i

Geological Survey
of
Canada

Department of Energy, Mines
and Resources

Memoir 000

BATHURST ISLAND GROUP

AND

BYAM MARTIN ISLAND, ARCTIC CANADA

(Operation Bathurst Island)

J. Wm. Kerr

Price -

1972

BATHURST ISLAND GROUP

AND

BYAM MARTIN ISLAND, ARCTIC CANADA

(Operation Bathurst Island)

GEOLOGICAL SURVEY OF CANADA

Memoir 000

BATHURST ISLAND GROUP

AND

BYAM MARTIN ISLAND, ARCTIC CANADA

(Operation Bathurst Island)

By

J.Wm. Kerr

DEPARTMENT OF ENERGY, MINES AND RESOURCES, CANADA

PREFACE

CONTENTS

Chapter I

Chapter II

Chapter III

Chapter IV

ILLUSTRATIONS

Page

Page

BATHURST ISLAND GROUP AND BYAM MARTIN ISLAND, ARCTIC CANADA (OPERATION BATHURST ISLAND)

ABSTRACT

The Bathurst Island group, and Byam Martin Island, together occupy about 8,000 square miles of land area. They are situated near the geographic center of the Canadian Arctic Archipelago and encompass the north magnetic pole. Most of the area is covered by sedimentary rocks of Ordovician to Late Devonian age, with a composite exposed thickness of approximately 20,000 feet. Exposures of younger rocks are limited to small areas in the northwest and southeast.

The oldest rocks exposed are Ordovician evaporites and carbonates; these are overlain by Upper Ordovician to Lower Devonian black graptolitic shale. The black shale sequence is followed by increasingly coarse-grained clastic rocks, including turbidites, of Early Devonian age. Unconformities and marked facies changes indicate three pulses of Devonian uplift of eastern Bathurst Island. Middle Devonian rocks are mainly carbonates grading basinward to shales. The Upper Devonian is represented by a thick sequence of paralic and nonmarine quartz-rich clastic sedimentary rocks which blanket the whole island group. The next record of sedimentation consists of a few hundred feet of Permian and Mesozoic strata which occur on Cameron and Helena Islands, in the northern part of the area. Upper Cretaceous plant-bearing sandstone and shale with an interbedded basalt flow occurs in a graben in southeastern Bathurst Island; nearby dykes and plugs probably are related to the flows.

Two fold belts intersect at near right angles in eastern Bathurst Island. The north-south trending Cornwallis Fold Belt along the east coast, first developed in Early Devonian time, and the east-west Parry Islands Fold Belt developed later. The younger belt had its first and main deformation between Late Devonian and Early Permian time in the Ellesmerian orogeny. A third period of deformation affected the entire area during the Late Cretaceous and probably Tertiary time. Included in this episode were faulting, intrusion and further folding of both the Cornwallis and Parry Islands Fold Belts.

The Cornwallis Fold Belt largely resulted from differential vertical movement in the underlying Precambrian basement. The Parry Islands Fold Belt is an allochthone that moved southward, above a décollement that apparently is in the Ordovician evaporites. A zone of left lateral strike slip movement in the western part of the Cornwallis Fold Belt delimits the eastern boundary of the allochthone. Western parts of the Cornwallis Fold Belt were involved in the décollement.

Chapter I

INTRODUCTION

Location and Field Work

This report describes the bedrock geology of the Bathurst Island group, and Byam Martin Island, a land area totalling about 8,000 square miles (Fig. 1). Bathurst Island group is an informal term first used by Dunbar and Greenaway (1956) to include Bathurst Island proper, Cameron, Vanier, Massey, Alexander, and Helena Islands, as well as nearby named and unnamed smaller islands.

Field work for Operation Bathurst Island was carried out in 1963 and 1964 with the use of Piper Super Cub aircraft that were supplied by Bradley Air Services Ltd., of Carp, Ontario. Special oversized, low-pressure tires permitted the aircraft to land on unprepared terrain including ground that is quite soggy or rough (Pl. I). Base camps were established during both seasons on east-central Bathurst Island, about midway between the head of Bracebridge Inlet and the head of Goodsir Inlet. Numerous small fly camps were established at widely separated points in the study area and these were occupied for varying lengths of time by one or two men.

There are no settlements within the study area and no permanent human habitation. Scattered ruins of stone dwellings and occasional artifacts indicate that Eskimos once lived in the area. Eskimos occasionally travel to Bathurst Island on hunting expeditions from Resolute, about 100 miles to the east. Four temporary oil-well drilling camps and drilling rigs have been established in the Bathurst Island group (see Map 000A) but they have either been moved or are now unoccupied.

