds in either structural or stratigraphic traps. Porous stromatoporoid-bearing intervals with as much as 15% porosity in the Allen Bay Formation are favourable sites for the accumulation of hydrocarbons generated in situ. The single well drilled on Devon Island, Imp. I.O.E. Panarctic et al. Devon E-45 encountered spotty oil stain in the Allen Bay Formation at subsea depths of -4690 feet to -5220 feet (total depth). This well is located near the southwest coast of Devon Island at latitude N75°04'21" and longitude W91°48'20".

In addition to hydrocarbon shows, there are some base metal occurrences on Devon Island. Both galena and sphalerite occur in the Thumb Mountain Formation exposed on southern Grinnell Peninsula. These base metal shows may indicate the existence of a Mississippi Valley type of lead-zinc deposit on Grinnell Peninsula similar to the one presently being exploited by Cominco Ltd. on Little Cornwallis Island. Geological field parties from Cominco Ltd. have surveyed Grinnell Peninsula extensively for mineral deposits during the summers of 1971 and 1972.

Significant base metal deposits may not be restricted to the Thumb Mountain Formation as some mineralization consisting of pyrite and galena occurs within vuggy porosity in Devonian limestone units that are exposed on southern Grinnell Peninsula. These units are probably age equivalents of the Blue Fiord Formation.

In summary, Devon Island has been the object of continuing interest by mining companies for its lead-zinc potential. The true hydrocarbon potential of Devon Island has yet to be assessed.

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APPENDIX I.

SEMI-QUANTITATIVE X-RAY DIFFRACTION ESTIMATES OF THE MINERALOGY OF SAMPLES FROM PALEOZOIC FORMATIONS EXPOSED NEAR PRINCE ALFRED BAY, DEVON ISLAND, N.W.T.

A Philips PR 4920/00 X-ray diffraction unit of the Institute of Sedimentary and Petroleum Geology in Calgary generated X-ray diffractograms for the samples listed below. Cu Kα, Ni-filtered radiation was used at a scan rate of 2°θ per minute and a chart speed of 2 cm/degree. Presence of a peak at 14 Å differentiated chlorite from kaolinite in these samples.

Thumb Mountain Formation

Sample	Calcite	Dolomite	Quartz	Microcline	Illite + Muscovite	Chlorite
19a	major	minor	minor	_____	_____	_____
64b	major	major	_____	_____	_____	_____
96e	major	minor	minor	trace	trace	trace
134b	major	major	_____	_____	_____	_____

Allen Bay Formation

Sample	Dolomite	Calcite	Quartz	Microcline	Illite
20a	major	trace	_____	_____	_____
32b	major	trace	trace	trace	trace
40a	major	minor	_____	_____	_____
166b	major	_____	_____	_____	_____

Cape Storm Formation

Sample	Calcite	Dolomite	Quartz	Microcline	Orthoclase	Illite	Chlorite
45a	major	—	minor	—	—	—	—
33c	major	major	minor	trace	trace	minor	trace
171d	—	major	major	minor	minor	trace	—
23a	major	trace	trace	—	—	—	—
102c	—	major	minor	trace	—	minor	trace

Douro Formation

Sample	Calcite	Dolomite	Quartz	Microcline	Orthoclase	Illite	Chlorite
86b	major	—	minor	—	—	trace	trace
37b	major	minor	minor	trace	trace	minor	trace
25d	major	minor	major	trace	trace	minor	trace

Devon Island Formation

Sample	Calcite	Dolomite	Quartz	Microcline	Orthoclase	Illite	Chlorite
141b	minor	major	major	trace	trace	major	minor
86f	major	major	major	trace	trace	minor	trace
38b	major	minor	trace	trace	trace	trace	trace
38a	trace	major	major	minor	trace	trace	___

Sutherland River Formation

Sample	Dolomite	Quartz	Microcline	Illite
4e	major	minor	trace	trace

Prince Alfred Formation

Sample	Calcite	Dolomite	Quartz	Microcline	Orthoclase	Illite	Kaolinite?
105a	trace	major	major	minor	trace	trace	___
60e	___	major	major	trace	___	minor	trace

APPENDIX II. X-RAY FLUORESCENCE DETERMINATIONS OF STRONTIUM AND MANGANESE IN SAMPLES FROM THE ALLEN BAY AND DEVON ISLAND FORMATION

Sample	Counts (200 second counting period)				
	24° Background	25.15° Strontium Peak	27° Background	62.97° Background	61° Manganese Peak
dol. st.*	169852	165813	138597	12489	21350
19b	179652	172058	146316	13193	14513
20a	178270	171739	145680	13447	14895
21a	178615	175225	145511	13147	15144
21b	179912	172825	146901	12884	14310
39c	179671	171659	147804	12929	14223
40a	177156	169360	144229	12832	13795
40c	180506	172309	146805	13023	14153
41a	180057	172545	146854	13170	14021
42a	180022	173119	147122	13326	13855
dol. st.	162150	159934	134970	12692	21413
42b	162030	161529	131311	11926	14222
dol. st.	169019	164854	137914	12861	23189
42c	176690	168779	142079	12856	13962
42d	175539	170300	142428	12860	13885
43a	176023	170128	142579	12688	14293
43b	175766	170614	143818	13068	13960
44b	166591	167150	137338	12118	14753

64e	177146	169396	144031	12917	14760
dol. st.	169411	165769	137504	12659	23044
65a	176687	170149	141709	13104	14589
dol. st.	167208	163379	137077	12853	22771
65c	147932	167957	142390	12882	14528
66a	174007	167582	141421	12778	14442
66b	175676	169005	142563	12915	14728
66c	175355	169278	142608	12954	15033
66d	172350	166874	140353	12673	14410
67a	176132	169653	143711	13181	14759
dol. st.	167423	163054	136369	12777	23487
67b	183335	174727	149793	13796	16017
67c	175236	178348	142538	13149	15636
68a	176489	169013	143863	13141	15535
68b	175448	169971	142426	12704	15128
68c	147307	152946	119707	11269	11859
dol. st.	167027	162644	134663	12740	22670
164b	181388	175276	147635	13278	15356
164c	176792	170468	143891	13325	14490
164d	176280	169027	142938	13098	17924
165a	176059	169685	143020	13322	14832
165b	176231	171025	143463	12999	14583
165c	175724	170463	144084	12997	15865
165d	176231	177752	142407	12942	15699
166a	177435	174272	144041	13542	20321

dol. st.	168470	164022	136498	12861	22630
166b	175546	171037	142458	13101	16393
166c	176086	176012	142336	13033	15855
167a	174008	173633	141941	12777	16005
37f	--	--	--	11985	33467
38b	--	--	--	11003	14567
141b	--	--	--	15059	28013

*dol. st. = dolomite standard.

Counts of Allen Bay strontium and manganese were compared with counts of a dolomite standard in order to obtain estimates of the absolute amounts of strontium and manganese in Allen Bay samples. This dolomite standard is the Standard Reference Material 88a Dolomitic Limestone of the National Bureau of Standards, U. S. Department of Commerce. It is a very nearly pure dolomite containing 231 ppm manganese and 85 ppm strontium. An XRD 700 (G.E.) X-ray spectrometer with a LiF diffracting crystal was used in this study.

Calculation of Strontium for a Typical Allen Bay Sample

167a - Sr background = 27° count + 1.85/3.00(24° count - 27° count)

= 141941 + 0.62(174008 - 141941)

= 161726

Sr peak - Sr background = 173633 - 161726

Count increase due to Sr presence = 11907

similarly the count increase in the dolomite standard due to Sr is = 7797

let x = ppm Sr in sample 167a

x/85 ppm Sr = Sr counts sample/Sr counts standard

$$x = 85 \ \frac{11907}{7797} = 130 \text{ ppm Sr in sample 167a.}$$

Manganese values were calculated in a similar fashion. The similar composition of the dolomite standard and Allen Bay dolomite rendered matrix corrections unnecessary. The last three samples listed were from the Devon Island Formation and their manganese content was estimated using background radiation as an internal standard as in the method described by Andermann and Kemp (1958).

A SPEX grinder powdered samples which were then pressed into thin discs 1.2 inches in diameter and 0.2 inches thick, in order to provide a smooth homogeneous sample surface for irradiation. This sample preparation procedure was also employed for X-ray diffraction determinations.

The percent standard counting error for a typical Sr determination (e.g., 167a) is:

$$\sigma\% = \frac{N_T + N_B}{N_T - N_B} 100 = \frac{173633+161726}{173633-161726} 100 = 4.86\%$$

N_T - total count at element peak

N_B - total count of background

The percent standard counting error for a typical Mn determination (e.g., 167a) is:

$$\sigma\% = \frac{N_T + N_B}{N_T - N_B} 100 = \frac{16005+12777}{16005-12777} 100 = 8.92\%$$

Allen Bay Samples

Section 1

Sample	Height Above Base (feet)	Strontium ppm	Manganese ppm
19b	20	55	35
20a	360	63	38
20b	598	59	22
21a	1375	98	52
21b	1648	59	37

Section 2

Sample	Height Above Base (feet)	Strontium ppm	Manganese ppm
39c	20	44	34

40a	121	51	25
40c	382	50	30
41a	502	55	22
42a	698	60	14
42b	730	117	51
42c	885	56	25
42d	1025	78	23
43a	1057	72	26
43b	1142	74	20
44b	1886	122	59

Section 7

Sample	Height Above Base (feet)	Strontium ppm	Manganese ppm
64e	440	51	41
65a	822	76	35
65c	880	61	38
66a	955	67	39
66b	1038	66	42
66c	1067	71	48
66d	1080	75	40
67a	1245	68	34
67b	1404	48	48
67c	1605	177	54

68a	1915	57	52
68b	1922	81	52
68c	1940	172	14

Section 9

Sample	Height Above Base (feet)	Strontium ppm	Manganese ppm
164b	40	72	48
164c	120	67	27
164d	247	59	105
165a	354	67	35
165b	365	78	37
165c	524	73	67
165d	843	154	64
166a	996	105	160
166b	1200	89	78
166c	1322	140	67
167a	1362	130	76

Devon Island Samples

Sample	37f	38b	141b
Manganese ppm	550	100	265

APPENDIX III. STABLE ISOTOPE DATA

All determinations of δC^{13} and δO^{18} were performed on a Nuclide 60° isotope ratio mass spectrometer. Phosphoric acid was used to extrace CO_2 from Allen Bay Dolomite in the manner described by Mc Crae (1950). Carbon and oxygen isotope data are reported as the per mil deviation relative to the PDB, Chicago belemnite standard (Craig, 1953): δO^{18} or $\delta C^{13} = (R/R_{standard}-1)\,1000$

$R = O^{18}/O^{16}$ or C^{13}/C^{12} ratio in the sample material.

$R_{standard} = O^{18}/O^{16}$ or C^{13}/C^{12} ratio in the standard material.

Carbon and Oxygen Isotope Content of
Allen Bay Samples

Sample	41a	43a	44b	64e	66c	68c	164b	165c	167a
δC^{13}	+0.85*	+0.18	+0.13	+0.62	+0.10	+0.09	+0.89	+0.31	+0.58
δO^{18}	-4.48	-4.34	-3.51	-4.44	-3.90	-3.98	-2.99	-2.90	+0.55

*Last decimal place not significant.

Section 1. This is a southwest dipping section with its base at 76°12'N, 92°17'W, 11-1/2 miles southeast of Sutherland River, on the east side of Prince Alfred Bay on Devon Island. The section is best seen on aerial photograph A-16747-143. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Douro Formation		
	Upper limit of rocks examined occurs within the upper part of the Douro Formation at a large stream.		
59	Limestone, weathers medium to dark grey; medium,** discontinuous lumpy bedding; wavy, discontinuous greyish green argillaceous seams; a dark brownish grey silty biopelmicrite with abundant brachiopod (*Atrypella* sp.), crinoid, and ostracode shell debris	2	6,126
58	Broken outcrop, the lower half of this interval is similar to underlying interval, whereas the upper half is the same as the overlying unit	47	6,124
57	Limestone, weathers medium greenish grey; thick to massive smooth continuous bedding; greyish green argillaceous material fairly homogeneously distributed throughout the rock; ripple marks (?) on bed surfaces; ripples have a wave length of 4" and an amplitude of 1"; an argillaceous grey micrite, possibly pelletal	10	6,077
56	Broken outcrop, limestone; weathers medium to dark grey; probably lumpy medium bedding; a dark brownish grey silty biopelmicrite; abundant brachiopod (*Atrypella* sp.) and crinoid fragments, some echinoid spines; greyish green argillaceous material in discontinuous, wavy seams; abundant finely comminuted bioclastic debris	45	6,067
55	Silty limestone, weathers yellowish grey; thin to medium bedding of lenticular festoon crossbeds; very low angle crossbeds with abundant brachiopods resting on parting planes within crossbeds	3	6,022
54	Broken outcrop, limestone; weathers medium greenish grey; thin, fairly continuous, lumpy bedding; an argillaceous biopelmicrite with brachiopods, corals (*Favosites* sp. and *Syringopora* sp) and bryozoa	123	6,019
53	Limestone, weathers light grey; medium to thick, anastomosing, faintly crossbedded laminated bedding; a silty slightly dolomitized pelmicrite; scattered wisps of greyish green argillaceous material.	15	5,896

* The terminology of Folk (1968) is employed for detailed carbonate and terrigenous rock classification in these sections.

** Bed thickness terminology of Zenger (1965).

Unit	Lithology	Thickness (feet)	Height above base (feet)
52	Broken outcrop, same as the underlying unit	15	5,881
51	Limestone, weathers light grey with yellowish grey mottlings; thin to medium anastomosing and lenticular bedding outlined by greyish green argillaceous seams; faint crossbedding in individual lenticles; some silty packed biopelmicrite with ostracode and brachiopod shells, disarticulated but unabraded and a fenestrate-like fabric of vugs less than 1mm long elongate parallel to bedding and infilled with sparry calcite; quartz silt abundant with some sericite;most of interval is simply a silty slightly dolomitized pelmicrite	5	5,853
50	Broken outcrop, same as overlying unit	106	5,848
	Measured thickness of Douro Formation	384	
	<u>Cape Storm Formation</u>		
	Contact conformable		
49	Limestone, weathers light grey with greyish green argillaceous seams; thin to medium somewhat lenticular bedding	52	5,742
48	Broken outcrop, same as overlying unit	26	5,690
47	Limestone, weathers yellowish grey; thin, anastomosing to lenticular bedding with internal, somewhat crinkled and folded laminations with a good fenestrate fabric; a silty fossiliferous pelmicrite (?); some ostracode shells (*Leperditia* sp.); abundant limonite grains and argillaceous material	5	5,664
46	Broken outcrop, same as overlying unit	159	5,659
45	Limestone, same as unit 46	5	5,500
44	Broken outcrop, same as underlying unit	168	5,495
43	Dolomitic limestone, weathers light grey; medium to thick bedded with poorly developed internal colour laminations, a silty, partly dolomitized biopelsparite; abundant ostracode shell debris with minor amounts of brachiopod shell debris; mainly quartz silt with minor amounts of sericite	5	5,327

Unit	Lithology	Thickness (feet)	Height above base (feet)
42	Covered, limestone; weathers yellow to yellowish grey; thin to medium somewhat lumpy bedding; a micrite, possibly bioclastic and pelletal; ostracodes abundant; a horizon of abundant *Thamnopora* sp. in the middle of the unit	10	5,322
41	Dolomitic limestone, 5 foot thick intervals of thick, lenticularly bedded, and yellowish grey weathering silty partly dolomitized packed biopelmicrite alternate with 5 foot thick intervals of medium-grey weathering, thick-bedded silty biopelmicrite and poorly washed biopelsparite; abundant ostracodes (*Leperditia* sp.) with subsidiary gastropods and trilobites(?) concentrated in lenticular placers; silty mainly quartz with minor sericite	30	5,312
	Broken outcrop,		
40	same as unit 37	176	5,282
39	Limestone, weathers light grey; thick continuous bedding; a grey pelmicrite(?)	4	5,106
	Broken outcrop,		
38	calcareous dolomite; weathers yellowish grey; probably thin to medium bedding; a slightly silty, nearly completely dolomitized pelmicrite or poorly washed pelsparite; sparse silt of mainly quartz grains but some orthoclase, microcline and sericite	88	5,102
	Broken outcrop,		
37	same as underlying unit	13	5,014
36	Dolomitic limestone, weathers yellowish grey; thick, smooth lenticular (lenticles 2 to 4 feet long) bedding; a slightly silty, partly dolomitized packed biopelmicrite; silt mainly quartz grains, minor sericite; ostracode shells with perhaps a few trilobite carapaces; a little limonitized authigenic pyrite	4	5,001
	Broken outcrop,		
35	dolomitic limestone debris; weathers yellow and yellowish grey; partly dolomitized micrite or pelmicrite	86	4,997
34	Limestone, weathers medium grey; thin to medium, fairly continuous somewhat spiny bedding; a slightly dolomitized pelmicrite or poorly washed pelsparite; a few scattered ostracode fragments; a little quartz silt	6	4,911

Unit	Lithology	Thickness (feet)	Height above base (feet)
33	Broken outcrop, calcareous dolomite debris; weathers light yellow and yellowish grey; thin fairly continuous bedding; a largely dolomitized pelmicrite and poorly washed pelsparite; some poor fenestrate fabric with planar shrinkage cracks (1 - 2 mm long) parallel to bedding; some disseminated limonite	159	4,905
32	Broken outcrop, limestone debris; 5 to 10 foot thick bands of medium grey thin-bedded laminated silty packed biopelsparite alternate with 5 to 10 foot thick bands of medium yellowish grey thin-bedded laminated silty partly dolomitized biopelsparite	286	4,746
31	Limestone and dolomitic limestone, weathers medium grey; massive, continuous bedding; a laminate composed of regularly alternating laminae 3 to 4 mm thick of silty pelmicrite and laminae of almost completely dolomitized silty micrite, possibly pelletal; quartz silt in both rock types	4	4,460
30	Broken outcrop, limestone and dolomite alternate as in underlying unit	220	4,456
29	Broken outcrop, 5 to 10 foot thick bands of dolomite; yellow weathering and laminated to thin, smooth discontinuous bedding with pronounced internal colour laminations (1 - 3 mm thick), disseminated limonite; scattered quartz grains; a finely crystalline dolomite; alternate with 5 to 10 foot thick bands of limestone; yellowish grey weathering; thin, fairly continuous bedding--a grey packed fossiliferous pelmicrite with a somewhat bioturbated appearance as pellets appear churned and ostracode shells are deformed or broken; scattered wisps of yellowish green argillaceous material; scattered grains of partly limonitized authigenic pyrite grains	250	4,236
28	Broken outcrop, same as underlying unit	100	3,986
27	Limestone, weathers light grey; thin to medium continuous rough, somewhat spiny bedding; a light brown partly dolomitized ostracode biopelsparite, a few intraclasts of poorly washed biopelsparite	20	3,886
26	Broken outcrop, same as underlying unit	109	3,866
25	Limestone, weathers light grey; thin to thick continuous rough, spiny weathering bedding; a medium brown intrapelsparite with greyish pink mottling; some very sparsely scattered ostracodes, brachiopods(?) and crinoids; some vertical burrow-like structures up to 1 cm long; disseminated limonite grains in streaks parallel to bedding	20	3,757

Unit	Lithology	Thickness (feet)	Height above base (feet)
24	Broken outcrop, same as overlying unit	328	3,737
23	Limestone, weathers medium grey; thick to massive continuous bedding; dominantly intrasparite as in previous interval; scattered ostracode (*Leperditia*? sp.) and a few colonial coral fragments; two, 1 foot thick massive beds of medium-grey weathering stromatolite biolithite occur at the top and base of this unit	8	3,409
22	Limestone, weathers dark grey; massive continuous bedding; a packed poorly-washed intrasparite; very poorly sorted, coated intraclasts of partly dolomitized micrite (0.01 mm to 3.0 cm long); larger clasts tend to be tabular and therefore may be reworked mudcrust rip-ups, some of which appear to have algal laminations	10	3,401
21	Broken outcrop, same as overlying unit	417	3,391
20	Limestone, weathers light grey with greyish yellow mottling; massive continuous bedding; very abundant, slightly silicified medium brown weathering tabular and hemispherical stromatoporoids; some rhynchonellid brachiopods and corals (*Favosites* sp.); some scattered limonite grains	8	2,974
	Total thickness of the Cape Storm Formation	2,776	
	<u>Allen Bay Formation</u>		
	Contact conformable		
19	Broken outcrop, dolomite; same as underlying unit	1,062	2,966
18	Broken outcrop, dolomite debris same as underlying unit; 5 to 10 foot bands of medium brown and grey dolomite alternate in the apparently nearly in-situ float; near top of interval dolomite similar to that in unit 15 and contains abundant somewhat silicified stromatoporoids and corals (*Favosites* sp. and *Cystihalysites* sp.)	406	1,904
17	Dolomite, weathers medium brown; thin to medium bedding; a colour laminated "sucrosic" finely to medium crystalline dolomite; vague packed pelletal ghosts	15	1,498

Unit	Lithology	Thickness (feet)	Height above base (feet)
16	Dolomite, weathers light to medium brown; massive fairly continuous bedding; a dark brownish grey, finely to medium crystalline dolomite; very abundant very light yellow-weathering tabular, and less abundant hemispherical stromatoporoids; some colonial corals (*Favosites* sp.); dolomite friable with good (5-10%?) apparent intercrystalline porosity	45	1,483
	Broken outcrop, same as underlying unit	225	1,438
14	Dolomite, thick-bedded, medium brown as in underlying units with one thick interbed two feet from top of interval of light grey-weathering, medium crystalline dolomite with abundant recrystallized tabular stromatoporoids	10	1,213
	Broken outcrop, same as underlying units	234	1,203
12	Dolomite, same as underlying unit; some corals but stromatoporoids almost absent; very petroliferous odor	60	969
	Broken outcrop, same as underlying unit	211	909
10	Dolomite, same as in underlying unit with many irregular vugs filled with sparry calcite; medium brown finely crystalline dolomite; some poorly preserved brachiopods, corals(?) and stromatoporoids; weathers light brownish yellow; less than 5% pinpoint intercrystalline porosity	11	698
	Broken outcrop, dolomite debris same as underlying unit	241	687
8	Dolomite, weathers medium brown; medium to thick, continuous bedding; a greyish brown finely crystalline dolomite with a petroliferous odor; 10 to 20% porosity of small vugs; (most partly or completely filled with sparry calcite); some finely disseminated limonite	20	446
	Broken outcrop, same as overlying unit	238	426
6	Dolomite, same as underlying unit	15	188
	Broken outcrop, same as underlying unit	43	173
4	Dolomite, weathers light yellowish grey; medium to thick continuous bedding; a light pinkish grey finely crystalline dolomite	5	130
	Total thickness of the Allen Bay Formation	2,841	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	CORNWALLIS GROUP		
	Irene Bay Formation		
	Contact conformable		
3	Covered and broken outcrop, limestone and argillaceous limestone debris	40	125
	Total thickness of Irene Bay Formation	40	
	Thumb Mountain Formation		
	Contact conformable		
2	Broken outcrop, limestone debris same as underlying unit	75	85
1	Limestone, weathers dark grey; medium, laterally continuous, somewhat uneven bedding; a medium brown crinoid ostracode packed biopelmicrite with some gastropods, dasyclad algae and corals (*Catenipora* sp.)	10	10
	Measured thickness of the Thumb Mountain Formation	85	
	Lower limit of measured section within the Thumb Mountain Formation.		

Section 2. This is a southwest dipping section with its base at 76°14'03"N, 92°29'00"W, 8 miles southeast of Sutherland River on the east side of Prince Alfred Bay on Devon Island. The section is best seen on aerial photograph A-16747-164. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
156	Limestone, bluish grey weathering; thick to massive bedded; a fetid crinoid and brachiopod-bearing biomicrite	20	8,221
	Examined thickness of undivided Devonian carbonates	20	
	Prince Alfred Formation		
	Contact covered, probably conformable		
155	Covered, dolomitic sandstone forms valley floor; weathers greyish yellow; a dolomite-cemented quartzarenite	(estimated) 80	8,201
	Total thickness of the Prince Alfred Formation	80	
	Sutherland River Formation		
	Contact conformable		
154	Dolomite, weathers light grey with some irregular pinkish grey mottlings; thin to medium, slightly uneven continuous bedding; a finely crystalline light grey dolomite	3	8,121
153	Covered, vegetated	85	8,118
152	Dolomite as in underlying unit but finely to very finely crystalline	20	8,033
151	Covered and broken outcrop, rubble same as in underlying unit	48	8,013
150	Same as in unit 148	5	7,965
149	Covered and broken outcrop, rubble same as in underlying unit	104	7,960
148	Dolomite, weathers very light grey. Thin to medium bedded, finely to medium crystalline homogeneous nearly white dolomite	25	7,856

Unit	Lithology	Thickness (feet)	Height above base (feet)
147	Covered, vegetated	95	7,831
146	Covered, and broken outcrop same as in underlying unit	4	7,736
145	Covered, and broken outcrop rubble, same as underlying unit	24	7,732
144	Dolomite, weathers light grey; medium to thick gently anastomosing bedding; a light grey finely crystalline dolomite; some brachiopod molds and small ironstone concretions--10% vug porosity	15	7,708
	Thickness of the Sutherland River Formation	428	
	Devon Island Formation		
	Contact conformable		
143	Covered, sandy and silty dolomite debris; weathers medium brownish yellow; thin continuous bedding; a medium brown silty finely crystalline dolomite with some organic matter as at Unit 135; quartz and microcline silt; internal laminations outline intra-bed slump structures; Some poorly exposed trough cross beds with individual troughs 2 feet across	142	7,693
142	Same as in underlying unit	10	7,551
141	Broken outcrop, rubble same as in underlying unit	113	7,541
140	Limestone, weathers medium greenish grey; thin to medium uneven to anastomosing bedding outlined by thin seams of abundant greyish green argillaceous material; a fossiliferous micrite; scattered crinoid fragments and brachiopods	16	7,428
139	Broken outcrop, sandstone debris; weathers yellowish orange; thin continuous bedding; a siltstone to fine sandstone: calcite-cemented mature impure quartzarenite; quartz silt with subsidiary microcline and orthoclase	23	7,412
138	Limestone, weathers medium grey; medium, uneven continuously bedded; an argillaceous and organic-rich recrystallized crinoid brachiopod biomicrite	3	7,389
137	Broken outcrop, debris same as primary rock type of underlying unit	487	7,386

Unit	Lithology	Thickness (feet)	Height above base (feet)
136	"Shale", weathers yellowish orange to yellow laminated smooth bedding; a very dark brown organic-rich silty limestone; mainly quartz silt; a little microcline and sericite silt and clay; abundant wisps of dark brown organic material oriented parallel to bedding tend to be concentrated in individual laminae; probably the apparent fissility of this rock is due to the organic matter content; one medium bed of light grey weathering finely crystalline recrystallized argillaceous crinoid biomicrite	2	6,899
135	Broken outcrop, rubble same as in overlying unit	69	6,897
	Total thickness of the Devon Island Formation	865	
	Douro Formation		
	Contact conformable		
134	Broken outcrop, rubble same as in underlying unit	119	6,828
133	Dolomitic limestone, weathers light yellowish grey; medium, uneven continuous bedding; some greyish green argillaceous material but less than at previous intervals; a brachiopod crinoid biomicrite	13	6,709
132	Broken outcrop, silty calcareous dolomite rubble; weathers light yellow; thin bedded; a finely crystalline silty medium yellow dolomite with patches of relict micrite; quartz silt	45	6,696
131	Limestone, weathers medium grey with an irregular but distinct greyish green mottling with an overall pattern orientation parallel to bedding; medium, fairly continuous lumpy bedding; a silty somewhat recrystallized crinoid brachiopod biomicrite; one thin continuous interbed with brachiopods, crinoids, gastropods and trilobites occurs at the middle of the interval.	50	6,651
130	Broken outcrop, lumpy limestone debris; same as in underlying unit	89	6,601
129	Argillaceous limestone, same as in underlying unit	2	6,512
128	Broken outcrop, rubble same as in underlying unit	171	6,510

Unit	Lithology	Thickness (feet)	Height above base (feet)
127	Argillaceous limestone; weathers dark grey with greyish yellow and greyish green mottling due to small wavy seams of argillaceous material; medium discontinuous lumpy bedding, a brachiopod (*Atrypella* sp.) crinoid? biomicrite	7	6,339
	Broken outcrop,		
126	rubble same as in overlying unit	25	6,332
125	Silty dolomitic limestone, weathers light yellowish grey and greyish yellow; a massive internally crossbedded unit composed entirely of low angle festoon crossbeds; small disarticulated brachiopod shells rest with convex side up on individual laminae outlining the crossbeds; a silty and argillaceous partly dolomitized biopel micrite; some ostracode shells	8	6,307
	Broken outcrop,		
124	rubble same as in underlying unit	100	6,299
	Broken outcrop,		
123	limestone debris; weathers medium to dark grey; probably medium lumpy bedded with abundant thin wavy seams of greyish yellow and greyish green argillaceous material; a crinoid brachiopod biomicrite	25	6,199
	Broken outcrop,		
122	rubble same as in the underlying unit but becoming thin bedded towards the top	68	6,174
121	Dolomitic limestone, weathers light yellowish grey; medium to thick continuous bedding with gently undulatory bed surfaces (ripples?); a light grey partly dolomitized silty micrite	10	6,106
	Broken outcrop,		
120	rubble same as in underlying unit	23	6,096
119	Limestone, weathers medium to dark grey with greenish and yellowish grey mottling of argillaceous material; thin to medium, anastomosing to lenticular bedding; a silty crinoid brachiopod biomicrite; *Atrypella* sp. and other brachiopods abundant	15	6,073
	Broken outcrop,		
118	rubble same as in underlying unit	12	6,058
117	Dolomitic limestone, weathers medium yellowish grey; laminated to thin lenticular bedding (1 foot wide lenticles) with faint very low angle crossbeds; a light grey silty largely dolomitized micrite with some thin discontinuous brown argillaceous seams	12	6,046
116	Limestone, weathers medium to dark brown with greyish green mottling; medium, very lumpy discontinuous bedding; outcrop debris weathers out in lumps rather than plates; thin, very wavy greyish green argillaceous seams are abundant; a dark grey crinoid		

Unit	Lithology	Thickness (feet)	Height above base (feet)
	brachiopod biomicrite; brachiopods probably all *Atrypella* sp.	14	6,034
	Total thickness of the Douro Formation	808	
	Cape Storm Formation		
	Contact conformable		
115	Broken outcrop, light greenish or yellowish grey weathering limestone debris; probably thin bedded with abundant seams of greyish-green argillaceous material	138	6,020
114	Broken outcrop, medium yellow weathering, very dolomitic limestone and dolomite debris; probably thin bedded; a finely crystalline yellow dolomite	130	5,882
113	Dolomitic limestone, weathers medium yellowish grey; thin to thick anastomosing continuous bedding outlined by thin medium brown argillaceous seams; a medium grey partly dolomitized poorly washed pack pelsparite; one light red thin continuous bed in the middle of the interval	7	5,752
112	Limestone, weathers medium grey with irregular light yellowish grey mottlings; medium to thick uneven bedding; yellow weathering horizontal burrows on bed surfaces; a slightly dolomitized and silty medium brown biopelmicrite with scattered ostracode shells	5	5,745
111	Limestone, weathers medium grey with irregular light yellowish or greenish grey mottlings; thin to medium gently anastomosing bedding; a medium grey fossiliferous pelmicrite; a few scattered ostracode shells	10	5,740
110	Dolomite, weathers light yellowish grey to greyish yellow; thin to medium gently anastomosing to lenticular bedding with lenticles up to 1 foot across (typical dimension of most lenticles in this formation) outlined by thin yellowish grey silty argillaceous seams; a medium yellowish brown finely crystalline dolomite	20	5,730
109	Dolomitic limestone, weathers medium yellowish to greyish green; medium to thick gently anastomosing continuous bedding; wavy greyish green seams of argillaceous material; partly dolomitized pelmicrite	5	5,710

Unit	Lithology	Thickness (feet)	Height above base (feet)
108	Broken outcrop, rubble same as in underlying unit; some zones of yellowish orange finely crystalline argillaceous dolomite	83	5,705
107	Limestone, weathers medium grey with an indistinct yellowish grey mottling; medium to thick continuous bedding containing zones of thin lenticular cross-beds outlined by gently wavy greyish green argillaceous seams; a medium grey pelmicrite	3	5,622
106	Dolomite, weathers yellowish to orangish grey; thin to medium bedded; light brown finely crystalline dolomite with greyish green argillaceous seams as laminations	3	5,619
105	Broken outcrop, rubble same as in underlying unit	26	5,616
104	Same as in unit 101	3	5,590
103	Dolomitic limestone, weathers light to medium yellowish grey; thin anastomosing to lenticular bedding outlined by wavy greyish green argillaceous seams; a partly dolomitized pelmicrite	10	5,587
102	Broken outcrop, dolomitic limestone debris; weathers medium yellowish grey; probably medium anastomosing to lenticular bedding; medium grey pelmicrite	37	5,577
101	Limestone, weathers medium grey with yellowish grey mottlings; a medium brown fossiliferous pelmicrite; a few scattered ostracode shells	12	5,540
100	Broken outcrop, rubble same as in underlying unit	249	5,528
99	Dolomitic limestone, weathers medium yellowish grey; thin anastomosing to lenticular smooth bedding; a dark brown ostracode poorly washed biopelsparite; thin discontinuous greyish green argillaceous seams parallel to bedding	30	5,279
98	Broken outcrop rubble almost all same as in the underlying unit but some zones of silty dolomitic limestone that weathers medium yellowish grey; probably laminated to thin lenticular bedding; a silty partly dolomitized pelmicrite; also some zones with pink colour laminations parallel to bedding	136	5,249
97	Dolomitic limestone, weathers medium yellowish grey; medium to thick smooth continuous bedding; with some laminated zones; a partly dolomitized biopelmicrite with scattered ostracode shells; some finely disseminated limonite in this and other yellow weathering dolomitic limestones in the sequence	18	5,113

Unit	Lithology	Thickness (feet)	Height above base (feet)
96	Broken outcrop, dolomitic limestone debris; weathers light yellow to yellowish grey; probably thin to medium anastomosing bedding; an almost completely dolomitized pel micrite.	42	5,095
95	Dolomitic limestone, weathers medium yellowish grey; thin to medium continuous bedding; a brown partly dolomitized ostracode and gastropod biopelmicrite; medium greyish green argillaceous seams define bedding	7	5,053
94	Covered, rubble same as in underlying unit	47	5,046
93	Broken outcrop, calcareous dolomite debris; weathers light yellow; probably medium anastomosing to lenticular bedding; outlined by brown slightly organic argillaceous seams	40	4,999
92	Dolomitic limestone, weathers medium grey; medium continuous bedding; a light grey partly dolomitized slightly silty dismicrite; some areas are finely mottled (bioturbated).	2	4,959
91	Broken outcrop, rubble same as in underlying unit	10	4,957
90	Slightly dolomitized, medium yellowish grey; thin to medium gently anastomosing continuous bedding with a slightly spiny weathering surface; a slightly dolomitized finely crystalline partly recrystallized medium brown ostracode and gastropod biopelmicrite	15	4,947
89	Broken outcrop, calcareous dolomite debris; weathers light yellow; medium smooth anastomosing to lenticular bedding defined by brown argillaceous seams; a nearly completely dolomitized micrite or pelmicrite	154	4,932
88	Silty dolomitic limestone, weathers medium yellowish-grey; very thin, lenticular discontinuous bedding defined by medium brownish yellow argillaceous seams	17	4,778
87	Broken outcrop, silty dolomitic limestone debris; weathers medium yellowish grey; probably with laminated bedding; a silty largely dolomitized pelmicrite?	15	4,761
86	Silty dolomitic limestone, weathers medium yellowish-grey; very thin anastomosing to lenticular discontinuous bedding defined by argillaceous seams; a light brown silty partly dolomitized pelmicrite	12	4,746

Unit	Lithology	Thickness (feet)	Height above base (feet)
85	Silty dolomitic limestone, weathers medium yellowish grey;;laminated to very thin, anastomosing to lenticular bedding; silty largely dolomitized pelmicrite	112	4,734
	Broken outcrop,		
84	very dolomitic silty limestone debris; weathers light yellow and yellowish grey; laminated to thin bedded; a silty partly dolomitized silty pelsparite; thin argillaceous seams parallel to bedding	59	4,622
	Broken outcrop,		
83	limestone debris, same as in underlying unit but medium bedded	55	4,563
82	Limestone, weathers medium grey; thin continuous bedding; a medium to dark grey micrite; a few scattered collophane fragments (fish fragments?)	3	4,508
81	Silty dolomitic limestone, weathers light brownish yellow; thin continuous, anastomosing bedding with a well developed internal laminated fabric; abundant thin yellowish brown argillaceous seams; a silty partly dolomitized poorly washed pelsparite	15	4,505
80	Limestone, weathers medium grey; thin to medium anastomosing bedding; medium brown pelmicrite	3	4,490
79	Dolomitic limestone, weathers medium yellowish grey; thin, anastomosing to lenticular discontinuous bedding; a silty fossiliferous partly dolomitized pelsparite with scattered ostracodes and a few brachiopods; some thin yellow argillaceous seams	4	4,487
	Broken outcrop,		
78	dolomitic limestone debris; same as at previous interval; thin bedded with 3 to 4 foot thick medium yellow weathering intervals with laminated bedding	150	4,483
	Broken outcrop,		
77	dolomitic limestone debris; weathers light greyish yellow; thin bedded partly dolomitized, slightly silty pelmicrite; some disseminated limonite	13	4,333
76	Same as in underlying unit	1	4,320
	Broken outcrop,		
75	limestone debris; medium grey weathering; medium smooth-bedded slightly dolomitized and silty packed pelmicrite	60	4,319

Unit	Lithology	Thickness (feet)	Height above base (feet)
74	Broken outcrop, interbeds of thin bedded light grey weathering pelmicrite and thin bedded light greyish yellow partly dolomitized pelmicrite rubble with some disseminated limonite and silt	26	4,259
73	Broken outcrop, rubble same as in underlying unit	30	4,235
72	Dolomitic limestone, weathers light grey with indistinct yellowish grey mottling; medium to thick continuous bedding; medium grey partly dolomitized silty pelmicrite with wavy discontinuous greyish green argillaceous seams parallel to bedding	10	4,203
71	Broken outcrop, rubble same as in underlying unit	33	4,193
70	Limestone, weathers medium grey; thin, anastomosing to lenticular very discontinuous bedding; a light brown fossiliferous poorly washed pelsparite; scattered ostracode shells	7	4,160
69	Dolomitic limestone, weathers light to medium grey with an indistinct greyish yellow mottling; thick, anastomosing to lenticular discontinuous bedding with very spiny surface weathering; a partly dolomitized, poorly washed biopelsparite; scattered ostracodes, brachiopods and a few solitary rugose corals; disseminated limonite	5	4,153
68	Limestone, weathers light grey; medium to thick continuous bedding; fossiliferous pelmicrite and poorly washed pelsparite; scattered ostracodes	17	4,148
67	Dolomitic limestone, weathers light yellowish grey; thin gently anastomosing continuous bedding; a light brown partly dolomitized pelmicrite	6	4,131
66	Broken outcrop, limestone debris; weathers light grey; medium continuous bedding with a spiny weathering surface; a medium brownish grey poorly washed? intrapelsparite	71	4,125
65	Limestone, weathers light grey; alternating thick and thin continuous beds; thin beds are smooth weathering, light grey micrite and pelmicrite; thick beds of medium brownish grey, spiny weathering poorly washed? intrapelsparite	5	4,054
64	Limestone, weathers light grey; thick continuous bedding with a spiny weathering surface; micrite with patches of intrapelmicrite	5	4,049

Unit	Lithology	Thickness (feet)	Height above base (feet)
63	Broken outcrop, rubble same as in underlying unit	9	4,044
62	Limestone, weathers medium grey; thin to medium, anastomosing to lenticular, lumpy bedding with a spiny weathering surface; brown intrapelsparite	5	4,035
61	Limestone, weathers light yellowish grey to greyish yellow; very thin, anastomosing to lenticular bedding with faint crossbeds; a finely laminated micrite; in some areas laminations are broken into tabular clasts; almost a "mud-chip" conglomerate; some silt and argillaceous material	5	4,030
60	Limestone, weathers medium grey; thin continuous bedding with a spiny weathering surface; a medium brown poorly washed biopelsparite with scattered disarticulated ostracode shells	10	4,025
59	Broken outcrop, rubble same as in underlying unit	11	4,015
58	Limestone, weathers medium grey with an indistinct greyish yellow mottling; thin to thick continuous bedding with a spiny weathering surface; a medium brown, poorly washed biopelsparite; scattered ostracode shells; some dark brown, wavy organic-rich argillaceous seams; some disseminated limonite	15	4,004
57	Broken outcrop, rubble same as in underlying unit	61	3,989
56	Limestone, weathers medium grey; thin to thick continuous bedding; a medium brown packed intrasparite; grapestone (clusters of pellets form intraclasts).	28	3,928
55	Broken outcrop limestone debris; weathers light grey; probably thin to medium bedded with spiny weathering surface	14	3,900
54	Same as at unit 52	6	3,886
53	Broken outcrop, limestone debris; weathers light grey; probably medium to thick bedded; a slightly silty light brown poorly washed packed intrapelsparite with a few scattered ostracode shells	168	3,880
52	Limestone, weathers light to medium grey, medium discontinuous bedding; a medium brown partly dolomitized packed biointrapelmicrite; stromatoporoids, corals (e.g., *Palaeocyclus* sp., *Cystihalysites* sp., and *Favosites* sp.), brachiopods, crinoids and ostracodes common; some disseminated limonite grains	8	3,712

Unit	Lithology	Thickness (feet)	Height above base (feet)
51	Limestone, weathers light grey; medium to thick bedded; a slightly silty light brown fossiliferous poorly washed, packed intrapelsparite; a few scattered ostracode shells; rounded intraclasts of poorly washed pelsparite in small lenticular placers	12	3,704
50	Limestone, weathers light grey with irregular light yellowish grey mottlings; thin, discontinuous anastomosing and lenticular bedding with a pronounced spiny weathering surface; medium brown recrystallized packed biopelmicrite; some very thin wavy argillaceous seams.	14	3,692
49	Limestone, weathers light grey; medium bedded with a spiny weathered surface; a medium grey, finely crystalline, recrystallized packed biopelmicrite; fairly abundant brachiopods and thamnoporid-like corals	30	3,678
48	Same as in underlying unit	10	3,648
47	Broken outcrop, rubble same as in underlying unit	71	3,638
46	Limestone, weathers medium grey; medium discontinuous bedding; a medium crystalline, recrystallized packed biopelmicrite; abundant silicified stromatoporoids (*Clathrodictyon*), and corals (e.g., *Synamplexoides* cf. *S. varioseptatus* and *Favosites*).	11	3,567
	Total thickness of the Cape Storm Formation	2,464	
	Allen Bay Formation		
	Contact conformable		
45	Dolomite, weathers very light grey; thin to thick continuous bedding; a finely to coarsely crystalline dolomite; scattered tabular shapes (4 to 5 mm long) of very finely crystalline dolomite are oriented parallel to bedding; packed pellet ghosts; disseminated limonite and limonitized pyrite concentrated in more finely crystalline areas.	4	3,556
44	Covered and broken outcrop, rubble same as in underlying unit	157	3,552
43	Dolomite, weathers light grey; smooth-weathering, nonfriable massive bedding; a medium grey, medium crystalline dolomite; abundant silicified stromatoporoids, corals, cephalopods and crinoid fragments	8	3,395