The area is normally reached by travelling through Resolute (Fig. 1), a centre operated principally by the Ministry of Transport. A gravel air strip at Resolute is serviceable throughout the year, and for a part of the summer and fall the centre is accessible also by ship. Resolute serves as the main distribution centre for groups operating north of about 73° N latitude. An Eskimo village situated on the shore of Barrow Strait some three miles southeast of the airport has been located at Resolute since 1953. Resolute has a weather station operated jointly by the Meteorological Branch of the Ministry of Transport, and a detachment of the Royal Canadian Mounted Police. Nordair Ltd., provides twice weekly air passenger and freight service from Montreal, and Pacific Western Airlines provides a similar link with Edmonton. Atlas Aviation Ltd., which is based permanently at Resolute, provides local charter and contract air services for this region.

From early June to late August or the beginning of September, the Bathurst Island group is accessible by light aircraft equipped with oversize, low-pressure tires. The rest of the year the area can be reached by ski-equipped aircraft. Ships can reach the southern and eastern coast of Bathurst during the short shipping season in the late summer and early fall. The northern and western coasts generally are ice-locked the year around.

The climate of the region is quite variable. Weather records from Resolute indicate that the mean annual temperature is about 0°F, and during only two to three months of the year are mean temperatures above freezing. The warmest month, July, has a mean of about 40°F. The snow usually begins to melt rapidly in June and by the middle of July most of the ground is bare; however, the summer of 1964 was unusually cool and the snow did not leave the higher parts of Bathurst Island. Winter snows usually cover the ground by the end of August or early in September. The two field seasons spent on Bathurst Island were very cloudy, it being overcast and cold about three-quarters of the time. When the sun is out, however, the summer climate is very pleasant. Between May and mid-August the midnight sun is constantly above the horizon, but from November to February there is constant night.

Vegetation in the area does not exceed a few inches in height and is restricted to hardy species that can exist in the very short growing season. Lichen and various kinds of mosses grow sporadically even on the most exposed ridges. Black and green lichen are a common cover on sandstone formations, whereas the limestone and dolomite are nearly barren. Shale and siltstone support various species of grass, sedge and Arctic willow. In late June and July small bright red saxafrage flowers are abundant in the tundra-covered areas and add splashes of brilliant colour to an otherwise bleak and desolate scene.

Vegetation grows best on the Bathurst Island, Stuart Bay and Griper Bay Formations. Widespread exposure of these units has given Bathurst Island one of the most prolific wildlife populations of any Arctic Island. Muskoxen and caribou are particularly abundant, and in 1963 there was a population explosion of lemming. Snowy owls, jaegers, gulls, and numerous varieties of ducks and geese use Bathurst Island as a nesting area.

Seal, walrus and beluga seemed most common along the east coast. Polar bears were seen often, and in late summer commonly migrate westward across the isthmus between Goodsir Inlet and Bracebridge Inlet, presumably in search of more abundant ice and better seal hunting.

Acknowledgments

The field studies for Operation Bathurst Island were carried out during both summers by J.Wm. Kerr and P.G. Temple. The latter wrote a doctoral thesis at Princeton University on part of the material collected in the study area (Temple, 1965), and this has been incorporated into the present report. In addition to these two, the full complement of the field party each summer included one assistant, a radio operator, a pilot, and a cook. In 1963 Doug MacDougall was field assistant, Don DeCecco cook, Bob Warnock pilot, and Dave Sellers radio operator. In 1964 Blair Amundsen was field assistant, Dennis Maier cook, John Bryant pilot, and Fred Affleck radio operator.

W. Blake, Jr. studied the surficial geology of the Bathurst Island group and made numerous observations that contributed to the report. W.W. Nassichuk, H.P. Trettin and J.G. Fyles also were associated with the operation for short periods of time in connection with independent studies in this area and elsewhere.

History of Geographical and Geological Exploration

Summaries of geographical exploration of this area have been made by Blackadar (1963, pp. 579-80), and Dunbar and Greenaway (1956, p. 253). The following 5 paragraphs largely paraphrase relevant parts of those two works. Bathurst Island (Fig. 1) was discovered by Lieutenant (later Admiral Sir) W.E. Parry in 1819 during his westward penetration of Parry Channel. No landing was made at the time and nearly 30 years elapsed before the island was visited again. From the available records it appears that Sir John Franklin, before wintering his ships at Beechey Island in 1845-46, ascended Wellington Channel and returned south along the east coast of Bathurst Island.

In late August of 1850, two British squadrons entered Barrow Strait in the search for the missing Franklin Expedition. One of these units, commanded by Captain Horatio Austin, took up winter quarters near Griffith Island; the other, commanded by the former whaler, Captain William Penny, wintered on the south coast of Cornwallis Island. From April until early June of 1851, several man-drawn sledge parties travelled west from Griffith Island along the south shore of Bathurst Island. The party led by Lieutenant R.D. Aldrich charted much of the western coast of the island, but due to the snow cover was unable to recognize the narrow straits separating the small islands northwest of Bathurst Island, Lieutenant F.L. M'Clintock examined the south coast of the island and explored Graham Moore Bay, while G.F. M'Dougall travelled along the east coast of Bathurst Island as far north as Neal Island.