Unit	Lithology	Thickness (feet)	Height above base (feet)
42	Broken outcrop, rubble same as in underlying unit	71	3,387
41	Dolomite, weathers medium greyish brown; smooth non-friable massive bedding; scattered somewhat silicified tabular stromatoporoids, colonial corals and small crinoid fragments; a finely to medium crystalline brown dolomite	7	3,316
40	Broken outcrop, rubble same as in underlying unit	56	3,309
39	Dolomite, weathers medium greyish brown; massive bedded; friable, finely to medium crystalline brown dolomite; scattered tabular stromatoporoids and colonial corals	15	3,253
38	Broken outcrop, 20 foot thick intervals of massive bedded dolomite debris alternate with 20 foot thick intervals very light weathering, apparently medium to thick bedded, finely crystalline dolomite debris with faint wavy interval laminations (stromatolites)	144	3,238
37	Broken outcrop, dolomite; weathers medium brown; massive bedded; smooth non-friable weathering; scattered dolomitized stromatoporoids, brachiopods, and corals (e.g., *Aulacera*) particularly towards the top of the interval	344	3,094
36	Dolomite, weathers medium to dark brown; massive bedded; medium crystalline dolomite with 5-10% intercrystalline porosity; abundant very light grey and yellow tabular stromatoporoids scattered throughout; very friable and crumbly weathering	11	2,750
35	Broken outcrop, rubble same as in underlying unit	101	2,739
34	Dolomite, weathers medium greyish brown; thick to massive bedded; a medium to coarsely crystalline dolomite; some sparsely scattered dolomitized corals	20	2,638
33	Dolomite, weathers light to medium greyish brown; thick to massive discontinuous uneven bedding; finely to coarsely crystalline, very crumbly and friable dolomite; scattered tabular stromatoporoids	65	2,618
32	Dolomite, weathers medium brown; medium to thick fairly smooth continuous bedding; medium brown homogeneous finely to medium crystalline dolomite; a few scattered small vugs of leached biogenic material	62	2,553

Unit	Lithology	Thickness (feet)	Height above base (feet)
31	Dolomite, weathers very light grey; medium to thick fairly smooth continuous bedding--faint wavy internal laminations (stromatolites); a very finely to finely crystalline light grey dolomite	45	2,491
30	Dolomite, weathers medium brown; medium to thick continuous fairly smooth bedding; medium brown homogeneous finely to medium crystalline dolomite	10	2,446
29	Covered, and broken outcrop dolomite debris; weathers medium orangish brown; medium to thick, continuous fairly smooth bedding; medium brown homogeneous finely to medium crystalline dolomite	137	2,436
28	Dolomite, weathers medium to dark brown; massive bedded with a thin to medium knobbly discontinuous internal bedding; very crumbly and friable; strong petroliferous odor; a finely to coarsely crystalline dolomite with a patchy distribution of intraclast and pelletal ghosts; 2-3% small vug porosity	5	2,299
27	Broken outcrop, rubble same as in underlying unit	89	2,294
26	Dolomite, weathers medium brown; medium to thick continuous fairly smooth bedding; medium brown homogeneous finely to medium crystalline dolomite, some scattered small vugs (less than 1/2 mm long).	15	2,205
25	Dolomite, same as in underlying unit	20	2,190
24	Broken outcrop, rubble same as in underlying unit	11	2,170
23	Dolomite, same as in underlying unit	7	2,159
22	Broken outcrop, rubble same as in underlying unit	15	2,152
21	Dolomite, same as in underlying unit	1	2,137
20	Broken outcrop, rubble same as in underlying unit	43	2,136
19	Dolomite, weathers medium brown; massive bedding with a thin to medium, knobbly, discontinuous internal bedding; very crumbly and friable; strong petroliferous odor; a finely crystalline brown dolomite; abundant yellow weathering tabular stromatoporoids with subsidiary corals and brachiopods	9	2,093
18	Covered, and broken outcrop rubble same as in overlying unit	95	2,084

Unit	Lithology	Thickness (feet)	Height above base (feet)
17	Dolomite, medium brown, very friable weathering; massive, indistinct bedding; scattered vugs of possible leached biogenic material; 8-10% vug porosity; a few scattered grains of limonite	7	1,989
16	Broken outcrop, rubble same as in underlying unit	14	1,982
15	Dolomite, same as in underlying unit; but less friable and petroliferous; no biogenic materials	10	1,968
14	Broken outcrop, rock debris same as in underlying unit, but biogenic material nearly absent; only a few stromatoporoids	10	1,958
13	Dolomite, same as in underlying unit	3	1,948
12	Covered and broken outcrop, rubble same as in underlying unit	62	1,945
11	Dolomite, weathers medium brown; massive indistinct bedding; finely to coarsely crystalline dolomite; very friable weathering and petroliferous; abundant dolomitized stromatoporoids and corals; 1-2% vug porosity in the centers of vugs (less than 4 mm long) only partly infilled with sparry dolomite	5	1,883
10	Broken outcrop, rubble same as in underlying unit	35	1,878
9	Dolomite, same as in underlying unit	6	1,843
8	Broken outcrop, rubble same as in underlying unit	19	1,837
7	Dolomite, weathers medium brown; massive indistinct bedding; very crumbly and friable; strong petroliferous odor; a finely crystalline brown dolomite; abundant dolomitized tabular stromatoporoids weather very light yellow; subsidiary dolomitized colonial corals and brachiopods; some porosity	50	1,818
6	Covered and broken outcrop, rubble same as in underlying unit	101	1,768
5	Dolomite, weathers medium brown; medium to thick continuous fairly smooth bedding; medium brown homogeneous finely to medium crystalline dolomite; scattered small vugs (less than 1/2 mm long); up to 10% vug porosity	2	1,667
4	Covered and broken outcrop; along strike one mile to the southeast the interval contains ledges of chocolate brown, petroliferous, porous, thick bedded to massive	(estimated) 225	1,665
	Total thickness of the Allen Bay Formation	2,116	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	CORNWALLIS GROUP		
	Irene Bay Formation		
	Contact covered, probably conformable		
3	Covered and broken outcrop, with rubble of greenish grey weathering argillaceous limestone	(estimated) 40?	1,440
	Total thickness of Irene Bay Formation	40?	
	Thumb Mountain Formation		
	Contact covered, probably conformable		
2	Mostly covered, intermittent outcrops of limestone, medium to thick bedded, fine to medium crystalline medium grey, weathering light grey, some mottled medium grey and tan limestone, gradational at the base with underlying unit	(estimated) 900	1,400
	Total thickness of Thumb Mountain Formation	900	
	Bay Fiord Formation		
	Contact conformable		
1	Limestone, fine to medium crystalline, thin bedded, mottled grey-brown and light tan; dolomite limy, sooty textured, olive grey; limy shale, greenish grey; above rock types are interbedded	(estimated) 500	500
	Exposed thickness of the Bay Fiord Formation Lower limit of exposure at a fault	500	

Section 3: This is a westerly dipping section with its base at 76°18'N, 93°40'W, 3 miles southeast of Sutherland River on the east side of Prince Alfred Bay on Devon Island. The section is best seen on aerial photograph A16747-163. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
	Dolomite, light grey weathering; thick to massive bedded; finely crystalline; orange weathering silicified brachiopods stand out in relief; a dolomitized crinoid and brachiopod bearing biomicrite	20	3,046
	Examined thickness of Undivided Devonian Carbonates	20	
	Prince Alfred Formation		
	Contact covered, probably conformable		
67	Covered and broken outcrops medium yellowish orange weathering; probably thick or massive bedded; a yellow dolomite-cemented quartz arenite sandstone; scattered limonite	60	3,026
	Total thickness of the Prince Alfred Formation	60	
	Sutherland River Formation		
	Contact covered, probably a disconformity		
66	Covered, the basal 50 feet of this interval is rubble the same as in the underlying unit; the remainder of the interval is obscured by a river	173	2,966
65	Dolomite, weathers very light grey; medium, discontinuous fairly smooth bedding; a slightly silty (quartz grains) light grey finely to medium crystalline dolomite; gastropod steinkerns, brachiopod molds and remnants of indeterminate fine shell debris	20	2,793
	Total thickness of the Sutherland River Formation	193	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Devon Island Formation		
	Contact covered, probably conformable		
64	Broken outcrop, dolomite debris same as in unit 63	142	2,773
63	Dolomite, weathers medium yellowish brown; laminated to thin, smooth continuous bedding; a silty finely crystalline dark brown dolomite; organic material abundant as thin wisps and seams parallel to bedding; seams of limonite also are common; laminations in this dolomite appear contorted in many places	11	2,631
62	Broken outcrop, rubble same as in underlying unit but more dolomitized	221	2,620
61	Broken outcrop, yellow weathering platy limestone debris; some corals and brachiopods in some individual medium beds of limestone that are scattered throughout	114	2,399
60	Dolomitic limestone, weathers light greyish yellow; laminated to thin smooth continuous bedding--a medium brownish grey silty partly dolomitized micrite; abundant dark brown organic matter in thin wisps and seams parallel to bedding; a few brachiopods (*Camarotoechia* sp.).	22	2,285
59	Broken outcrop, rubble same as in underlying unit	171	2,263
58	Broken outcrop, rubble same as at unit 56; but several dark grey thick beds of limestone in the interval, one of which caps the interval; a slightly silty biopelmicrite; abundant brachiopod and crinoid fragments with some graptolites, ostracodes, pelecypods, and gastropods	190	2,092
57	Broken outcrop, dolomitic limestone debris; same as in underlying unit but partly dolomitized; scattered pieces of collophane	128	1,902
56	Limestone, light yellow weathering; laminated smooth continuous bedding; a very dark brownish grey silty fine-grained limestone with very abundant organic material as 1-2 mm long wavy dark brown wisps parallel to bedding; commonly these wisps are gathered into thin seams (1-2 mm wide) parallel to bedding; quartz silt with minor amounts of sericite; rounded blocks of fossiliferous pelmicrite rest on lower contact with Douro Formation--some fish fragments	2	1,774
	Total thickness of the Devon Island Formation	1001	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Douro Formation		
	Contact conformable		
55	Limestone, weathers dark grey; thick to massive uneven but continuous bedding; a fossiliferous micrite; with ostracodes, crinoids, brachiopods, echinoids, pelecypods and trilobites (*Encrinurus* (*Frammia*) cf. (*F.*) *arcticus*); pyritized fish and cephalopods rest on upper contact with the Devon Island shale	3	1,772
54	Broken outcrop, mainly dark greyish green weathering limestone debris; an argillaceous biomicrite with abundant crinoid, brachiopod and ostracode shell fragments; bioturbated	20	1,769
53	Limestone, weathers medium to dark grey, thick to massive, uneven but fairly continuous bedding; a slightly fossiliferous micrite; scattered crinoids and brachiopods (*Atrypella* sp.)	40	1,749
52	Broken outcrop, very argillaceous limestone debris	25	1,709
51	Limestone, weathers dark grey; thin to medium uneven discontinuous bedding; a dark grey slightly silty crinoid biomicrite	4	1,684
50	Broken outcrop, rubble same as at unit 48	35	1,680
49	Limestone, weathers medium grey; medium, fairly continuous uneven bedding; very little argillaceous material; a slight silty and argillaceous fossiliferous micrite; scattered brachiopods; some authigenic pyrite and limonitized pyrite crystals	75	1,645
48	Broken outcrop, very shaly dark greyish-green micrite	15	1,570
47	Limestone, weathers medium grey with some greyish green argillaceous material as before; a silty argillaceous dark grey; medium, uneven to lumpy bedding; biopelmicrite; some articulated brachiopods (notably *Atrypella* sp.), crinoid and high-spired gastropods	3	1,555
46	Broken outcrop, rubble sand as in overlying unit; with ostracodes, gastropods, echinoderm fragments and corals (*Entelophyllum* sp., *Favosites* sp., and *Thamnopora* sp.); bioturbated	6	1,552

Unit	Lithology	Thickness (feet)	Height above base (feet)
45	Limestone, weathers medium grey with wisps of greyish green argillaceous material; thin to medium discontinuous, lumpy bedding; a dark grey silty argillaceous biomicrite; some articulated brachiopods as before in a crinoid and gastropod shell hash; bioturbated	6	1,546
44	Calcareous shale, weathers dark greyish green; the very dark greyish-green shale encloses isolated grey micrite nodules which are similar in size and form to the nodules composing the thin-bedded nodular limestones of underlying units	10	1,540
43	Limestone, weathers medium grey with abundant greyish green argillaceous material outlining thin, discontinuous nodular bedding; a silty, argillaceous biomicrite with articulated brachiopods (notably *Atrypella* sp.) in crinoid, echinoid, trilobite (*Encrinurus* [?*Frammia*] sp.) and bryozoan debris; some authigenic pyrite and limonitized pyrite grains; bioturbated	9	1,530
42	Limestone, weathers dark grey; thick, slightly uneven bedding; very little argillaceous material a brachiopod (*Atrypella* sp.), crinoid biomicrite	12	1,521
41	Limestone, similar to unit 37 but very abundant greyish-green argillaceous material and articulated *Atrypella* sp. and other brachiopods; some authigenic pyrite and limonitized pyrite crystals	7	1,509
40	Same as in underlying unit but more resistant due to lack of argillaceous material	13	1,502
39	Limestone, weathers dark grey with greenish grey argillaceous material outlining thin discontinuous bedding of thin lumpy nodules of dark grey micrite elongate parallel to bedding; very sparse *Atrypella* sp.; bioturbated	11	1,489
38	Broken outcrop; rubble same as in underlying unit	3	1,478
37	Limestone, weathers dark grey with greyish green argillaceous mottlings; medium to thick, fairly continuous uneven to lumpy bedding; a dark greyish green silty biopelmicrite; several discrete zones of articulated brachiopods (*Atrypella* sp., and others) bioturbated	10	1,475
36	Dolomitic limestone, weathers light yellowish grey; thin anastomosing bedding; a silty, partly dolomitized, sparsely fossiliferous pelmicrite and poorly washed pelsparite; a few scattered ostracode fragments; quartz grains and sericite forms silt	2.5	1,465

Unit	Lithology	Thickness (feet)	Height above base (feet)
35	Broken outcrop, rubble same as in overlying unit	60	1,462.5
34	Silty dolomite, weathers light orangish grey; thin, discontinuous lenticular bedding; some discontinuous, wavy, thin, greyish green and pinkish grey argillaceous seams; faint laminations due to vertical alternations in silt content	2.5	1,402.5
33	Covered and broken outcrop, limestone; weathers medium grey; very thin to medium, gently anastomosing to lenticular bedding; bedding commonly outlined by greyish green argillaceous seams; a medium grey slightly fossiliferous and silty pelmicrite; ostracode and other shell debris of indeterminate origin; some streaks of disseminated limonite grains	87	1,400
	Total thickness of the Douro Formation		
	Cape Storm Formation		
	Contact covered, probably conformable		
32	Covered and broken outcrop, rubble same as in underlying unit	33	1,313
31	Silty dolomite, weathers light orangish grey; thin, discontinuous, anastomosing and lenticular bedding; some discontinuous, wavy, thin greyish green and pinkish grey argillaceous seams; vertical alternations in silt content	2	1,280
30	Broken outcrop, rubble, same as in underlying unit	23	1,278
29	Dolomite, weathers light yellowish grey; thin to medium, anastomosing, lenticular bedding; some zones of irregular white weathering, grey chert nodules oriented parallel to bedding; a light brown, slightly silty dolomite	8	1,255
28	Broken outcrop, dolomitic limestone debris; same as in unit 25	63	1,247
27	Dolomitic limestone, weathers light grey; medium bedded with an internal bedding of discontinuous anastomosing, slightly lumpy thin beds; discontinuous pink wavy seams of argillaceous material; a partly dolomitized ostracode biopelsparite with sparse crinoid fragments	5	1,184
26	Covered and broken outcrop, rubble, same as in overlying unit	260	1,179

Unit	Lithology	Thickness (feet)	Height above base (feet)
25	Dolomitic limestone, weathers light yellowish grey with pinkish grey streaks; thin discontinuous, lenticular bedding; a largely dolomitized biomicrite and biopelmicrite; scattered ostracode shell fragments; some scattered limonite grains	25	919
24	Broken outcrop, almost all of the interval is rubble of the same lithology as in the overlying unit	132	894
23	Limestone, medium grey weathering; massive, slightly uneven to lumpy, continuous bedding; a slightly dolomitized biomicrite and biopelmicrite; some areas of intramicrite with intraclasts up to 4 mm long; crinoid and ostracode fragments most abundant with subsidiary gastropod, brachiopod and thamnoporid-like coral debris	1	762
22	Dolomitic limestone, weathers light yellowish grey; thin, anastomosing to lenticular bedding; medium brown silty biomicrite and biopelmicrite; some ostracode shell fragments	4	761
21	Broken outcrop, rubble same as in underlying unit	74	757
20	Calacreous dolomite, weathers medium grey to yellowish grey; thin to thick gently anastomosing to lenticular smooth bedding; a medium greyish brown slightly silty and dolomitized biopelmicrite and poorly washed biopelsparite; abundant ostracode shell fragments, less abundant brachiopod fragments	6	683
19	Broken outcrop, rubble same as in underlying unit	15	677
18	Dolomitic limestone, weathers light grey; thin, lenticular, discontinuous bedding with faint internal laminations outlining festoon crossbeds; a partly dolomitized, slightly silty biopelmicrite	2	662
17	Limestone, weathers light grey to light yellowish grey; thin to medium, smooth, continuous bedding; a partly dolomitized biomicrite; some brachiopods	5	660
16	Broken outcrop, rubble same as in underlying unit	26	655
15	Dolomitic limestone, weathers light grey; thin to medium, continuous lumpy bedding; a medium grey, partly dolomitized biomicrite; a little quartz silt; some ostracode shells	3	629
14	Covered and broken outcrop, dolomitic limestone debris; weathers yellowish grey; thin, fairly continuous? bedding with worm? castings on bed surfaces	195	626

Unit	Lithology	Thickness (feet)	Height above base (feet)
13	Covered and broken outcrop, silty calcareous dolomite debris; weathers light yellowish grey; thin to medium, smooth anastomosing bedding; some faint shallow cross-beds; a silty dolomitized micrite; quartz grains and sericite silt	108	431
	Total thickness of the Cape Storm Formation	990	
	Allen Bay Formation		
	Contact covered, probably conformable		
12	Dolomite, weathers light yellowish grey; thick to massive, fairly continuous bedding somewhat spiny weathering--a brownish grey fine to medium crystalline dolomite; some dolomitized bioclastic debris?; scattered limonitized pyrite crystals	6	323
11	Broken outcrop, rubble same as in underlying unit	7.5	317
10	Dolomite, weathers light grey; medium to thick, fairly smooth bedding; a grey medium crystalline dolomite; areas of more coarsely crystalline dolomite may be dolomitized sparry calcite vug-fillings	4	309.5
9	Dolomite, same lithology as in underlying unit	2	305.5
8	Broken outcrop, rubble same as in underlying unit	12	303.5
7	Dolomite, same as in underlying unit	2	291.5
6	Broken outcrop, rubble same as in underlying unit	5	289.5
5	Dolomite, weathers light grey; thin to medium anastomosing, smooth discontinuous bedding with a good internal discontinuous, anastomosing to lenticular laminated bedding; a brown and pinkish brown finely crystalline dolomite laminite	1.5	284.5
4	Broken outcrop, rubble same as in underlying unit	14	283
3	Dolomite, same as in underlying unit	5	269
2	Covered and broken outcrop, rubble same as in underlying unit	259	264
1	Dolomite, weathers light yellowish grey; medium to thick, rough somewhat discontinuous bedding; a greyish brown, medium crystalline dolomite; some finely disseminated limonite; less than 5% porosity in pinpoint vugs	5	5
	Exposed thickness of the Allen Bay Formation Lower limit of exposure at a fault zone	323	

Section 4: This is a southwest dipping section with its base at 76°19'20"N, 92°47'30"W, on the southeast bank of Sutherland River east of Prince Alfred Bay on Devon Island. The formation is best seen on aerial photograph A16747-162. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
39	Limestone, bluish grey weathering; thick to massive bedding; an organic-rich crinoid and brachiopod-bearing biomicrite	15	1,700
	Examined thickness of undivided Devonian carbonates	15	
	Prince Alfred Formation		
	(type section of Thorsteinsson, 1963b)		
	Contact covered, probably conformable		
38	Covered and broken outcrop, rubble, the same as in underlying unit	100	1,685
37	Silty, dolomite, weathers medium greenish blue; thin continuous smooth bedding; a laminated silty dolomite; more silty finely crystalline dolomite alternates with somewhat less silty very finely crystalline dolomite; some small spherical (less than 1 cm in diameter) ironstone concretions	10	1,585
36	Breccia, very poorly sorted clasts up to 2 feet long (larger clasts tend to be tabular) of light yellowish brown weathering slightly silty dolomicrite with vague pellet ghosts in a silty finely crystalline medium brown weathering dolomite matrix; much of matrix is a dolomite-cemented siltstone	40	1,575
35	Slightly silty dolomite, weathers light yellowish grey; medium smooth continuous bedding; a slightly silty dolomicrite with vague packed pellet ghosts; some scattered limonite and partly limonitized pyrite	15	1,535
34	Dolomitic siltstone, weathers medium brownish grey; thick anastomosing discontinuous bedding; perhaps crossbedded; siltstone; dolomite cemented mature impure quartzarenite; packed quartz silt grains with subsidiary microcline, orthoclase and sericite; 5 to 10% intergranular porosity due to leaching of intergranular dolomite; a little disseminated limonite	5	1,520

Unit	Lithology	Thickness (feet)	Height above base (feet)
33	Dolomite breccia, weathers light greenish grey with light greyish red mottling; thin to medium uneven continuous bedding; a breccia with clasts most less than 3 cms long of finely laminated dolomicrite and silty dolomicrite in a silty finely crystalline dolomite groundmass; quartz microcline silt	5	1,515
	Total thickness of Prince Alfred Formation	175	
	Sutherland River Formation (type section of Thorsteinsson, 1963b)		
	Contact covered, probably disconformable		
32	Covered and broken outcrop, rubble, same as in underlying unit	25	1,510
31	Slightly silty dolomite, weathers light to medium yellowish grey with some very light reddish grey zones; thin to medium fairly smooth continuous bedding; a slightly silty finely crystalline dolomite and dolomicrite; a discontinuous internal laminated fabric of dolomicrite laminae with very little quartz silt alternating with laminae of finely crystalline dolomite and more abundant silt; limonite and partly limonitized pyrite disseminate throughout	40	1,485
30	Dolomite and silty dolomite, weathers light yellowish grey; thin to medium, smooth to slightly uneven gently anastomosing bedding; mostly silty finely crystalline recrystallized dolomicrite as at previous intervals; some laminae of breccia with tabular clasts (1 cm long) floating in a silty dolomicrite matrix occur interlaminated with silty dolomicrite; towards top of interval rather lumpy bedded with some dolomitized crinoid fragments and a few collophane fragments (fish bones?)	90	1,445
29	Broken outcrop, rubble same as in underlying unit	8	1,355
28	Slightly silty dolomite, weathers light yellowish grey; medium smooth continuous bedding; a slightly silty dolomicrite with vague packed pellet ghosts; some scattered limonite and partly limonitized pyrite grains; small flakes of organic material oriented parallel to bedding are scattered throughout	1	1,347

Unit	Lithology	Thickness (feet)	Height above base (feet)
27	Silty dolomite, weathers light yellowish grey; laminated to thin fairly continuous anastomosing bedding with some faint internal, low angle cross-bedding; a silty finely crystalline recrystallized dolomicrite; seams of disseminated limonite and limonitized pyrite grains are responsible for faint internal laminations	1	1,346
26	Covered and broken outcrop, rubble same as in underlying unit	64	1,345
25	Broken outcrop, same as in underlying unit	70	1,281
24	Silty dolomite, weathers light to medium brown; thin to medium very gently anastomosing smooth bedding with some faint internal low angle crossbedding; a medium brown silty finely crystalline dolomite; some small collophane fragments (fish bones?) and some small vugs of leached biogenic material; quartz silt with some sericite and flakes of organic material	40	1,211
	Total thickness of the Sutherland River Formation	339	
	<u>Devon Island Formation</u>		
	Contact covered, probably conformable		
23	Broken outcrop, same as in underlying unit	35	1,171
22	Organic-rich silty dolomite, weathers yellowish grey; thin to medium smooth continuous bedding with rather indistinct internal laminations and cross-bedding; a medium to dark brown silty, organic-rich very finely to finely crystalline dolomite; vague packed pellet and intraclast ghosts; mainly quartz silt	30	1,136
21	Broken outcrop, same as in underlying unit	155	1,106
20	Organic-rich silty dolomite, weathers light greyish brown; thin continuous smooth bedding with well developed internal laminations due to alternations in silt content; some distinct low angle cross-bedding within some laminations; an organic-rich silty finely crystalline dolomite and dolomicrite; organic matter as thin wisps parallel to bedding	45	951
19	Broken outcrop, same as in underlying unit	120	906

Unit	Lithology	Thickness (feet)	Height above base (feet)
18	Silty dolomite and calcareous dolomite; weathers light bluish and greenish grey; thin to medium, smooth continuous bedding; a finely laminated, medium grey silty micrite, dolomicrite and finely crystalline dolomite; abundant organic matter in tiny flakes parallel to bedding; some graptolites (*Monograptus uniformis*?)	170	786
17	Same as in unit 15; graptolites (*Monograptus transgradiens*) abundant; laminated, organic-rich, silty and argillaceous micrite and dolomicrite or finely crystalline dolomite	40	616
16	Calcareous shale as in underlying unit; some zones of graptolites (*Monograptus transgradiens*) with scattered fish plates; 4 feet from top of interval are a series of three dark grey weathering, medium uneven but continuously bedded limestones; a strongly recrystallized packed biopelmicrite; abundant crinoids and brachiopods; some corals and ostracodes; a few scattered small micrite intraclasts; some organic matter and limonite	25	576
15	Broken outcrop, calcareous "shale" debris; weathers medium yellow; laminated smooth bedding; a very dark brown, very organic-rich silty and argillaceous micrite and dolomicrite; organic matter in thin wisps and seams parallel to bedding; microcline and quartz silt; abundant sericite	100	551
	Total thickness of the Devon Island Formation	720	
	Douro Formation		
	Contact conformable		
14	Argillaceous dolomitic limestone, weathers dark grey with greyish-green argillaceous mottlings; thin, discontinuous uneven bedding; an partly dolomitized biopelmicrite; abundant gastropod, brachiopod and trilobite (e.g., *Cyphoproetus* sp. and *Encrinurus arcticus*) shells and shell fragments; crinoid, echinoid and bryozoan fragments are common; bioturbated	10	451
13	Broken outcrop, same as in underlying unit	20	441

Unit	Lithology	Thickness (feet)	Height above base (feet)
12	Silty and argillaceous, dolomitic limestone, weathers dark greyish green argillaceous stringer parallel to bedding, thick to massive fairly smooth continuous bedding; a partly dolomitized silty, argillaceous biomicrite; some areas of biopelmicrite?; brachiopods and ostracodes some thamnoporid-like corals and crinoids--scattered quartz silt	15	421
	Broken outcrop		
11	^, rubble same as in underlying unit	10	406
10	Dolomitic limestone, weathers dark grey with greyish green wavy argillaceous seams parallel to bedding; thin to medium fairly continuous uneven anastomosing bedding; a partly dolomitized packed biopelmicrite; fairly abundant ostracode and brachiopod shell fragments; scattered crinoid and a few sparse echinoid fragments; bioturbated	30	396
	Broken outcrop		
9	^, rubble, same as in underlying unit	10	366
8	Dolomitic limestone, weathers light grey with wavy greyish-green argillaceous seams parallel to bedding; medium fairly continuous uneven bedding; a slightly silty and dolomitized biomicrite; scattered ostracode, crinoid and brachiopod fragments; a little quartz silt and disseminated limonite	10	356
7	Dolomitic limestone, weathers medium grey with greyish green wavy argillaceous seams; medium to thick slightly lumpy continuous bedding; a slightly dolomitized and silty packed biopelmicrite; abundant brachiopods (e.g., *Atrypella* sp.) and crinoids; a little quartz silt and disseminated limonite	12	346
6	Dolomitic limestone, weathers light grey with wavy greyish green seams parallel to bedding; medium fairly continuous smooth bedding; a slightly dolomitized biopelmicrite; brachiopods (e.g. *Atrypella* sp.), ostracodes, gastropods and crinoids abundant; pyrite and limonitized pyrite grains common--bioturbated	20	334
	Broken outcrop		
5	^, rubble, same as in underlying unit	20	314
4	Limestone, weathered dark grey with greyish green wavy argillaceous seams, medium very discontinuous, lumpy bedding; a crinoid brachiopod packed biopelmicrite; brachiopods mostly *Atrypella* sp.; minor ostracodes and gastropods; pyrite and limonitized pyrite grains common	4	294

Unit	Lithology	Thickness (feet)	Height above base (feet)
3	Covered and broken outcrop, dark grey thin to medium lumpy bedded limestone debris appears interbedded with thinner intervals of light brownish grey medium bedded finely crystalline dolomite debris; bioturbated	150	290
	Total thickness of the Douro Foramtion	311	
	Cape Storm Formation		
	Contact covered, probably conformable		
2	Dolomite, same as in underlying unit	40	140
1	Covered and broken outcrop, dolomite debris; weathers medium grey with pale yellowish grey mottlings; medium to thick bedded fairly continuous smooth bedding; light brown, finely crystalline dolomite with packed pelletal and intraclast ghosts; some faint laminations; abundant disseminated limonite	100	100
	Exposed thickness of Cape Storm Formation	140	
	Base of section near Grinnell Thrust Fault		

Section 5. This is a northeast dipping section with its base at 76°21'05"N, 92°50'00"W, in a valley running through the Douro Range on the northeast side of Prince Alfred Bay, Devon Island. The section is best seen on aerial photograph A16747-162. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Devon Island Formation		
	Upper limit of rocks measured within the Devon Island Formation at the top of a ridge crest		
25	calcareous shale debris; very platy; yellow-weathering, organic-rich very dark brown calcareous shale	100	2,091
	Examined thickness of Devon Island Formation	100	
	Douro Formation (type section of Thorsteinsson, 1963b)		
	Contact covered, probably conformable		
24	Broken outcrop, rubble same as in underlying unit	35	1,991
23	Same as in underlying unit with abundant bryozoa, echinoderms, brachiopods and trilobites (e.g., *Hemiarges* sp., and *Encrinurus* sp.)	120	1,956
22	Argillaceous limestone; weathers medium to light grey; thin to medium, slightly uneven, continuous bedding; abundant colonial rugose corals and brachiopods	55	1,836
21	Broken outcrop, rubble same as in underlying unit	43	1,781
20	Argillaceous limestone, weathers medium to dark greenish grey; thin to medium continuous uneven bedding; abundant biogenic debris, with gastropods, cephalopods and corals in some beds alternating with brachiopods, mainly *Atrypella* sp. and ostracodes in other beds; a silty biomicrite	2	1,738
19	Argillaceous limestone, weathers medium grey with a pale pink tinge; medium to thick very discontinuous lumpy bedding with greyish green argillaceous material forming bedding plane partings; abundant biogenic material, articulated brachiopods, notably *Atrypella* sp., colonial rugose corals and high spired gastropods; a silty biomicrite; bioturbated	50	1,736

Unit	Lithology	Thickness (feet)	Height above base (feet)
18	Argillaceous limestone, weathers medium grey with abundant greyish green argillaceous material in seams and bedding plane partings; thin to medium slightly lumpy bedding; fairly abundant articulated brachiopods, notably *Atrypella* sp., some corals and ostracodes; a silty biomicrite	100	1,686
17	Argillaceous limestone, weathers dark grey with greyish green argillaceous material in seams that mottle bedding surfaces; thin to medium, lumpy fairly continuous bedding; very abundant articulated brachiopods, notably *Atrypella* sp., bioturbated	270	1,586
16	Argillaceous limestone, weathers medium grey with greenish grey argillaceous material as seams and partings; medium, lumpy fairly continuous bedding; abundant biogenic material with echinoderm debris, unabraded coral debris; notably ?*Tabularia* sp., and ?*Thamnopora* sp., and abundant, largely articulated brachiopods notably *Atrypella* sp., argillaceous biomicrite	4	1,316
15	Covered and broken outcrop, limestone debris, same as in underlying unit	62	1,312
14	Argillaceous limestone with several 5 to 10 foot interbeds of calcareous dolomite, weathering light grey to light greenish grey; somewhat laminated thin to medium smooth continuous bedding; fairly abundant mudcracks and greenish yellow argillaceous seams throughout	55	1,250
13	Argillaceous limestone, weathers dark grey with greenish and reddish hematitic patches; thin to medium, lumpy fairly continuous bedding; green argillaceous material forms bedding plane partings; brachiopods fairly abundant; a silty biomicrite; most brachiopods are articulated	20	1,195
12	Broken outcrop, rubble same as in the overlying unit	363	1,175
	Total thickness of the Douro Formation	1,179	
	<u>Cape Storm Formation</u>		
	Contact covered, probably conformable		
11	Broken outcrop, rubble same as in underlying unit	192	812
10	Dolomitic limestone, weathers brown to light brown; thin to thick continuous bedding; a medium brown partly dolomitized pelmicrite and intramicrite	22	620

Unit	Lithology	Thickness (feet)	Height above base (feet)
9	Broken outcrop, rubble similar to underlying unit but thin to thick bedded	41	598
8	Dolomitic limestone; weathers light brown; medium to thick continuous bedding; a tan dolomitized pelmicrite and intramicrite; some ostracode shells	10	557
7	Broken outcrop, rubble same as in underlying unit	49	547
6	Limestone, weathers light brown; thick continuous fairly smooth bedding; a fossiliferous brown pelmicrite; some ostracode shells	2	498
5	Broken outcrop, limestone same as in underlying unit	117	496
4	Limestone, light brown, thin to medium bedding; some green argillaceous material as partings and as green mottlings in otherwise brown fossiliferous pelmicrite; scattered small ostracode shells	4	379
3	Broken outcrop, limestone as in underlying unit	260	375
2	Limestone, light brown; thin to medium, somewhat uneven, fairly continuous bedding; a tan biopelmicrite with scattered small shell fragments	15	115
	Total thickness of Cape Storm Formation	712	
	<u>Allen Bay Formation</u>		
	Contact conformable		
1	Covered and broken outcrop, dolomite rubble; light brown weathering; probably thick bedded; finely crystalline	100	100
	Examined thickness of the Allen Bay Formation Lower limit of examination at a fault.	100	

Section 6. This is a northeast dipping section with its base at 76°23'N, 92°56'W, on the northeast side of the Douro Range northeast of Prince Alfred Bay, Devon Island. The formation is best seen on aerial photograph A16749-11. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
18	Limestone, medium bluish grey weathering; thick bedded; an organic-rich crinoid and brachiopod-bearing biomicrite	10	700.5
	Examined thickness of undivided Devonian carbonates	10	
	Prince Alfred Formation		
	Contact covered, probably conformable		
17	Covered and broken outcrop, sandstone debris; yellowish orange weathering, a dolomite-cemented, slightly limonitic quartzarenite	(estimated) 300	690.5
	Total thickness of the Prince Alfred Formation	300	
	Sutherland River Formation		
	Contact covered (probably disconformable or unconformable)		
16	Covered and broken outcrop, dolomite as in underlying units	187	390.5
15	Dolomite, weathers light grey and cream; thin to medium, smooth to slightly uneven continuous bedding; a finely crystalline dolomitized pelsparite; some wisp-like clay seams and limonite grains	2	203.5
14	Broken outcrop, dolomite debris as in underlying unit	35	201.5
13	Dolomite, weathers light grey; thin to medium fairly continuous, somewhat uneven bedding; light yellow dense finely crystalline; a fossiliferous dolomitized pelsparite with some crinoid fragments and tiny fragments of collophane; some dolomitized intraclasts (1 to 2 mm long)	.5	166.5
12	Dolomite, weathers light grey; thick to massive fairly continuous somewhat uneven bedding; light greyish yellow finely crystalline	2	166
11	Broken outcrop, dolomite debris as in underlying unit	14	164

Unit	Lithology	Thickness (feet)	Height above base (feet)
10	Dolomite, same as in underlying unit but thin, poorly developed discontinuous somewhat uneven bedding; scattered limonite grains	3	150
9	Dolomite, weathers light grey and cream; medium to thick, smooth to undulatory continuous bedding; some wisps of reddish orange limonite and clay; finely crystalline dolomite	1	147
8	Covered and broken outcrop, dolomite rubble as in underlying unit	55	146
7	Dolomite, same as in underlying unit but with thick to massive bedding; a little vug porosity (2%); apparent dissolution of indeterminate biogenic debris; some thin clay and quartz silt seams with limonite along seams	2	91
6	Dolomite, weathers very light grey and cream; medium to thick, smooth continuous bedding; dense finely crystalline light yellow dolomite with some poorly developed fenestrate fabric; 2 to 5% vuggy porosity; a little clay and quartz silt	3	89
5	Broken outcrop, dolomite debris as in underlying unit	31	86
4	Dolomite as at top of unit 2, but medium-bedded	.5	55
3	Dolomite, as in underlying unit but thin, continuous rather undulatory bedding; scattered limonite specks; fenestrate fabric partly infilled with grainy calcite common in the upper part of the interval with abundant planar shrinkage-type vugs (less than 2 mm long) parallel to bedding	3	54.5
2	Dolomite, weathers very light grey and cream; thick, smooth, laterally continuous bedding; very homogeneous, dense, finely crystalline light yellow dolomite	1.5	51.5
	Total thickness of the Sutherland River Formation	340.5	
	Devon Island Formation (type section of Thorsteinsson, 1963b)		
	Contact conformable		
1	Broken outcrop, calcareous shale debris; yellow weathering platy organic-rich dark brown shale	50	50
	Examined thickness of Devon Island	50	
	Base of section within the Devon Island Formation		

Section 7. This is a northeast dipping section with its base at 76°22'20"N, 93°12'05"W, near the mouth of Reid Creek and crosses to the north side of the Douro Range, north of Prince Alfred Bay, Devon Island. The section is best seen on aerial photograph A16749-10. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
194	Limestone, medium bluish grey weathering; thick continuous bedding; an organic-rich crinoid and brachiopod bearing biomicrite; fetid odor when struck	15	6,103
	Examined thickness of Undivided Devonian Carbonates	15	
	Prince Alfred Formation		
	Contact covered, probably conformable		
193	Covered and broken outcrop, rubble, same as in underlying unit	115	6,088
192	Sandstone, weathers white, medium to thick continuous bedding; a fine sandstone: calcite and dolomite cemented mature impure quartzarenite; some microcline and orthoclase grains; coarsely crystalline dolomite and calcite cement	4	5,973
191	Covered and broken outcrop, rubble mostly similar to underlying unit	134	5,969
190	Dolomite, weathers light grey; thin to medium, finely laminated continuous bedding; a dolomicrite with 1 to 5 mm thick alternating laminations of dolomicrite and finely crystalline dolomite with packed pelletal ghosts; some laminae contain vertical cracks that may be desiccation cracks; very sparse quartz silt	25	5,835
189	Broken outcrops, rubble same as in overlying unit	60	5,810
188	Siltstone, weathers light to medium greyish green; thin and medium gently anastomosing continuous bedding; siltstone: dolomite-cemented mature impure quartzarenite a little microcline silt; and sericite; sparse pyrite and limonite	2	5,750
187	Breccia, as at unit 183	1.5	5,748
186	Same as at unit 182	3	5,746.5
185	Same as at unit 183	0.5	5,743.5
184	Same as at unit 182	6	5,743

Unit	Lithology	Thickness (feet)	Height above base (feet)
183	Breccia, thick discontinuous bedding; a large lens of breccia 20 feet wide--light greenish grey, poorly sorted angular dolomicrite clasts (up to 20 cm across) oriented parallel to bedding in a siltstone matrix; dolomite-cemented mature impure quartz-arenite; small scale ripple marks	1	5,737
182	Dolomite, weathers very light brownish grey, medium gently anastomosing continuous bedding very finely crystalline silty dolomite; indistinct laminations; sparse quartz silt; some very silty bands	4	5,736
181	Breccia; weathers light yellow and brownish yellow; thick to massive gently anastomosing smooth bedding; light yellow poorly sorted dolomicrite clasts floating in a silty finely crystalline dolomite groundmass; larger clasts are tabular and are up to 10 cm long; breccia in lenticular pods	2	5,732
180	Dolomite, weathers light grey; medium continuous bedding; finely crystalline dolomite; sparse quartz silt and sericite; sparse ostracode and brachiopod shell ghosts; sparse limonite grains; discontinuous mudcracks	4.5	5,730
	Total thickness of the Prince Alfred Formation	362.5	
	Sutherland River Formation		
	Contact slight, angular unconformity		
179	Dolomite, weathers very light grey to light brownish grey; thin to medium continuous bedding; a dolomite laminite with alternating laminae of dolomicrite and finely crystalline dolomite; sparse quartz silt in the finely crystalline dolomite and pyrite and limonite in the dolomicrite laminae	30	5,725.5
178	Covered and broken outcrop, rubble same as in overlying interval	60	5,695.5
	Total thickness of the Sutherland River Formation	90	
	Devon Island Formation		
	Contact covered, probably conformable		
177	Broken outcrop, rubble same as in underlying unit	26	5,635.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
176	Limestone, weathers light grey with light yellowish grey mottlings; medium, gently anastomosing continuous bedding; a silty, somewhat dolomitized packed biopelmicrite; crinoid and brachiopod fragments; some collophane fragments; abundant quartz and microcline silt; abundant wisps of organic matter; some limonite	10	5,609.5
175	and broken outcrop Covered, rubble same as in underlying unit	93	5,599.5
174	Dolomitic limestone, weathers light brownish yellow; laminated smooth continuous bedding; a silty, organic-rich, partly dolomitized pelmicrite; organic material in thin wisps and seams as before; abundant quartz silt and some sericite	7	5,506.5
173	Broken outcrop, rubble same as in underlying unit	81	5,499.5
172	Dolomitic "shale", weathers light yellowish grey; laminated fissile bedding; a silty organic-rich finely crystalline dolomite; laminations of greater and lesser amounts of wisps of brown organic material; quartz silt and some sericite; a few brachiopods	25	5,418.5
171	and broken outcrop Covered, rubble similar to underlying unit but with three equidistantly spaced limestone bands	90	5,393.5
170	Calcareous "shale", weathers medium yellow; laminated smooth continuous fissile bedding; a silty, organic-rich finely crystalline limestone; abundant dark brown wisps of organic material mostly concentrated in thin laminae parallel to bedding; quartz and microcline silt with some sericite; two bands in this interval of light grey weathering, medium bedded poorly washed packed biopelsparite with abundant crinoid, brachiopod, ostracode, trilobite and echinoid fragments--a few collophane? fragments	25	5,303.5
	Total thickness of the Devon Island Formation	357	
	Douro Formation		
	Contact covered, probably conformable		
169	Broken outcrop, rubble same as in underlying unit	58	5,278.5
168	Limestone, weathers dark grey; medium discontinuous lumpy bedding with greyish green argillaceous partings; a silty packed, biomicrite with crinoids, gastropods, solitary corals, brachiopods, echinoderms and the trilobite *Encrinurus* sp., sparse quartz silt; appears bioturbated	14	5,220.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
167	Covered and broken outcrop, rubble same as in underlying unit	138	5,206.5
166	Limestone as in underlying units with brachiopods (e.g., *Atrypella* sp.), solitary and colonial corals (e.g., *Favosites* sp.)	3	5,068.5
165	Broken outcrop, rubble same as in underlying unit	72	5,065.5
164	Broken outcrop, limestone rubble; weathers dark grey; thin to medium lumpy bedding; abundant greyish green argillaceous seams; an argillaceous biomicrite; abundant brachiopods (e.g., *Atrypella* sp.); some echinoderm debris and the trilobite *Cyphoproetus* sp.	170	4,993.5
	Total thickness of the Douro Formation	455	
	<u>Cape Storm Formation</u>		
	Contact conformable		
163	Broken outcrop, rubble same as in underlying unit	48	4,823.5
162	Limestone, weathers light to medium grey; medium lumpy fairly continuous lumpy bedding with a spiny weathering surface; a slightly dolomitized packed biopelmicrite; ostracodes, thamnoporid-like corals, and brachiopods are common; quartz silt and sericite in thin seams; a little pyrite and limonite	1.5	4,775.5
161	Dolomitic limestone, weathers medium yellowish grey; laminated and thin continuous bedding; a slightly dolomitized, silty, poorly washed pelsparite; abundant ostracode fragments; some coral and crinoid fragments; quartz silt and sericite; shell fragments almost all concave-up; quartz silt and sericite concentrated in fine seams which appear to outline indistinct small scale crossbedding; scattered limonite	4	4,774
160	Broken outcrop, rubble same as in underlying unit	95	4,770
159	Dolomitic limestone, weathers medium grey with yellowish and greenish grey mottlings; thin to medium, lumpy lenticular bedding outlined by yellowish and greenish grey argillaceous seams; a slightly silty, partly dolomitized, packed biopelmicrite; scattered ostracode and brachiopod shells; some thamnoporid-like corals; sparse quartz silt	3	4,685
158	Covered and broken outcrop, rubble same as in underlying unit	144	4,682

Unit	Lithology	Thickness (feet)	Height above base (feet)
157	Dolomitic limestone; weathers light grey; medium to thick, fairly continuous bedding; abundant wisps of greyish green argillaceous material; a silty, partly dolomitized biopelmicrite; ostracodes, brachiopods, tharmoporid-like corals and trilobites are all abundant; quartz silt	28	4,538
156	Same as at unit 153	9	4,510
155	Same as at unit 149	2	4,501
154	Same as at unit 150, but with abundant hemispherical stromatoporoids and colonial corals (e.g., *Favosites* sp.)	13	4,499
153	Dolomite, weathers light yellow; medium smooth bedding; alternating laminae of finely crystalline dolomite and dolomicrite; laminations somewhat contorted and appear to neck-out in places; some bird's eye fabric with coarsely crystalline-dolomite infilled vugs; sparse quartz silt; abundant pyrite and limonitized pyrite grains	8	4,486
152	Dolomitic limestone; weathers light yellowish grey; medium continuous bedding; a silty, partly dolomitized, fossiliferous, packed?, pelmicrite; scattered ostracode shells; alternating zones of more and less densely packed pellets forms a laminated fabric; pellets compressed into various shapes; abundant quartz and microcline silt; some sericite; abundant pyrite	8	4,478
151	Calcareous dolomite, weathers dark brownish grey with irregular light brown mottlings and some orange-stained ironstone concretions medium, fairly continuous bedding; a silty, largely dolomitized packed? biopelmicrite; abundant ostracode shells; some brachiopods (e.g., *Atrypella* sp.) colonial corals (e.g., *Favosites* sp.) and bryozoa; abundant organic solution seams and large pyrite cyrstals; abundant quartz silt	17	4,470
150	Calcareous dolomite, weathers light yellow; thin to medium, anastomosing and lenticular bedding; a silty, nearly completely dolomitized fossiliferous packed pelmicrite; abundant coarse quartz and microcline silt; dolomicrite has preferentially replaced interpelletal matrix; abundant grains of pyrite and limonitized pyrite; problematical areas of very dense dolomicrite (supratidal mudcrack rip-ups?)	7.5	4,453

Unit	Lithology	Thickness (feet)	Height above base (feet)
149	Dolomitic limestone, weathers light grey, medium to thick, fairly continuous bedding; a silty, slightly dolomitized packed biopelmicrite; scattered ostracode and brachiopod shells tend to be concave up; abundant quartz silt; some laminae of relatively unfossiliferous dolomicrite	3	4,445.5
148	Dolomitic limestone, weathers medium grey; thin to medium, continuous bedding; yellow argillaceous material fills mudcracks; silty, partly dolomitized fossiliferous packed pelmicrite; ostracodes concentrated in loosely-packed pelletal laminae	1	4,442.5
147	Covered, and broken outcrop rubble, same as in underlying unit	69	4,441.5
146	Dolomitic limestone; weathers light grey with yellowish and greenish grey mottlings; medium, discontinuous, lumpy bedding; abundant thin wisps of greyish green argillaceous material; a slightly silty, largely dolomitized packed? biopelmicrite; ostracode bioclasts in small lenticular placers	5	4,372.5
145	Broken outcrop, rubble same as in underlying unit	17	4,367.5
144	Dolomitic limestone, weathers light yellowish grey; medium, smooth continuous bedding; a slightly silty largely dolomitized fossiliferous packed biopelmicrite; scattered ostracode shells	3	4,350.5
143	Broken outcrop, rubble same as in underlying unit	10	4,347.5
142	Dolomitic limestone, weathers light yellowish grey; thin to medium, very anastomosing uneven bedding with argillaceous partings; a partly dolomitized silty fossiliferous packed pelmicrite; some large ostracode shells; sparse quartz silt	1	4,337.5
141	Same as at unit 132	3	4,336.5
140	Covered, and broken outcrop calcareous dolomite debris; weathers light yellow; thin lenticular? bedding; silty dolomicrite with some patches of relict micrite, disseminated limonite	86	4,333.5
139	Dolomitic limestone, weathers light yellowish grey; thin to medium smooth continuous bedding with argillaceous partings; a partly dolomitized, slightly silty, packed pelmicrite; a few scattered ostracode shells; sparse quartz silt and disseminated limonite	3	4,247.5
138	Broken outcrop, rubble same as in underlying unit	17	4,244.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
137	Dolomitic limestone, weathers light brownish grey; thin, gently anastomosing bedding outlined by thin, brown organic-rich argillaceous seams; a partly dolomitized, slightly silty packed biopelmicrite; abundant ostracodes; some brachiopod, colonial coral, dasyclad and girvanellid-like algal fragments, and several crinoid fragments; sparse quartz silt	3	4,227.5
136	Broken outcrop, rubble same as in underlying unit	76	4,224.5
135	Limestone, weathers medium grey; thick continuous bedding; a fossiliferous pelmicrite? with scattered ostracodes	3	4,148.5
134	Covered and broken outcrop, rubble same as in underlying unit	176	4,145.5
133	Dolomitic limestone, weathers light brownish grey; thin, gently anastomosing bedding outlined by thin brown argillaceous seams; a partly dolomitized, packed fossiliferous pelmicrite; ostracode shells abundant in small lenticular placers; several gastropod steinkerns; sparse quartz silt	12	3,969.5
132	Broken outcrop, rubble same as in underlying unit	142	3,957.5
131	Calcareous dolomite, weathers light yellowish grey; thin to medium lenticular bedding outlined by thin argillaceous seams; a light grey dolomicrite with some patches of relict pelmicrite?; sparse quartz silt; seams of limonite and disseminated limonite	2	3,814.5
130	Broken outcrop, rubble same as in underlying unit	115	3,812.5
129	Dolomitic limestone, weathers medium grey; medium continuous bedding; a slightly silty partly dolomitized fossiliferous packed intrapelmicrite; graded laminae of pellets and pelmicrite intraclasts; ostracode bioclasts concentrated in coarser grained layers; sparse quartz silt	32	3,697.5
128	Dolomitic limestone, weathers very light yellowish grey; thin to medium, anastomosing and lenticular bedding; a light brown silty and partly dolomitized packed biopelmicrite; most bioclastic material concentrated in small lenticular placers; abundant ostracode shells; some trilobite and colonial coral fragments; sparse quartz silt; limonite concentrated in areas of abundant bioclastic material	8	3,665.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
127	Covered, and broken outcrop rubble similar to underlying unit but with some medium continuous bedding	129	3,657.5
126	Limestone, weathers medium grey; thin, lenticular and anastomosing bedding; a slightly silty and dolomitized packed biopelmicrite; most bioclastic material (ostracode and brachiopod fragments) is concentrated in lenticular placers; sparse quartz silt	28	3,528.5
125	Dolomitic limestone, weathers light greyish brown; thin lenticular bedding outlined by thin medium brown argillaceous seams; a slightly silty partly dolomitized packed biopelmicrite; abundant ostracode shells abundant limonitized pyrite particularly in biogenic material; sparse quartz silt	4	3,500.5
124	Broken outcrop rubble same as in underlying unit	5	3,496.5
123	Limestone, weathers medium grey; medium continuous bedding; a fetid dark brown packed ostracode biopelmicrite	1	3,491.5
122	Calcareous dolomite; weathers light yellowish grey; medium anastomosing and lenticular bedding; dolomicrite and finely crystalline dolomite with a few patches of relict pelmicrite?; disseminated limonite several ostracode and brachiopod fragments	4.5	3,490.5
121	Same as at unit 113	5	3,486
120	Limestone, weathers medium grey; medium continuous bedding with a very spiny weathering surface; a slightly dolomitized, partly recrystallized packed intrapelmicrite; blocky, poorly sorted intraclasts of pelmicrite up to 2 mm long; a few ostracode shells; abundant tiny vertical burrows? (1 mm wide); some brown organic matter and disseminated limonite	5	3,481
119	Same as at unit 113	4	3,476
118	Calcareous dolomite, weathers light greyish yellow; laminated to thin, lenticular bedding; a slightly silty finely crystalline dolomite and dolomicrite; some patches of relict pelmicrite?	5	3,472
117	Limestone, weathers medium grey; medium continuous bedding; a fetid, packed ostracode biopelmicrite?	5	3,467

Unit	Lithology	Thickness (feet)	Height above base (feet)
116	Limestone, weathers light to medium grey; laminated to thin continuous bedding partly outlined by thin argillaceous seams; a slightly dolomitized and silty packed biopelmicrite; some disseminated limonite; scattered ostracode and small brachiopod shells	9	3,462
115	Broken outcrop, rubble same as in underlying unit	74	3,453
114	Dolomitic limestone, weathers light to medium grey; laminated to thin, anastomosing and lenticular bedding outlined by thin, argillaceous seams; a partly dolomitized, slightly silty packed biopelmicrite; some ostracode fragments; sparse quartz silt and disseminated limonite	8	3,379
113	Dolomitic limestone, weathers medium brown; laminated to thin, anastomosing to lenticular bedding; a dark brown, fetid, partly dolomitized and silty packed biointramicrite; poorly sorted, angular intraclasts of burrowed pelmicrite up to 1 cm long; very abundant ostracode shells; sparsely scattered quartz silt; disseminated brown organic matter and limonite grains	3	3,371
112	Broken outcrop, rubble same as in underlying unit	39	3,368
111	Dolomitic limestone, weathers medium yellowish grey; laminated to thin, anastomosing to lenticular bedding; a slightly silty, partly dolomitized, poorly washed packed biointrapelsparite; abundant ostracode shells; scattered quartz silt; some pelmicrite intraclasts; disseminated limonite	6	3,329
110	Limestone, weathers light grey with an irregular yellow mottling; massive continuous bedding; a slightly dolomitized, poorly washed, packed biopelsparite with ostracode, gastropod, trilobites?, brachiopod and thamnoporid-like and horn coral fragments; corals and brachiopods somewhat silicified; a few scattered small pelmicrite intraclasts	4	3,323
109	Broken outcrop, rubble same as in underlying unit	20	3,319
108	Dolomitic limestone, weathers light grey; thin anastomosing to lenticular bedding with a few medium beds; a slightly silty, partly dolomitized, fossiliferous packed pelsparite; a few scattered ostracode and small brachiopod shells; sparse quartz silt	7	3,299

Unit	Lithology	Thickness (feet)	Height above base (feet)
107	Dolomitic limestone, weathers light greyish yellow; thin lenticular bedding; a medium brown, partly dolomitized packed ostracode biopel?micrite; ostracode shells convex up, packed pellets have vague barely discernible outlines; limonitic argillaceous seams outline bedding	1	3,292
106	Limestone, weathers light grey; thin, anastomosing and lenticular bedding; a slightly dolomitized, silty packed biopelmicrite; abundant ostracode shells most of which are concentrated in lenticular placers; some quartz silt with a few microcline grains; uniformly disseminated limonite grains	2	3,291
105	Dolomitic limestone, weathers light yellowish grey; thin continuous bedding outlined by thin argillaceous seams; a slightly silty and dolomitized packed biointrapelmicrite; abundant concave up ostracode shells; some collophane-like fragments (fish fragments); tabular fossiliferous pelmicrite intraclasts up to 1 cm long; some quartz silt; limonitized pyrite in biogenic material	3	3,289
104	Dolomitic limestone, weathers medium brown; thick continuous bedding; a dark brown slightly dolomitized biopelmicrite?	2	3,286
103	Broken outcrop, rubble same as in underlying unit	39	3,284
102	Dolomitic limestone, weathers light grey; thin to thick, smooth continuous bedding; a slightly dolomitized packed biopelmicrite; a few lenticles of pelsparite with some compound "grapestone"-like intraclasts; scattered ostracode shells, most convex upward but some areas with concave upwards ostracode shells; scattered grains of limonite and partly limonitized pyrite	24	3,245
101	Limestone, weathers medium grey; thin bedding; pelmicrite?	2	3,221
100	Dolomitic limestone, weathers light grey; thin to medium anastomosing and lenticular bedding defined by thin argillaceous seams; spiny weathering surface; a partly dolomitized, poorly washed packed biointrapelsparite; pelmicrite intraclasts; abundant ostracode shells (some articulated); a little quartz silt	13	3,219
99	Limestone, weathers medium grey; medium continuous bedding; a biopel?micrite with some silicified tabular stromatoporoids and corals (e.g., ?*Catenipora* sp. and *Favosites* sp.)	3	3,206

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Broken outcrop,		
98	rubble same as in underlying unit	35	3,203
97	Dolomitic limestone, weathers light greyish yellow; laminated lenticular bedding outlined by paper-thin argillaceous seams; a poorly washed intrapelsparite?	7	3,168
96	Dolomitic limestone, weathers medium grey; thin to medium gently anastomosing bedding; a partly dolomitized packed intrapelmicrite and poorly washed packed intrapelsparite; several generations of pelmicrite intraclasts; larger intraclasts (up to 1.5 mm long) tend to be tabular	3	3,161
	Broken outcrop,		
95	rubble same as in underlying unit	42	3,158
94	Limestone, weathers light brown; thick, smooth continuous bedding with some thin internal discontinuous beds; a slightly dolomitized, poorly washed packed intrapelsparite; pelmicrite intraclasts; ostracode shells in some intraclasts	14	3,116
	Broken outcrop,		
93	rubble same as in underlying unit	13	3,102
92	Limestone, weathers light grey; thin to medium bedding light brown, slightly dolomitized intrapelsparite; pelmicrite intraclasts; some second generation intraclasts	11	3,089
	Broken outcrop,		
91	rubble same as in underlying unit	11	3,078
90	Calcareous dolomite, weathers light grey; thin to medium bedded; light brown dolomicrite with a few intrapelmicrite patches and scattered undolomitized ostracode shells; abundant disseminated limonite; sparse quartz silt	4	3,067
	Broken outcrop,		
89	rubble in underlying unit	10	3,063
88	Limestone, weathers light greyish brown; medium continuous bedding; anastomosing and lenticular layers of poorly washed packed intrapelsparite occur in pelmicrite; a few ostracode shells and some horizontal burrows scattered throughout the pelmicrite; coated intraclasts of pelmicrite; disseminated limonite in pelmicrite layers	10	3,053
	Broken outcrop,		
87	rubble same as in underlying unit	14	3,043

Unit	Lithology	Thickness (feet)	Height above base (feet)
86	Limestone, weathers light greyish brown; medium continuous bedding; medium brown, slightly dolomitized fossiliferous intrapelmicrite; abundant pelmicrite; abundant pelmicrite intraclasts; some scattered ostracode shells; a few scattered limonite grains	18	3,029
	Broken outcrop,		
85	rubble same as in underlying unit	30	3,011
84	Dolomitic limestone, weathers light grey; medium discontinuous bedding; a partly dolomitized packed pelmicrite; a few ostracode shell fragments	9	2,981
83	Limestone, weathers light brownish grey; thin lenticular bedding; a fossiliferous pelmicrite	5	2,972
	Broken outcrop,		
82	rubble same as in underlying unit	15	2,967
81	Limestone, weathers light grey; medium, somewhat discontinuous bedding with somewhat spiny weathering; a light brown fossiliferous pelmicrite; a few crinoid and ostracode fragments; some tabular stromatoporoids at the base of the interval	14	2,952
	Broken outcrop,		
80	rubble same as in underlying unit	30	2,938
79	Same as at unit 77	5	2,908
78	Dolomitic limestone, weathers light grey to light yellowish grey; very thin lenticular bedding; a partly dolomitized packed pelmicrite; some disseminated limonite	3	2,903
77	Limestone, weathers light yellowish grey with large irregular light yellow mottlings; medium continuous bedding; a slightly dolomitized packed fossiliferous intrapelmicrite; abundant coated grains and intraclasts (second and third generation); scattered crinoids; disseminated limonite concentrated in intraclasts	5	2,900
	Broken outcrop,		
76	rubble, blocky limestone debris; weathers light grey; a medium grey pel micrite; some 2 to 5 foot thick bands of greyish yellow weathering light brownish yellow finely crystalline calcareous dolomite	50	2,895

Unit	Lithology	Thickness (feet)	Height above base (feet)
75	Broken outcrop, rubble, calcareous dolomite; weathers light grey--medium lumpy bedding; a dark grey medium and coarsely crystalline dolomite with abundant partly silicified, ramose, hemispherical and tabular stromatoporoids, corals and abundant crinoids	100	2,845
74	Dolomitic limestone, weathers light yellowish brown; thin to medium anastomosing and lenticular bedding; a light brownish yellow partly dolomitized biopel?-micrite; some brachiopods, stromatoporoids and corals	2	2,745
73	Limestone, weathers light to medium brown; medium continuous bedding; a dark brown packed poorly washed fossiliferous intrapelsparite; scattered ostracode shells; pelmicrite intraclasts up to 1 mm long; a little disseminated limonite	19	2,743
72	Dolomitic limestone, weathers light yellowish grey; thin, anastomosing and lenticular bedding; scattered tabular stromatoporoids and horn corals	2.5	2,724
71	Same as at unit 69	3	2,721.5
70	Dolomitic limestone, weathers medium brownish to yellowish grey; thin anastomosing and lenticular bedding; a medium brown, partly dolomitized, recrystallized coarsely crystalline limestone; abundant brachiopods silicified corals and stromatoporoids	3	2,718.5
69	Dolomitic limestone, weathers medium to dark brown; medium continuous bedding with very pronounced spiny surface weathering; a slightly dolomitized packed fossiliferous intrapelmicrite; first and second generation intraclasts up to 5 mm long and compound grains; some brachiopods and slightly silicified horn corals	8	2,715.5
68	Broken outcrop, rubble same as in underlying unit	5	2,707.5
67	Dolomitic limestone, weathers light grey; medium to thick continuous bedding; a medium brown partly dolomitized recrystallized intrapelmicrite; a few sparsely scattered crinoid, brachiopod, and ostracode fragments; the upper 1 foot of the interval contains some silicified stromatoporoids and corals	4	2,702.5
66	Broken outcrop, rubble same as in overlying unit	4	2,698.5
65	Calcareous dolomite, same as at previous interval but stromatoporoids less, and corals more abundant	1.5	2,694.5
64	Broken outcrop, rubble same as in underlying unit	19	2,693

Unit	Lithology	Thickness (feet)	Height above base (feet)
63	Dolomite, weathers light grey; medium anastomosing, very discontinuous lumpy bedding defined by thin argillaceous seams; a dark grey medium and coarsely crystalline dolomite; abundant partly silicified ramose, hemispherical and tabular stromatoporoids and corals (e.g., *Favosites* sp.); abundant crinoid fragments; the abundant stromatoporoids responsible for the lumpy and anastomosing bedding character	6.5	2,674
62	Dolomite, weathers light greyish yellow; laminated to thin, anastomosing bedding; a light yellow finely crystalline dolomite with abundant pellet ghosts; fairly abundant disseminated limonite	1	2,667.5
61	Broken outcrop, rubble same as in underlying unit	6	2,666.5
60	Dolomitic limestone, weathers dark grey; thin to medium continuous bedding with a spiny weathering surface; a medium brown biopelmicrite with scattered slightly silicified stromatoporoids and corals; a few scattered limonite grains	5	2,660.5
59	Dolomitic limestone, weathers light grey; medium continuous bedding; a partly dolomitized poorly washed intrapelsparite with packed poorly sorted intraclasts	2	2,655.5
58	Dolomitic limestone, weathers dark brownish grey; thin to medium anastomosing to lenticular bedding; a partly dolomitized, packed, poorly washed intrapelsparite; intraclasts up to 3 or 4 mm long; limonite disseminated throughout and in seams	4.5	2,653.5
57	Dolomite, weathers light grey; thin to medium continuous bedding; finely crystalline light brownish yellow dolomite; some zones of fenestrate fabric with sparry calcite-filled vugs; some pellet ghosts and disseminated limonite	2	2,649
56	Dolomite, weathers light yellowish grey; thin, discontinuous uneven bedding; light brownish yellow finely crystalline dolomite	1	2,647
55	Dolomitic limestone, weathers light grey; thin to medium continuous bedding; a partly dolomitized, poorly washed intrapelsparite with a few scattered ostracode shells; a little disseminated limonite	1	2,646
54	Limestone, weathers light grey; thin to medium bedded; a biopelmicrite with scattered slightly silicified ostracodes	3	2,645

Unit	Lithology	Thickness (feet)	Height above base (feet)
53	Dolomite, light brownish yellow; thin lenticular bedding; finely crystalline dolomite	1	2,642
52	Dolomitic limestone, weathers light grey; medium continuous bedding; a slightly dolomitized, poorly washed intrapelsparite with poorly sorted packed intraclasts; a few scattered ostracode shells; a little disseminated limonite	2.5	2,641
51	Limestone, weathers medium grey; thin lenticular bedding; a poorly washed intrapelsparite	1	2,638.5
50	Dolomitic limestone, weathers medium grey; thin to medium gently anastomosing bedding with a slightly spiny weathering; a medium greyish brown slightly dolomitized intrapelmicrite	2	2,637.5
49	Dolomite, weathers very light grey; medium continuous smooth bedding; light brown finely crystalline dolomite with packed pellet and intraclast or compound grain ghosts	2.5	2,635.5
	Broken outcrop,		
48	rubble same as in underlying unit	11	2,633
47	Limestone, weathers medium grey; a medium brownish grey stromatoporoid-coral biolithite with abundant tabular and hemispherical stromatoporoids up to 1 foot across	4	2,622
	Broken outcrop,		
46	rubble same as in underlying unit	7	2,618
45	Calcareous dolomite, weathers light grey; massive bedding; a medium brownish yellow finely to medium crystalline dolomite with some relict pel?micrite; some scattered dolomitized stromatoporoids	4	2,611
	Broken outcrop,		
44	rubble same as in underlying unit	20	2,607
43	Limestone, weathers medium grey; thin continuous bedding; a medium brown, partly dolomitized fossiliferous intrapelmicrite; a few scattered ostracodes; some layers with dolomite-filled burrows	20	2,587
	Total thickness of the Cape Storm Formation	2,256.5	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Allen Bay Formation		
	Contact conformable		
42	Dolomite, weathers medium greyish brown to brownish grey; medium to thick continuous bedding with a spiny weathering surface; medium brown finely crystalline dolomite; abundant silicified and dolomitized stromatoporoids and corals (e.g. *Favosites* sp.) packed pellet and intraclast ghosts	25	2,567
41	Broken outcrop, rubble same as in underlying unit	15	2,542
40	Dolomite, weathers very light grey; medium to thick bedding; light grey finely to medium crystalline dolomite	8	2,527
39	Covered and broken outcrop, dolomite debris; weathers medium yellowish brown; probably thick bedded; a finely to medium crystalline dolomite; some intercrystalline limonite; 2 to 5% intercrystalline porosity	395	2,519
38	Dolomite, weathers light brownish yellow; thin to medium continuous bedding with internal colour laminations; a finely crystalline dolomite; vertical alternations in mean dolomite crystal size are responsible for the laminations; a bird's eye fabric of vugs 0.5 mm across occurs in laminations of more finely crystalline dolomite; some organic material and finely disseminated limonite	17	2,124
37	Broken outcrop, rubble same as in underlying unit	40	2,107
36	Dolomite, weathers light grey; massive continuous bedding; very light grey, finely to medium crystalline dolomite; some scattered silicified stromatoporoids and corals	12	2,067
35	Dolomite, weathers medium brownish grey; medium continuous bedding; medium brown, medium crystalline dolomite	9	2,055
34	Broken outcrop, rubble same as in underlying unit	35	2,046
33	Dolomite, weathers light brownish yellow; thin to medium continuous bedding; finely to medium crystalline dolomite	25	2,011
32	Dolomite, weathers light yellowish grey to grey; thick to massive bedding; finely to coarsely crystalline light yellowish brown dolomite with abundant intraclast? ghosts up to 0.45 mm long	20	1,986

Unit	Lithology	Thickness (feet)	Height above base (feet)
31	Broken outcrop, rubble same as in underlying unit	100	1,966
30	Dolomite, weathers light brownish yellow; thick to massive bedding; friable and crumbly weathering; medium yellowish brown medium crystalline dolomite	30	1,866
29	Broken outcrop, rubble same as in underlying unit	34	1,836
28	Dolomite, weathers light yellowish grey; massive bedding; light yellowish brown finely to medium crystalline dolomite with packed pellet ghosts; a few round vugs either partly or completely infilled with dolomite; only 2% porosity	8	1,802
27	Broken outcrop, rubble same as in underlying unit	50	1,749
26	Dolomite, weathers medium brownish grey; thin to medium gently anastomosing continuous bedding; friable and crumbly weathering; a medium brown medium crystalline dolomite	80	1,744
25	Broken outcrop, rubble same as in underlying unit	35	1,664
24	Dolomite, weathers medium brown; medium continuous bedding; medium brown very finely to finely crystalline dolomite with vague pellet ghosts; very finely crystalline dolomite tends to occur in discrete layers which contain a weakly developed fenestrate fabric containing vugs partly or completely infilled with calcite	15	1,629
23	Dolomite, weathers medium brownish grey; thinly laminated medium to thick fairly continuous bedding; undulating laminations appear to define dolomitized laterally-linked hemispherical stromatolites; finely crystalline medium brown dolomite with vague pelletal ghosts	6	1,614
22	Dolomite, weathers medium to dark brown; massive bedded; finely crystalline medium brown dolomite with packed intraclast (up to 0.4 mm across) and pellet? ghosts; some scattered limonite grains	13	1,608
21	Broken outcrop, rubble same as in underlying unit	81	1,595
20	Dolomite, weathers light to medium yellowish grey; massive continuous bedding; medium to coarsely crystalline dolomite with packed pelletal ghosts; some scattered dolomitized brachiopod shells; scattered vugs 0.5 mm across, probably of leached biogenic material coarsely crystalline calcite partly infills some vugs; a little disseminated limonite	5	1,514

Unit	Lithology	Thickness (feet)	Height above base (feet)
19	Dolomite, weathers medium yellowish brown to brown; thick to massive bedding; very friable and rubbly weathering; some scattered dolomitized tabular stromatoporoids weather very light grey; perhaps some intercrystalline porosity	33	1,509
18	Broken outcrop, rubble same as in underlying unit	15	1,476
17	Dolomite, weathers light to medium yellowish grey; thin, anastomosing to lenticular bedding; finely crystalline light brown dolomite	13	1,461
16	Dolomite, weathers medium brownish grey; thick to massive smooth continuous bedding; finely to medium crystalline medium brown dolomite; coarsely crystalline dolomite partly infills scattered vugs 0.5 mm across in a weakly developed fenestrate fabric; 5% vug porosity	4	1,448
15	Broken outcrop, rubble same as in overlying unit	10	1,444
14	Broken outcrop, rubble same as in underlying unit	9	1,434
13	Dolomite, weathers light brownish grey; thin, fairly continuous, somewhat uneven bedding with faint internal colour laminations several mm thick; a finely crystalline dolomite; vertical variations in packed intraclast and pellet? ghost sizes (0.10 mm to 2 mm) responsible for colour laminations; a few scattered ostracode shell ghosts	9	1,425
12	Broken outcrop, rubble same as in underlying unit	20	1,416
11	Dolomite, weathers light brownish grey; thick to massive bedding; a medium to coarsely crystalline sucrosic light brown dolomite; 5 to 10% vug porosity of leached organic material; pellet and intraclast (compound grains?) ghosts abundant in more coarsely crystalline areas whereas more finely crystalline areas are uniformily vacuolized and contain disseminated limonite	15	1,396
10	Broken outcrop, rubble same as in overlying unit	34	1,381
9	Dolomite, weathers light greyish brown; thick continuous bedding with a thin, anastomosing to lenticular internal bedding; a medium crystalline light brown sucrosic dolomite; very friable crumbly weathering and broken outcrop	35	1,347
8	Covered, rubble same as in underlying unit	273	1,312

Unit	Lithology	Thickness (feet)	Height above base (feet)
7	Dolomite, weathers light yellowish grey; medium to thick continuous bedding; a light yellow, medium to coarsely crystalline sucrosic dolomite; a few dolomitized crinoid fragments and unidentifiable shell fragments; 5 - 10% vug porosity from leached organic material	55	1,039
6	Covered, and broken outcrop rubble same as in overlying unit	379	984
	Total thickness of the Allen Bay Formation	1,962	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	Contact conformable		
5	Argillaceous limestone, weathers light grey mottled greyish yellow with argillaceous material; medium to thick gently anastomosing to lenticular bedding; some low angle crossbedding outlined by greenish grey slightly dolomitized packed biopelmicrite with abundant crinoids, ostracodes, gastropods, brachiopods; some cephalopods and trilobites; dasyclad algal debris common; grains of limonitized pyrite common, particularly along solution seams	38	605
	Total thickness of the Irene Bay Formation	38	
	Thumb Mountain Formation		
4	Broken outcrop, rubble same as in overlying unit	91	567
3	Broken outcrop, rubble same as in underlying unit	316	476
2	Limestone, weathers medium to dark grey; medium to thick, uneven, continuous bedding; a little yellowish and greyish green argillaceous material as thin wavy discontinuous seams along bedding planes; abundant, irregular vermiform partly dolomitized brownish grey weathering mottlings tend to have preferential orientations parallel and perpendicular to bedding; a partly dolomitized, fossiliferous micrite and pelmicrite with sparsely scattered brachiopod shell fragments; a few cephalopods and gastropods	60	160
	Total thickness of the Thumb Mountain Formation	467	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Bay Fiord Formation		
	Contact conformable		
1	Covered and broken outcrop, limestone debris; brownish grey weathering, medium bedded, fossiliferous micrite	100	100
	Total examined thickness of Bay Fiord Formation	100	
	Lower limit of exposure at a fault (parts of Thumb Mountain and Bay Fiord Formations may be faulted)		

Section 8. This is a southeast dipping section with its base at 76°25'05"N, 93°41'31"W, at the southern end of the Grinnell Range southwest of the head of Arthur Fiord on Devon Island. The section is best seen on aerial photograph A16749-44. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
	Limestone, bluish grey weathering; thick continuous bedding; an organic-rich crinoid and brachiopod-bearing biomicrite	25	5,223
	Examined thickness of undivided Devonian carbonates	25	
	Prince Alfred Formation		
	Contact covered		
97	Covered, thickly vegetated; some dolomitic sandstone debris as in underlying unit	385	5,198
96	Covered and broken outcrop, dolomitic sandstone debris; weathers orange; thin to medium bedded; probable large scale trough crossbedding (several feet across) in broken outcrop; a fine sandstone: dolomite-cemented limonite (hematite?)-bearing mature quartzarenite	119	4,813
95	Broken outcrop, rubble same as in underlying unit	25	4,614
94	Dolomitic sandstone, weathers dark red; thin to medium discontinuous bedding; a fine sandstone: dolomite-cemented limonite-bearing mature impure quartz-arenite; some very dark red, very limonitic thin silty dolomite interbeds	10	4,589
93	Broken outcrop, rubble same as in underlying unit	55	4,579
92	Very silty dolomite, weathers medium greyish green to brown; thin to medium continuous bedding; a finely crystalline silty dolomite; quartz and microcline silt; some thin interbeds of very argillaceous silty medium to dark greyish green dolomite	80	4,524
91	Slightly silty dolomite, weathers very light grey, medium continuous bedding with a faint internal lamination; lamination due to vertical alternation of dolomicrite and finely crystalline dolomite; quartz silt with a few microcline silt grains	2	4,444

Unit	Lithology	Thickness (feet)	Height above base (feet)
90	Breccia, weathers light grey to light greenish grey; massive bedded with angular, very poorly sorted blocks (less than 0.5 inch to 1 foot long tabular blocks) of silty dolomicrite in a matrix of silty, finely crystalline dolomite, quartz silt with subsidiary microcline; some small clasts of laminated micrite	5	4,442
89	Silty dolomite; weathers light greyish green; very thin continuous bedding with good internal laminations (due to vertical changes in silt content)	3	4,437
88	Limestone, weathers very light grey; thin to medium smooth continuous bedding; a dismicrite with 0.5 mm long oval bird's eye-like vugs oriented parallel to bedding; some pellets	1	4,434
87	A thick bed of very light grey weathering calcareous dolomite; small areas of dismicrite occur scattered throughout a finely to medium crystalline dolomite; abundant "pinpoint" intercrystalline porosity (10 - 20% porosity)	1	4,433
86	Broken outcrop, rubble of breccia; angular, very poorly sorted dolomicrite clasts in a silty dolomite matrix; massive bedded and weathers very light greyish green	47	4,432
85	Same as at underlying unit	10	4,385
84	Silty dolomite, very light greenish grey; medium to thick continuous bedding with internal laminations and breccia zones; laminations of dolomicrite and slightly silty dolomicrite; quartz and microcline silt; irregular breccia clasts (up to 4 cm long) of slightly silty dolomicrite in a groundmass of finely crystalline dolomite (solution collapse breccia)	5	4,375
83	Massive beds of very dolomitic siltstone as in underlying units that weather very light red and very light grey alternate with 0.5 foot thick beds of dark brownish red, very limonitic dolomite-cemented siltstone; massive beds have somewhat lumpy upper surfaces; a siltstone: dolomite-cemented limonite-bearing mature impure quartzarenite; minor microcline	20	4,370
82	Dolomitic sandstone, weathers light reddish orange; massive bedding with an internal bedding of medium anastomosing continuous beds, fine sandstone: dolomite-cemented, limonite-bearing impure quartzarenite; some microcline silt grains	8	4,350

Unit	Lithology	Thickness (feet)	Height above base (feet)
81	Dolomitic siltstone, white weathering; massive bedded with faint crossbedding; siltstone: dolomite-cemented mature impure? quartzarenite; some microcline and chert? silt grains	10	4,342
80	Dolomitic sandstone; same as in underlying unit but is limonite-bearing and weathers light reddish orange	5	4,332
79	Dolomitic sandstone, weathers very light grey; massive bedded with an indistinct medium discontinuous internal bedding; a fine sandstone: dolomite-cemented mature impure quartzarenite	5	4,327
78	Broken outcrop; rubble same as in underlying unit	10	4,322
77	Dolomitic siltstone, weathers light to medium red; medium to thick somewhat lumpy continuous beds separated by thin seams of dark red limonitic dolomite-cemented siltstone; a siltstone: dolomite-cemented limonite-bearing mature impure quartzarenite; some microcline and sericite; up to 20% porosity along leached seams parallel to bedding	7	4,312
76	Dolomitic siltstone and sandstone as in underlying unit; large festoon crossbeds up to 3 feet wide in massive beds	3	4,305
75	Dolomitic sandstone, similar to that in underlying interval, but with two 2-foot thick intervals of medium-bedded silty dolomite that weathers light greenish yellow and is mudcracked; several discontinuous and continuous seams of dark red limonitic siltstone	25	4,302
74	Dolomitic sandstone, three massive beds of light orange and light yellow weathering sandstone separated by thin beds of dark red weathering, very limonitic dolomite-cemented siltstone, a fine sandstone: dolomite-cemented limonite and dolomicrite clast-bearing mature impure quartzarenite; apparent burrows on upper surfaces of some massive beds	15	4,277
73	Dolomitic siltstone, weathers pinkish orange to light yellow; thick continuous beds separated by very limonitic dark red seams of dolomitic siltstone that infills very shallow scours (only 1 to 2 inches deep) between two successive thick beds; a siltstone: dolomite-cemented limonite-bearing mature impure quartzarenite	6	4,262

Unit	Lithology	Thickness (feet)	Height above base (feet)
72	Dolomitic siltstone, weathers light reddish orange to light yellow; massive continuous bedding with large scale festoon crossbedding; individual festoons several feet across; a siltstone dolomite cemented, limonite bearing mature impure quartzarenite; some microcline and sericite grains; abundant porosity due to leaching along seams parallel to bedding	3	4,256
71	Dolomitic sandstone, weathers dark red with green mottlings; very hard, medium, gently anastomosing continuous bedding--current ripples on some bed surfaces (λ = 3 inches, A = 1 inch); a fine sandstone: dolomite-cemented limonite-bearing mature impure quartzarenite; some microcline and sericite grains; some silt seams with abundant limonite	3	4,253
70	Covered and broken outcrop, rubble probably same as in underlying unit	178	4,250
	Total thickness of the Prince Alfred Formation	1,126	
	Sutherland River Formation		
	Contact covered		
69	Covered and broken outcrop, dolomite debris; light greenish grey weathering; thin to medium bedded, very finely crystalline	174	4,072
68	Very silty and sandy dolomite, medium continuous bedding; weathers medium greyish pink with colour laminations with varying amounts of pink; some laminations are breccia zones with tabular clasts (less than 3 cm long) of pinkish yellow dolomite in a pink silty dolomite matrix; a finely to medium crystalline very silty pink dolomite with quartz and microcline silt; abundant intercrystalline limonite	2	3,898
67	Broken outcrop, rubble same as in unit 69	84	3,896
	Total thickness of the Sutherland River Formation	260	
	Douro Formation		
	Contact angular unconformity		
66	Dolomite, weathers medium yellowish green; thin to medium lumpy discontinuous bedding; a finely to medium crystalline, slightly silty and argillaceous dolomite; abundant brachiopod molds and poorly preserved brachiopods (?*Atrypella* sp.)	5	3,812
65	Broken outcrop, rubble same as in underlying unit	6	3,807

Unit	Lithology	Thickness (feet)	Height above base (feet)
64	Same as unit 61	5	3,801
63	Slightly silty dolomite, weathers medium yellowish green; thin to medium fairly continuous uneven to lumpy bedding; fairly packed blocky to tabular areas up to 3 or 4 cm long, of medium crystalline dolomite with packed pellet ghosts occur in a finely crystalline slightly silty dolomite matrix; some scattered dolomitized atrypellid-like brachiopods	10	3,796
62	Slightly silty dolomite, weathers medium yellowish green; massive continuous bedding with an internal thin discontinuous bedding; outlined by thin argillaceous seams; a finely to medium crystalline greyish green dolomite; well defined patches of very finely crystalline dolomite (dolomitized intraclasts) occur in a medium crystalline matrix; packed pellet ghosts in areas of medium crystalline dolomite; some sparse quartz silt	6	3,786
61	Same as at unit 55	10	3,780
60	Silty dolomite, weathers medium to light greenish yellowish grey; thick to massive continuous bedding with an internal discontinuous medium bedding; a silty finely to medium crystalline dolomite with some patches of very finely crystalline dolomite; packed pellet ghosts; some shell ghosts (brachiopods or ostracodes)	9	3,770
59	Broken outcrop, rubble same as in underlying unit	51	3,761
58	Silty dolomite, weathers medium greyish green; thin, anastomosing, fairly continuous bedding outlined by greyish green seams of silty, argillaceous material; a medium crystalline, very silty, medium grey dolomite; quartz and microcline silt grains abundant; some sericite; scattered limonite grains	3	3,710
57	Broken outcrop, rubble same as in overlying unit	32	3,707
56	Silty dolomite, weathers greenish grey; medium discontinuous lumpy bedding outlined by greenish grey argillaceous and silty seams; medium brown finely crystalline silty dolomite; some brachiopod molds, dolomitized tabulate corals and thamnoporid-like corals	4	3,675
55	Broken outcrop, rubble silty dolomite debris; weathers medium greenish grey; probably medium, lumpy bedded; a silty finely to medium crystalline dolomite; some broken shell material	32	3,671
	Total thickness of the Douro Formation	164	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Cape Storm Formation		
	Contact covered, probably conformable		
54	Covered and broken outcrop, rubble same as in underlying unit	20	3,648
53	Silty dolomite, weathers light yellowish grey; medium to thick, somewhat anastomosing to lenticular bedding defined by thin yellow argillaceous partings; a medium grey silty medium crystalline dolomite; a rather indistinct fine lamination due to a vertical alternation of quartz silt abundance; very vague pellet ghosts in less silty areas	8	3,628
52	Broken outcrop, same as in underlying unit	79	3,620
51	Silty dolomite, weathers medium greyish green; thin to medium fairly continuous anastomosing bedding outlined by thin green silty and argillaceous partings; a medium crystalline very silty medium grey dolomite; quartz and microcline silt grains abundant; some sericite and limonite	4	3,541
50	Covered and broken outcrop, dolomite debris; medium yellowish grey weathering; probably thin to medium anastomosing bedding; a finely crystalline yellow slightly silty dolomite	92	3,537
49	Dolomitic limestone and dolomite intimately interbedded, thin beds of medium grey, partly dolomitized fossiliferous pel?micrite with scattered ostracode shells alternate with medium bedded, medium yellowish grey weathering finely to medium slightly silty dolomite with a small scale internal colour mottling; bedding outlined by thin argillaceous seams	4	3,445
48	Covered and broken outcrop, rubble, same as in underlying unit	115	3,441
47	Calcareous dolomite, weathers light yellowish grey; medium continuous bedding; a medium brown dolomicrite with somewhat contorted fine colour laminations; pellet ghosts and dolomitized ostracode shells (some of which are articulated); a little disseminated limonite	2	3,326
46	Broken outcrop, rubble same as in underlying unit	102	3,324
45	Dolomite, weathers light yellowish grey; medium continuous bedding; a faintly laminated medium brown dolomicrite; some scattered minute limonite grains; vague pellet ghosts and dolomitized ostracode shells	2	3,222

Unit	Lithology	Thickness (feet)	Height above base (feet)
44	Broken outcrop, dolomite debris, same as at unit 38	87	3,220
43	Dolomite, same as at unit 38	2	3,133
42	Broken outcrop, rubble same as in underlying unit	54	3,131
41	Dolomite, same as in unit 36	3	3,077
40	Broken outcrop, rubble same as in underlying unit	72	3,074
39	Dolomite, weathers light to medium greyish yellow; thin, gently anastomosing to lenticular bedding with a finely mottled appearance (bioturbated?); a light yellow dolomicrite; vague pellet ghosts and ostracode? shell debris; scattered quartz silt	1.5	3,002
38	Covered, and broken outcrop rubble same as in underlying unit	244	3,000.5
37	Dolomite, weathers medium greyish yellow; thin to medium anastomosing continuous bedding; a light yellow dolomicrite; some scattered ostracode shells and vague pellets; a few limonite grains	6	2,756.5
36	Broken outcrop, dolomite debris; weathers light yellowish grey and light yellow; finely mottled (burrowed?); probably medium bedded; a light yellow dolomicrite with some vague pellet ghosts; scattered minute grains of limonite; sparse quartz silt	116	2,750.5
35	Broken outcrop, rubble same as at unit 32	19	2,634.5
34	Slightly calcareous dolomite, weathers very light yellowish grey; thin to medium, discontinuous, anastomosing to lenticular bedding; a light brown dolomicrite; pellet and ostracode shell ghosts fairly abundant; a little quartz silt; a few scattered limonite grains	2	2,615.5
33	Broken outcrop, calcareous dolomite debris; weathers light yellow; probably thin bedded; a light yellow finely crystalline dolomite	30	2,613.5
32	Dolomitic limestone, weathers light grey with irregular yellowish grey mottlings; medium to thin continuous bedding; a light brown fossiliferous poorly washed pelsparite; scattered ostracode shells; some irregular burrows 1-2 mm long with an overall vertical orientation	4.5	2,583.5
31	Dolomitic limestone, similar to that in unit 19, but with medium rather than thin bedding.	4	2,579

Unit	Lithology	Thickness (feet)	Height above base (feet)
30	Calcareous dolomite, weathers medium yellowish grey; thin, slightly anastomosing, continuous bedding; a largely dolomitized fossiliferous pelmicrite and intrapelmicrite; some scattered ostracode shells	4	2,515
29	Dolomitic limestone, same as in unit 19	5	2,571
28	Calcareous dolomite, weathers medium grey to medium yellowish grey; thin, anastomosing, fairly continuous bedding; a largely dolomitized, fossiliferous pelmicrite and intrapelmicrite; a few scattered ostracode shells and some thamnoporid-like coral fragments	5	2,566
27	Dolomitic limestone, same as in unit 19	5	2,561
26	Limestone, weathers medium grey; thin, discontinuous lenticular bedding; a medium grey fossiliferous micrite with ostracode and brachiopod shell fragments	2	2,556
25	Dolomitic limestone, same as in unit 22	1	2,554
24	Dolomitic limestone, weathers light greyish yellow; thin lenticular bedding with faint crossbeds; a largely dolomitized, slightly silty biopelmicrite	1	2,553
23	Dolomitic limestone, weathers medium to dark grey with some irregular yellowish orange stains; medium continuous bedding; a medium to dark brownish grey slightly dolomitized and silty biopelmicrite; disarticulated ostracode shells abundant; fewer brachiopod shells	5	2,552
22	Broken outcrop, calcareous dolomite debris; weathers light to medium greyish yellow with a small scale grey horisontal mottling (burrows?); thin, anastomosing, fairly continuous bedding; a largely dolomitized, slightly silty biopelmicrite; fairly abundant ostracode shells and a few brachiopod shells; tiny limonitized pyrite nodules scattered throughout	27	2,547
21	Covered and broken outcrop, limestone debris as in underlying unit	72	2,520
20	Dolomitic limestone, weathers medium to dark grey; thin to medium, very gently anastomosing continuous bedding; a medium brown, slightly silty and dolomitized fossiliferous micrite; faint shallow, small scale crossbedding; bioclastic material, such as ostracodes and brachiopod shells concentrated in crudely lenticular "placers"; limonitized pyrite grains and organic material also concentrated in shell placers	6	2,448
	Total thickness of the Cape Storm Formation	1,206	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Allen Bay Formation		
	Contact covered, probably conformable		
19	Covered, and broken outcrop blocky, light yellowish grey weathering dolomite debris as in underlying unit	561	2,442
18	Broken outcrop, rubble same as in underlying unit; some 20-foot thick zones of laterally-linked hemispherical stromatolites	164	1,881
17	Covered, and broken outcrop light yellowish grey dolomite debris; some scattered dolomitized tabular stromatoporoids, colonial and solitary corals	856	1,717
16	Covered, and broken outcrop dolomite debris as in underlying unit	396	861
15	Dolomite, weathers very light grey and yellowish grey; massive fairly continuous bedding; very light yellow finely crystalline dolomite; fairly abundant dolomitized crinoid and ostracode or brachiopod fragments; many somewhat skeletal-shaped vugs of leached biogenic material	125	465
	Total thickness of the Allen Bay Formation	2102	
	Irene Bay Formation		
	Contact covered, probably conformable		
14	Covered, rubble same as in overlying unit	105	340
	Total thickness of Irene Bay Formation	105	
	Thumb Mountain Formation		
	Contact covered, probably conformable		
13	Limestone, weathers medium brown with light brownish grey mottlings elongate both perpendicular and parallel to bedding; medium to thick slightly uneven smooth bedding; a partly dolomitized biopelmicrite; abundant crinoid trilobite?, ostracode, and dasycladacean debris; limonitized pyrite grains occur in dolomitized areas	37	235

Unit	Lithology	Thickness (feet)	Height above base (feet)
12	Limestone, weathers medium greyish green with green mottlings of argillaceous material on bed surfaces; medium discontinuous lumpy bedding; an argillaceous biomicrite with brachiopod (e.g., *Rhynchotrema*), crinoid, ostracode, gastropod (*Maclurites* sp.) and bryozoan debris; some in situ colonies of ?*Catenipora* sp.; some large straight cephalopods; limonitized pyrite grains	5	198
11	Broken outcrop, rubble same as in overlying unit	45	193
10	Dolomite, same as at unit 7	1	148
9	Same as at unit 6	13	147
8	Dolomite, weathers light to medium yellow; thin anastomosing to lenticular bedding defined by argillaceous partings; a slightly silty dark brownish grey dolomicrite; very sparse quartz silt grains; some limonite concentrated along argillaceous seams	1	134
7	Limestone, weathers dark grey; medium to thin anastomosing to lenticular lumpy bedding outlined by greyish green argillaceous seams; slightly dolomitized and argillaceous biomicrite; crinoid, ostracode, gastropod, and brachiopod shells and shell fragments abundant; a few straight cephalopod fragments; abundant dasycladacean algae fragments; limonitized		

Section 9. This is a northeast dipping section with its base at 76°29'N, 94°03'W, in the central part of the Grinnell Range eleven miles northwest of the head of Arthur Fiord on Devon Island. The section is best seen on aerial photography A16749-42. Thicknesses were measured by Jacob staff.

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Undivided Devonian Carbonates		
114	Covered and broken outcrop, rubble of dolomite, medium chocholate brown, hard, vuggy	100	2,971
113	Broken outcrop, rubble of limestone, bluish grey, bioclastic in part, sharp break with underlying unit	30	2,871
	Examined thickness of Undivided Devonian carbonates	130	
	Prince Alfred Formation		
	Contact covered, probably conformable		
112	Broken outcrop, large blocks of dark yellowish brown to light yellow weathering fine sandstone dolomite-cemented quartzarenite; some breccia zones with abundant clasts of yellow dolomicrite in a sandstone matrix	20	2,841
	Exposed thickness of Prince Alfred Fromation	20	
	Cape Storm Formation		
	Contact angular unconformity		
111	Same as in underlying unit	40	2,821.5
110	Covered and broken outcrop, dolomite debris; weathers medium yellow with irregular blobs of medium grey slightly dolomitized micrite; thin to medium, gently anastomosing, continuous bedding; a lightly silty dolomicrite and partly dolomitized micrite; a little quartz silt; some faint, very shallow crossbeds	100	2,781.5
109	Calcareous dolomite, weathers yellow with irregular patches of reddish orange disseminated limonite oriented parallel to bedding; thin, gently anastomosing and lenticular bedding; a dolomicrite with a fenestrate fabric of patches of clear unvacuolized dolomite in dolomicrite	3	2,681.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
108	Limestone, weathers light grey with indistinct light yellow mottlings; medium, anastomosing to lumpy discontinuous bedding; a light brown partly dolomitized fossiliferous pelmicrite; scattered ostracode shells; a little limonite	8	2,678.5
	Broken outcrop,		
107	rubble same as in overlying unit	24	2,670.5
106	Limestone, weathers light bluish grey with wisps of greyish green argillaceous material homogeneously distributed throughout; medium to thick smooth continuous bedding with some thinly bedded intervals; a slightly silty partly dolomitized fossiliferous pelmicrite; a few ostracode shells; a few scattered quartz silt grains; some disseminated limonite	15	2,646.5
	Broken outcrop,		
105	limestone debris; weathers medium brown; probably thin bedded; a slightly silty pel micrite	48	2,631.5
104	Limestone, weathers medium bluish grey; medium to thick smooth continuous bedding; medium brown micrite	3	2,583.5
103	Dolomitic limestone, weathers light greyish yellow with tiny homogeneously distributed reddish orange iron stains, medium anastomosing smooth continuous bedding; a slightly argillaceous and silty largely dolomitized micrite; some scattered quartz silt grains and limonite grains	4	2,580.5
	Broken outcrop,		
102	rubble same as in underlying unit	55	2,576.5
101	Limestone, weathers medium grey with wisps of yellowish green argillaceous material; medium smooth continuous bedding; a slightly dolomitized biopelmicrite; scattered ostracode and brachiopod shell debris; some collophane fragments; a few scattered limonite grains	10	2,521.5
100	Limestone, weathers medium brown, medium smooth continuous undulatory bedding with a laminated fabric; a brown stromatolite biolithite	15	2,511.5
	Broken outcrop,		
99	rubble same as in underlying unit	15	2,496.5
98	Limestone, weathers medium brown; thin to medium continuous uneven bedding; a medium brown micrite	7	2,481.5
97	Dolomite, weathers yellow; laminated to thin, anastomosing and lenticular bedding; light grey finely crystalline dolomite	3	2,474.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
96	Limestone, weathers medium grey with greyish green wisps and mottlings of argillaceous material; an argillaceous grey micrite?	0.5	2,471.5
95	Dolomitic limestone, weathers light yellowish grey; medium bedded; a medium grey partly dolomitized micrite and pelmicrite	3	2,471
94	Dolomitic limestone, weathers dark brown; thick continuous bedding; a brown biomicrite with tabular stromatoporoids and colonial corals; crinoid debris scattered throughout matrix	1.5	2,468
93	Limestone, weathers light grey; medium smooth continuous bedding; a light brown packed pelmicrite	5	2,466.5
92	Limestone, weathers dark brown with a well defined irregular mottling of light brown; a brown somewhat recrystallized biomicrite with fairly abundant tabular stromatoporoids with some colonial corals (e.g., *Favosites* sp.) and scattered crinoid debris	5	2,461.5
91	Limestone, weathers medium brown; thin to medium anastomosing bedding with an internal laminated fabric; a medium brown stromatolite biolithite	5	2,456.5
90	Dolomite, weathers light greyish yellow; medium to thick continuous bedding; a finely crystalline light yellow dolomite; abundant minute limonite grains scattered throughout	6	2,451.5
89	Limestone, weathers medium brown; laminated to thin continuous, undulatory bedding; a medium brown pelsparite	2	2,445.5
88	Limestone, weathers medium grey; massive continuous bedding; a light brown fossiliferous poorly washed pelsparite; scattered ostracode and brachiopod shells; some scattered limonite grains and wisps of brown organic material	3	2,443.5
87	Covered and broken outcrop, rubble, same as in underlying unit	60	2,440.5
86	Limestone, weathers medium grey; medium, anastomosing smooth continuous bedding with a fabric of pronounced wavy laminations; a light brown slightly dolomitized stromatolite biolithite; poorly washed intrapelsparite constitutes laminae	15	2,380.5
85	Dolomite, same as at unit 83	15	2,365.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
84	Limestone, weathers medium brown; thin to medium anastomosing bedding with an internal fabric of well-developed undulatory laminations; a slightly dolomitized medium brown micrite with some stromatolite biolithite; a few scattered pellets and ostracode shells; some mudcracks	10	2,350.5
83	Dolomite, weathers very light yellowish grey; massive continuous bedding; light yellow finely to medium crystalline dolomite; some intraclast "ghosts" of very finely crystalline dolomite; some scattered limonite grains	9	2,340.5
82	Broken outcrop; rubble same as in overlying interval	5	2,331.5
81	Limestone, weathers dark brown; thick, anastomosing bedding with a well developed internal fabric of undulatory laminations; a light brown stromatolite biolithite with abundant small lenses of poorly washed pelsparite; limonite grains fairly abundant	1	2,326.5
80	Broken outcrop; rubble same as in overlying unit	20	2,325.5
79	Limestone, weathers medium grey; medium anastomosing smooth continuous bedding with a well-developed wavy internal laminated fabric; a light brown stromatolite biolithite; individual laminae composed of poorly washed intrapelsparite	7	2,305.5
78	Broken outcrop; rubble same as in underlying unit	28	2,298.5
77	Limestone, weathers medium grey; a medium bedded light brown slightly dolomitized intrapelmicrite with some zones of poorly washed pelsparite; a few scattered ostracode and gastropod shells	25	2,270.5
76	Limestone, weathers medium grey; thick, continuous smooth bedding; a light brown packed pelsparite; some thin zones of fenestrate fabric with bird's eye vugs; a few scattered ostracode shells	12	2,245.5
75	Limestone, weathers light grey; medium to thin continuous anastomosing bedding within a larger scale massive bedding; very fine stromatolitic laminations throughout; a light brown pelsparite; some seams of coarsely crystalline white dolomite along stromatolitic seams	25	2,233.5
	Total thickness of the Cape Storm Formation	613	

Unit	Lithology	Thickness (feet)	Height above base (feet)
	Allen Bay Formation		
	Contact conformable		
74	Dolomite, weathers medium grey; thick to massive continuous bedding; some very fine vertical color laminations due to differential dolomite crystal size from fine to medium crystalline; pellet ghosts abundant; some small vugs in a poorly developed fenestrate fabric	210	2,208.5
73	Dolomite, weathers light grey; medium to thick bedded; a finely crystalline grey dolomite; some zones of slightly wavy stromatolites	10	1,998.5
72	Dolomite, weathers medium brown with irregular grey mottlings oriented parallel to bedding; scattered silicified rugose corals; a finely crystalline dolomite with vague packed pellet and intraclast ghosts	5	1,988.5
71	Broken outcrop, rubble same as in overlying unit	35	1,983.5
70	Dolomite, weathers medium yellowish grey; medium to massive continuous bedding; finely crystalline light brown dolomite	5	1,948.5
69	Covered and broken outcrop, rubble same as in overlying unit	40	1,943.5
68	Dolomite, weathers medium greyish brown; massive fairly continuous bedding; medium brown finely crystalline dolomite; some scattered corals; a few large vugs of leached biogenic material	35	1,903.5
67	Covered and broken outcrop, dolomite debris; weathers medium greyish brown; probably medium to thick bedding; finely crystalline brown dolomite with a bird's eye or fenestrate fabric of small vugs (3 to 4% porosity)	190	1,868.5
66	Dolomite, weathers dark brown; thick to massive continuous bedding with some zones of faint 1" to 2" thick light brown colour laminations; a finely to medium crystalline dark brown dolomite; a poorly developed fenestrate fabric with scattered small vugs	20	1,678.5
65	Dolomite, weathers medium brownish grey; massive continuous bedding, a dolomitized stromatoporoid coral biolithite; abundant tabular very light grey weathering stromatoporoids, scattered corals and crinoids	15	1,658.5
64	Broken outcrop, rubble same as in overlying unit	10	1,643.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
63	Dolomite, weathers very light grey; thick continuous bedding; a finely crystalline dolomite with packed pelletal ghosts; fairly abundant leached biogenic porosity	13	1,633.5
62	Dolomite, weathers dark brown; thick to massive bedded; dark brown finely to medium crystalline dolomite; some scattered limonite grains and disseminated organic matter	5	1,620.5
61	Covered and broken outcrop, rubble same as at unit 62	50	1,615.5
60	Covered and broken outcrop, rubble same as in underlying unit	50	1,565.5
59	Dolomite, weathers dark brown; thick to massive continuous bedding with faint 1" to 2" thick light brown colour laminations--a finely to medium crystalline dark brown dolomite; some scattered small vugs; fenestrate fabric	12	1,517.5
58	Covered and broken outcrop, rubble same as in overlying unit	95	1,503.5
57	Dolomite, weathers medium grey; thick; continuously bedded; a finely crystalline dolomite with packed pelletal ghosts; 5% porosity with vugs of leached biogenic material	4	1,408.5
56	Covered and broken outcrop, rubble similar to that in underlying unit but stromatoporoids less abundant and porosity is less	175	1,404.5
55	Dolomite, weathers dark reddish brown; massive very resistant indistinct bedding; a finely to medium crystalline dolomitized stromatoporoid biolithite; very light grey tabular and hemispherical stromatoporoids are common; 10 to 20% vug porosity	65	1,229.5
54	Broken outcrop, rubble of dark brown weathering dolomite debris; probably thick bedded; scattered limonite grains and disseminated organic matter	90	1,164.5
53	Dolomite, bands of very light grey weathering, thick bedded dolomite alternate with thick bedded dark brown weathering dolomite; grey dolomite finely crystalline with abundant leached biogenic material; packed pelletal ghosts; dark brown dolomite, finely to medium crystalline; only very few pinpoint vugs; some scattered limonite grains and disseminated organic matter	55	1,074.5
52	Broken outcrop, rubble same as in underlying unit	65	1,019.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
51	Dolomite, weathers medium to dark brown, very compact massive bedding; some white chert nodules	3	954.5
50	Broken outcrop, rubble same as in underlying unit	105	951.5
49	Dolomite, weathers light brown; indistinct thick to massive discontinuous bedding; very rotten, friable weathering; very petroliferous odor; fairly common leached biogenic material, particularly crinoids, form bands parallel to bedding resulting in 3-5% porosity; many dolomitized, very light brown tabular stromatoporoids parallel to bedding	15	846.5
48	Broken outcrop, rubble same as in underlying unit	80	831.5
47	Dolomite, weathers light to medium brown; thick to massive uneven continuous bedded; medium brown finely crystalline dolomite; band of very light grey scattering irregular modules near top of interval; nodules composed of very finely crystalline dolomite with more abundant organic matter and limonite than groundmass dolomite	20	751.5
	Total thickness of the Allen Bay Formation	1,532	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	Contact covered, probably conformable		
46	Covered and broken outcrop, dolomite rubble, like unit 47, but presumed to be the Irene Bay Formation	55	731.5
	Presumed thickness of the Irene Bay Formation	55	
	Thumb Mountain Formation		
	Contact covered, probably conformable		
45	Dolomitic limestone, weathers light yellowish grey to greyish yellow; thick to massive smooth continuous bedding; silicified mottlings as at unit 43, but more subdued; a medium brown biomicrite with some packed biopelmicrite; fairly abundant solitary and colonial rugose corals, Receptaculites, brachiopod shell fragments, crinoid, ostracode and trilobite fragments	20	676.5
44	Broken outcrop, rubble same as in underlying unit	35	656.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
43	Dolomitic limestone, weathers light yellowish-grey; massive smooth continuous bedding; differentially weathered light brown silicified mottlings oriented parallel to bedding; a partly dolomitized crinoid and ostracode biomicrite with rather abundant soliraty and colonial corals including *Bighornia* sp., ?*Lobocorallium* sp., *Calapoecia* sp., *Catenipora* sp., *Favosites* sp., and a streptelasmid coral and echinoderm fragments	43	621.5
	Broken outcrop,		
42	rubble same as in overlying unit	20	578.5
	Broken outcrop,		
41	rubble same as in underlying unit	60	558.5
40	Limestone, weathers medium grey; medium to thin anastomosing continuous bedding; a brown biomicrite with scattered silicified crinoids and ostracodes	8	498.5
	Broken outcrop,		
39	rubble same as in overlying unit	65	490.5
38	Limestone, weathers brownish grey with some orange staining; thin to medium smooth anastomosing to lenticular bedding; dark brown partly dolomitized biopelmicrite; some horizons of abundant corals (*Catenipora* sp.)	13	425.5
	Broken outcrop,		
37	limestone rubble as in underlying unit with some silicified fossils	13	412.5
36	Limestone, weathers brownish grey with some orange staining; thin to medium smooth anastomosing to lenticular bedding; a dark brown, partly dolomitized biopelmicrite; abundant ostracode, crinoid, brachiopod, gastropod and dasyclad algae debris, also some cephalopods and encrusting bryozoa; limonite concentrated in recrystallized areas and in biogenic material	6	399.5
	Broken outcrop,		
35	rubble same as in overlying unit	32	393.5
34	Limestone, weathers medium grey with an orange stained spiny weathered surface; thin, anastomosing to lenticular bedding; a medium brown, partly dolomitized packed biopelmicrite with very abundant coral, crinoid, ostracode, gastropod and dasyclad algae fragments	10	361.5
	Broken outcrop,		
33	rubble same as in overlying unit	9	351.5
32	Limestone, weathers light grey with some orange-stained silicified corals and crinoids; thin to medium smooth, gently anastomosing continuous bedding; a dark brownish grey slightly dolomitized biopelmicrite; very abundant bioclastic material of crinoid, brachiopod, gastropod, echinoderm and dasyclad algae fragments; some scattered clumps of limonitized pyrite grains	8	342.5

Unit	Lithology	Thickness (feet)	Height above base (feet)
31	Broken outcrop, limestone rubble; weathers dark brown; thin, anastomosing to lenticular bedding; vugs of leached biogenic material; a dark brown biomicrite with scattered crinoids and ostracodes	30	334.5
30	Limestone, weathers light grey with orange stain on scattered silicified corals and crinoids; thin to medium smooth continuous bedding; a dark brownish grey slightly dolomitized biointrapelmicrite; very abundant bioclastic material of crinoid, brachiopod, gastropod, echinoderm and dasyclad algae fragments; scattered clumps of limonitized pyrite grains	1	304.5
29	Broken outcrop, rubble; same as in overlying unit	12	303.5
28	Limestone, same as at unit 26	1	291.5
27	Limestone, weathers dark brown; thin, anastomosing to lenticular bedding; some large vugs of leached biogenic material; a dark brown, very fetid biomicrite with scattered crinoids and ostracodes	3	290.5
26	Limestone, light grey weathering with orange staining; thin to medium continuous bedding; a finely crystalline medium to light grey partly dolomitized biomicrite with stromatoporoids and corals in a bioclastic matrix of crinoid, brachiopod, ostracode and dasyclad algae fragments	.5	287.5
25	Limestone, weathers dark brown; thin anastomosing to lenticular bedding; some large vugs of leached biogenic material; a dark brown very fetid biomicrite with scattered crinoids and ostracodes	1	287
24	Broken outcrop, rubble; same as in overlying unit	45	286
23	Limestone, weathers light grey with orangish yellow staining; thin to medium smooth continuous bedding; a light grey finely crystalline partly dolomitized packed biopelmicrite; slightly silicified ostracode, crinoid and dasycladacean algal fragments abundant	5	241
22	Broken outcrop, limestone debris; weathers light grey with some orangish yellow staining; medium grey biomicrite; some finely comminuted bioclastic material, brachiopod, coral and crinoid fragments	.20	236
21	Dolomite; weathers light grey; medium to thick, smooth, continuous bedding; fairly abundant silicified shell debris; a finely crystalline dolomite with pelletal ghosts	5	216

Unit	Lithology	Thickness (feet)	Height above base (feet)
20	Broken outcrop, dolomite rubble; weathers very dark brown; probably thick bedded; a finely crystalline dolomite with packed pellet ghosts and scattered dolomitized crinoid and brachiopod fragments	22	211
19	Same as in underlying unit but a little thicker bedded in the upper part of the interval	5	189
18	Dolomite, weathers medium greyish brown; thin continuous anastomosing bedding; a brown, finely crystalline dolomite with packed pelletal ghosts	12	184
17	Dolomite, weathers medium greyish brown; thin continuous anastomosing bedding; a brown, finely crystalline dolomite with packed pelletal ghosts	1.5	172
16	Dolomite, weathers medium greyish brown; medium, fairly continuous uneven bedding; abundant fine skeletal debris consisting mainly of crinoids; a medium to dark brown finely to medium crystalline dolomite with abundant pelletal ghosts	2	170.5
15	Dolomite, weathers medium greyish brown; thin continuous, anastomosing bedding at base of interval becoming medium bedded towards top; thinly laminated in some places with fairly abundant disseminated limonite; a brown, finely to medium crystalline dolomite; packed pelletal ghosts	3.5	168.5
14	Dolomite, weathers light brown; massive bedded with some thin discontinuous, uneven internal laminations; some fine bioclastic debris, mainly crinoids	2	165
13	Dolomite, weathers medium greyish brown; thin continuous anastomosing bedding; a brown, finely crystalline dolomite with packed pelletal ghosts	2	163
12	Dolomite, weathers light grey; medium smooth continuous bedding; some thinly laminated zones sandwich homogeneous medium beds of brown finely to medium crystalline dolomite	1	161
11	Dolomite, weathers light brown, massive bedded with some thin discontinuous uneven internal laminations; some skeletal debris	2	160
10	Dolomite, weathers medium greyish brown; very discontinuous lumpy anastomosing bedding; dark brown finely crystalline dolomite with some white-weathering, fine skeletal mainly crinoidal debris and pellet ghosts	2	158
9	Broken outcrop, limestone rubble; same as at unit 6	25	156

Unit	Lithology	Thickness (feet)	Height above base (feet)
8	Covered, and broken outcrop dolomite rubble, same as in underlying unit	50	131
7	Dolomite, weathers medium greyish brown with vermiform light brown mottlings; a dark brown finely crystalline dolomite; some white-weathering small indeterminate shell debris; pellet? and intraclast ghosts; one large straight cephalopod; this interval of dolomite and all subsequent dolomite intervals occur as large stratigraphic pods several hundred yards across	15	81
6	Limestone, weathers medium grey with orangish brown vermiform mottlings; thick to medium continuous bedding; pronounced spiny weathering with dolomitized vermiform mottlings weathered out in relief; a greyish brown fossiliferous micrite with some intrapelmicrite; crinoid, gastropod, brachiopod and ostracode shells and shell fragments	9	66
5	Limestone, weathers dark brownish grey; medium to thick, lumpy discontinuous bedding; a very dark brown, fetid crinoid biomicrite; some other indeterminate fine shell debris	8	57
4	Limestone, weathers medium grey with orangish brown vermiform mottlings; massive continuous slightly uneven bedding; pronounced spiny weathering, dolomitized vermiform mottlings weathered out in relief; a greyish brown fossiliferous micrite with some intrapelmicrite; crinoid, gastropod, brachiopod and ostracode shells and shell fragments	10	49
3	Same as in underlying units, but medium, continuous bedding	8	39
2	Broken outcrop, rubble same as in underlying unit	16	31
1	Limestone, weathers dark brownish grey; medium to thick, uneven to lumpy, discontinuous bedding; a very dark brown, fetid crinoid biomicrite; some other slightly silicified shell debris (skeletal fragments less than 3 mm long); some ironstone concretions at the base of the interval	15	15
	Exposed thickness of the Thumb Mountain Formation Limit of exposure at a fault.	676.5	

APPENDIX V. FAUNAL LISTS

Thumb Mountain Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-19aF 115 feet from top	Section 1, E519000 N845350 *Catenipora* sp. age: Middle Ordovician to Late Silurian	C-11885
DM-71-95bF 78 feet from top	Section 8, E482800 N8481750 ?*Receptaculites* sp. *Catenipora* sp. age: probably late Middle Ordovician to Late Ordovician	C-11930
DM-71-163bF 251 feet from top	Section 9, E473000 N8489250 *Catenipora* sp. age: late Middle Ordovician to Late Silurian	C-11938
DM-71-163cF 55 feet from top	Section 9, E473000 N8489250 echinoderm fragments streptelasmid coral *Bighornia* sp. ?*Lobocorallium* sp. *Calapoecia* sp. *Catenipora* sp. *Favosites* sp. age: Late Ordovician	C-11939

Identifications by B. S. Norford

Irene Bay Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-97aF at top	Section 8, E482800 N8481750 bryozoan gastropod undetermined brachiopod *Rhynchotrema* sp. age: Middle or Late Ordovician	C-11932

Identifications by B. S. Norford

Allen Bay Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-20cF 844 feet from base	Section 1, E519000 N845350 indeterminate coral age: Middle Ordovician to Permian	C-11886
DM-71-22aF 1,062 feet from base	Section 1, E519000 N845350 *Cystihalysites* sp. *Favosites* sp. age: Silurian	C-11887
DM-71-41bF 1,463 feet from top	Section 2, E513300 N8461700 indeterminate tabulate coral age: probably Middle Ordovician to Devonian	C-11911
DM-71-43cF 462 feet from top	Section 2, E513300 N8461700 indeterminate stromatoporoid ?*Aulacera* sp. age: probably Late Ordovician or Silurian	C-11911
DM-71-68cF 5 feet from top	Section 7, E494350 N8477500 stromatoporoid *Favosites* sp. age: Silurian to Middle Devonian	C-11918

Identifications by B. S. Norford

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-71cF 87 feet from base	Section 7, by Reid Creek, E494350 N8477500 stromatoporoid ?*Favosites* sp. indeterminate fossils age: Silurian to Devonian	C-11919
DM-71-72aF 107 feet from base	Section 7, E4943500 N8477500 stromatoporoid(?) solitary coral *Favosites* sp. age: Late Ordovician to Middle Devonian	C-11920
DM-71-75dF 638 feet from base	Section 7, E4943500 N8477500 stromatoporoid indeterminate solitary coral ?*Catenipora* sp. *Favosites* sp. age: Late Ordovician to Late Silurian	C-11921
DM-71-83cF 1,902 feet from base	Section 7, E4943500 N8477500 bryozoan ?*Favosites* sp. age: Silurian or Devonian	C-11923
DM-71-84aF 1,928 feet from base	Section 7, E4943500 N8477500 stromatoporoid *Favosites* sp. age: Silurian or Devonian	C-11924
DM-71-169cF 253 feet from base	Section 9, 7 miles west of Arthur Fiord, E473000 N8489250 stromatoporoid *Favosites* sp. age: Late Ordovician to Middle Devonian	C-11940
DM-71-138bF 40 feet from top	Section 4, on Sutherland River, E505500 N8471600 at base of section ?*Thamnopora* sp. age: Silurian to Permian	C-11944

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No. [1]
DM-71-28aF 435 feet from top	Section 1, Douro Range near Colin Archer Peninsula, E519000 N845350 ostracode indeterminate leperditiid	C-11898

Identifications by B. S. Norford and M. J. Copeland [1]

Douro Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-15aF 380 feet from base	Section 5, just west of Sutherland River, E504250 N8475000 *Atrypella scheii* *Howellella*? sp. age: Ludlow	C-11884[2]
DM-71-16aF 330 feet from top	Section 5, E504250 N8475000 echinoderm fragments gastropod *Atrypella scheii* *Protathyris* aff. *P. infantile* ostracodes indeterminate gastropod indeterminate solitary coral age: Ludlow	C-11884A[2]
DM-71-25aF 382 feet from base	Section 1, Douro Range near Colin Archer Peninsula, E519000 N845350 indeterminate orthotetacean *Atrypella scheii* *Protathyris didyma* Kozlowski non Dalman *Protathyris* aff. *P. infantile* age: Ludlow	C-11891[2]
DM-71-25dF 325 feet from base	Section 1, E519000 N845350 indeterminate orthotetacean *Atrypella scheii* *Protathyris* aff. *P. infantile* *Howellella* sp. *Spirinella* sp. age: Ludlow	C-11892[2]
DM-71-25eF 277 feet from base	Section 1, E519000 N845350 indeterminate orthotetacean *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11893[2]

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-26aF 177 feet from base	Section 1, E519000 N845350 bryozoan *Favosites* sp. *Syringopora* sp. *Atrypella scheii* *Protathyris didyma* Kozlowski non Dalman *Howellella* sp. indeterminate favositid coral fish plate? age: Ludlow	C-11894[2]
DM-71-36cF 231 feet from base	Section 3, just east of Sutherland River, E509000 N8468500 echinoderm fragments *Leperditia* cf. *L. artica* Jones[1] gastropod stromatoporoid undetermined rugose corals *Entelophyllum* sp. *Favosites* sp. *Syringopora* sp. ?*Thamnopora* sp. undetermined brachiopods age: Silurian, Middle to Late	C-11901
DM-71-37aF 240 feet from top	Section 3, E509000 N8468500 *Atrypella scheii* age: Ludlow	C-11902[2]
DM-71-37bF 140 feet from top	Section 3, E509000 N8468500 indeterminate orthotetacean *Atrypella scheii* *Protathyris* aff. *P. infantile* indeterminate rhynchonellid ostracode age: Ludlow	C-11903[2]
DM-71-37cF 35 feet from top	Section 3, E509000 N8468500 echinoderm and brachiopod fragments age: not diagnostic	C-11904

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-37dF 20 feet from top	Section 3, E509000 N8468500 echinoderm and fish fragments *Atrypella scheii* indeterminate atrypid crinoids age: Ludlow	C-11905[2]
DM-71-85bF at base	Section 7, by Reid Creek, E494350 N8477500 *Atrypella scheii* *Protathyris didyma* Kozlowski non Dalman *Protathyris* aff. *P. infantile* ostracodes age: Ludlow	C-11925[2]
DM-71-85cF 170 feet from base	Section 7, E494350 N8477500 echinoderm debris *Atrypella scheii*[2] *Protathyris didyma* Kozlowski non Dalman[2] *Howellella*[2] *Cyphoproetus* age: Ludlow	C-11926
DM-71-85dF 245 feet from base	Section 7, E494350 N8477500 undetermined solitary corals *Favosites* indeterminate orthotetacean[2] *Atrypella scheii*[2] *Howellella*[2] indeterminate solitary coral[2] ostracodes[2] crinoids[2] age: Ludlow	C-11927
DM-71-86aF 397 feet from base	Section 7, E494350 N8477500 undetermined solitary corals ?*Atrypella scheii*[2] *Ferganella* cf. *F. turkestanica*[2] indeterminate gastropods[2] indeterminate orthocene cephalopods indeterminate fossils, algae?[2] *Encrinurus* sp. age: Ludlow	C-11928

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-103cF 27 feet from base	Section 8, just west of the head of Arthur Fiord, E482800 N8481750 tabulate coral(?) age: probably Silurian or Devonian	C-11934
DM-71-104cF at top	Section 8, E482800 N8481750 indeterminate brachiopods age: Ludlow	C-11935[2]
DM-71-138cF base of Douro	Section 4, on Sutherland River, E505500 N8471600 echinoderm debris bryozoan algae(?) undetermined rugose and tabulate corals *Micula* sp. *Thamnopora* sp. age: Silurian, Middle or Late	C-11944A
DM-71-139aF 154 feet from base	Section 4, E505500 N8471600 *Atrypella scheii* age: Ludlow	C-11945[2]
DM-71-141aF at top	Section 4, E505500 N8471600 bryozoans indeterminate orthotetacean *Ferganella* cf. *F. turkestania*[2] *Atrypella scheii*[2] *Protathyris* aff. *P. infantile*[2] *Howellella* sp.[2] indeterminate ostracodes[2] indeterminate bryozoans[2] indeterminate gastropods[2] *Cyphoproetus* sp. *Encrinurus (Frammia)* cf. *E. (F.) arcticus* (Haughton) age: Late Silurian	C-11946

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-146bF 775 feet from top	Section 5, E504250 N8475000 at base of section; see also C-11883 to C-11884A echinoderm debris ?*Tabularia* sp. ?*Thamnopora* sp. *Atrypella scheii*[2] *Protathyris didyma* Kozlowski non Dalman[2] *Protathyris* aff. *P. infantile*[2] *Howellella* sp.[2] ostracodes[2] age: Ludlow	C-11951
DM-71-146cF 505 feet from top	Section 5, E504250 N8475000 indeterminate rhynchonellid *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11952[2]
DM-71-147aF 405 feet from top	Section 5, E504250 N8475000 *Atrypella scheii* *Howellella* sp. ostracodes age: Ludlow	C-11953[2]
DM-71-147bF 355 feet from top	Section 5, E504250 N8475000 indeterminate orthotetacean *Atrypella scheii* age: Ludlow	C-11954[2]
DM-71-147cF 210 feet from top	Section 5, E504250 N8475000 straight cephalopod gastropods *Morinorhynchus* sp. indeterminate rhynchonellid *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11955[2]

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-147eF 35 feet from top	Section 5, E504250 N8475000 echinoderm debris bryozoan undetermined brachiopods *Encrinurus (Frammia)* sp. *Hemiarges* sp. age: Late Silurian	C-11957
DM-71-151bF 329 feet from top	Section 3, a few miles southeast of Sutherland River, E508350 N8467500 at base of section *Atrypella scheii* *Protathyris didyma* Kozlowski non Dalman *Howellella* sp. age: Ludlow	C-11959[2]
DM-71-151cF 325 feet from top	Section 3, E508350 N8467500 *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11960[2]
DM-71-152bF 293 feet from top	Section 3, E508350 N8467500 *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11962[2]
DM-71-152bF 280 feet from top	Section 3, E508350 N8467500 *Morinorhynchus* sp. *Atrypella scheii* *Howellella* sp. age: Ludlow	C-11963[2]
DM-71-152dF 252 feet from top	Section 3, E508350 N8467500 bryozoan *Morinorhynchus?* sp.[2] *Atrypella scheii*[2] *Protathyris didyma* Kozlowski non Dalman[2] *Protathyris* aff. *P. infantile*[2] *Howellella* sp.[2] *Encrinurus (?Frammia)* sp. age: Ludlow	C-11965

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-153aF 128 feet from top	Section 3, E508350 N8467500 *Gypidula* sp. (=*coeymanansis* Holtedahl) *Atrypella scheii* ostracodes age: Ludlow	C-11966[2]
DM-71-154aF 3 feet from top	Section 3, E508350 N8467500 *Atrypella scheii* *Lingula?* sp. crinoids age: Ludlow	C-11967[2]
DM-71-154cF Topmost bed	Devon Island, 2 mi. S.E. of Sutherland River. *Polygnathoides siluricus* Branson and Mehl *Kockelella variabilis* Walliser *Ozarkodina excavata* [Branson and Mehl; *P. siluricus* Zone; upper Middle to lower Upper Ludlow, upper part coincides with the *Monograptus fritschi linearis* Zone (Walliser, 1964, 1971)] age: Ludlow	C-11968[3]

Identifications by B. S. Norford, M. J. Copeland,[1] R. E. Smith[2] and T. T. Uyeno[3]

Devon Island Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-154bF at top "(fish scale 1' from base of Devon)"	Section 3, E508350 N8467500 pelecypod fish brachiopods *Encrinurus (Frammia)* cf. *E. (F.) arcticus* (Haughton) age: Late Silurian	C-11969
DM-71-38a 487 feet from base	Section 3, immediately east of Sutherland River. Base of section at E509000 N8468500 cf. *"Camarotoechia"* sp. - fragment of a small form; very long hollow spine-like structure age: probably Late Silurian	C-11906
DM-71-38b 627 feet from base	Section 3, E509000 N8468500 *Lingula* sp. cf. *Mesodouvillina* sp. cf. *Levena* sp. cf. *Gypidula* sp. - fragment of a small smooth form cf. *Spinulicosta* sp. *Warburgella rugulosa* (Alth) *canadensis* Ormiston - head fragment undetermined trilobite tail fragment age: early Gedinnian (early Early Devonian)	C-11907
DM-71-86e 140 feet above base	Section 7; near Reid Creek; base of section at E494350 N8477500 *Orbiculoidea* sp. *"Camarotoechia"* sp. undetermined brachiopod fragment echinoderm ossicle fragment age: probably Late Silurian	C-11929

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-141b 125 feet above base	Section 4, on Sutherland River, Grinnell Peninsula E505500 N8471600 cf. *Rhipidium* sp. cf. *Coelospira* sp. cf. *Meristella* sp. *Spinatrypa* sp. echinoderm ossicle with single axial canal ostracodes fish fragment scolecodonts *Monograptus* cf. *M. transgrediens*[1] (Perner) age: Late Silurian, probably late Pridolian	C-11947
DM-71-141e	Section 4, E505500 N8471600 *Monograptus fanicus* Koren (n. sp.) age: Gedinnian	C-11949 [2]
DM-71-141c 165 feet above base	Section 4, E505500 N8471600 *Gypidula* sp. - small smooth form cf. *Coelospira* sp. undetermined finely macerated brachiopod fragments echinoderm ossicle with single axial canal conodont fragment age: possibly Late Silurian	C-11948

Identifications by A. W. Norris, R. Thorsteinsson[1] and D. Jackson[2]

Sutherland River Formation

Field No. and Stratigraphy	Locality (in UTM coordinates), Fauna and Age	GSC Loc. No.
DM-71-38d 20 feet above base	Section 3, E509000 N8468500 undetermined gastropod impression undetermined brachiopod impression age: not determinable	C-11908

TABLE ~~II~~ 2

Strontium Content in 39 Samples of Allen Bay Dolomite

	Mean value ppm	Standard deviation ppm
Strontium content of all samples (39)	81.0	33.4
Strontium content of samples from the subtidal massive-bedded lithofacies (27)	74.0	28.0
Strontium content of samples from the peritidal medium-bedded lithofacies (12)	96.0	38.0

Student's "t" of massive-bedded lithofacies strontium content versus that of the medium-bedded lithofacies = 2.00

$$\text{where } t = \frac{\overline{X}_1 - \overline{X}_2}{S_\rho}$$

$\overline{X}_1$ = mean strontium content of massive-bedded lithofacies

$\overline{X}_2$ = mean strontium content of medium-bedded lithofacies

S_ρ = estimated standard error of the difference between $\overline{X}_1$ and $\overline{X}_2$

$$\text{where } S_\rho = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2}} \cdot \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$$

n_1 = number of strontium determinations from the massive-bedded lithofacies

n_2 = number of strontium determinations from the medium-bedded lithofacies

s_1 = standard deviation of strontium determinations from the massive-bedded lithofacies

s_2 = standard deviation of strontium determinations from the medium-bedded lithofacies

Therefore μ subtidal strontium sample values = μ peritidal strontium sample values (μ = population)

Table ~~III~~ 3

Correlation Coefficients for Trend Surfaces from Degrees 1 to 5 Fitted to Manganese and Strontium Concentrations in the Allen Bay Formation

	Manganese Trend Surface Correlation Coefficients	Strontium Trend Surface Correlation Coefficients
1st degree	0.632	0.677
2nd degree	0.719	0.694
3rd degree	0.755	0.699
4th degree	0.791	0.720
5th degree	0.813	0.741

TABLE ~~IV~~ 4

Residual Strontium Values from Second Degree Trend Surface on Strontium Values of the Allen Bay Formation

	Mean Strontium Residual Value (ppm)	Standard Deviation of Strontium Residual Values (ppm)
medium-bedded lithofacies-peritidal (12 samples)	4.4	29.9
massive-bedded lithofacies-subtidal (27 samples)	0.1	24.0

Student's "t" of strontium residual values from the medium-bedded lithofacies versus those from the massive-bedded lithofacies = 0.436. Therefore, if μ = population of residual values, medium-bedded lithofacies = μ massive-bedded lithofacies (see Table II for method of calculation of Student's "t")

TABLE 5

Manganese Content of the Allen Bay Formation

	Mean Value of Manganese Content in Allen Bay Samples (ppm)	Standard Deviation of Manganese Content in Allen Bay Samples (ppm)
All samples (39)	46.0	26.3
massive-bedded lithofacies-subtidal (12 samples)	42.0	27.0
medium-bedded lithofacies-peritidal (27 samples)	55.0	20.4

Student's "t" of massive-bedded lithofacies manganese values versus those from the medium-bedded lithofacies = 1.44

Therefore: if μ = population of values, μ massive-bedded lithofacies = μ medium-bedded lithofacies (see Table II for method of calculation of Student's "t")

TABLE ~~VI~~ 6

Residual Manganese Values from Third Degree Trend Surface on Manganese Values of the Allen Bay Formation

	Mean Manganese Residual Value (ppm)	Standard Deviation of Manganese Residual Values (ppm)
medium-bedded lithofacies-peritidal (12 samples)	0.33	16.9
massive-bedded lithofacies-subtidal (27 samples)	-0.24	20.6

Student's "t" of manganese residual values from the medium-bedded lithofacies versus those from the massive-bedded lithofacies = 0.075. Therefore, if μ = population of residual values, μ = medium-bedded lithofacies = μ massive-bedded lithofacies. (see Table II for method of calculation of Student's "t")