This expedition returned to England in the autumn of 1851. The next year, five ships were dispatched under the command of Sir Edward Belcher. The Resolute, and Intrepid, under the command of Captain Henry Kellett, proceeded to Melville Island, the North Star remained at Beechey Island, and the Assistance and Pioneer proceeded up Wellington Channel to the western coast of Grinnell Peninsula where they wintered in Northumberland Sound. Between April and July 1853, travelling parties from the Assistance and Pioneer, under Commander G.H. Richards, traversed and charted the entire north coast of Bathurst Island, and Lieutenant Sherard Osborn made a journey by boat from Cape Lady Franklin south to Goodsir Inlet.

Three expeditions under the command of Captain J.E. Bernier visited the Arctic Islands before World War I. These were dispatched by the Canadian Government to patrol arctic waters and to annex the islands granted to Canada by Great Britain in 1880. Bernier made three brief stops on Bathurst Island, one at Cape Cockburn in 1906, and the others near Cape Aldrich and Cape Schomberg in 1909.

V. Stefansson made a short stop at Success Point, northwest Cameron Island, on his return from the Sverdrup Islands in the spring of 1917. In the course of one of the longest of all RCMP arctic patrols, Inspector A.H. Joy traversed the south shore of Bathurst Island in the spring of 1929.

Until July 1947, when the true nature of the Bathurst Island group was noted by the U.S.A.F. and R.C.A.F. observers on a reconnaissance flight, the group was thought to be all one island, with the exception of the Berkeley Islands in the northeast. The northwest peninsula was found at this time to be divided into five islands. The northernmost island was named Cameron Island in 1952, after the late Chief Cartographer of Canada, who was responsible for the first large scale mapping of the Arctic Archipelago during the Second World War. On February 1, 1962 the three largest of the remaining four islands were named Alexander, Massey, and Vanier, after the three most recent Governors General of Canada. These three islands together are informally called the Governors General group. A fourth island near these three is Ile Marc, named after the late Marc Boyer, former deputy minister of the then Department of Mines and Technical Surveys. The strait between Alexander and Massey Islands is Boyer Strait, also in honour of Dr. Boyer. A small island between Massey and Vanier at the west end of Pearse Strait was approved as Ile Pauline after the wife of General Vanier in May, 1963.

Few observations on the geology of the Bathurst Island group were made until recent years. Some of the fossils collected during searches for Franklin were described by Haughton (1857) and Adams (1875). McMillan (1910), on Bernier's second trip, also made a few important observations. Aerial photography of the archipelago in recent years, and a few observations made either on the ground or from aircraft, permitted Jenness (1952a, b) and Taylor (1956) to deal with some aspects of the physical geology of the region, and enabled Fortier and Thorsteinsson (1953) to include most of Bathurst Island in the Parry Islands Fold Belt.

Geological studies of a systematic reconnaissance nature were begun in the Canadian Arctic Islands in 1950 by the Geological Survey of Canada, when Y.O. Fortier and R. Thorsteinsson, along with T. Harwood of the Defence Research Board circumnavigated Cornwallis Island in a canoe. The study of that island was continued by canoe-supported field parties headed by Thorsteinsson in the summers of 1951, 1952, and 1953. In 1955 the Geological Survey of Canada undertook a major helicopter-supported operation in the Arctic Islands called Operation Franklin. The report on this project (Fortier, et al., 1963), provided a framework of the areal and stratigraphic geology of the Queen Elizabeth Islands. Six small isolated regions of the Bathurst Island group were examined and reports on those areas are included in the volume (Thorsteinsson and Glenister, 1963; McLaren, 1963b; McMillan, 1963b; Norris, 1963; Greiner, 1963; and Tozer, 1963b). A preliminary geological map of the Bathurst Island group was made (in Fortier et al., 1963), to show the six areas that had been examined on the ground. The reports of Tozer (1963b) and Greiner (1963b) were relied upon heavily for information on the Permian and younger rocks of Cameron Island, and the comments herein mainly paraphrase those two reports. Eastern parts of Bathurst Island were studied in 1959 and 1960 by A.H. McNair (1961) who wrote on the intersecting relationship of the Parry Islands and Cornwallis Fold Belts.

In the winter of 1963-4 the Dominion Explorers Group of companies drilled an unsuccessful wildcat well on the Caledonian River Dome in south-central Bathurst Island (Fig. 2, Section 38). The completion report of this well (Dominion Explorers Group, 1964) is on open file with the Department of Indian Affairs and Northern Development, and is available to the public. Three other wells have been drilled within the study area (see Map 000A), but at the time of writing the information was still classified as confidential.

Recent publications by officers of the Geological Survey of Canada that concern the present study area include the following: summary reports of field work by the writers (Kerr, 1964; Kerr and Temple, 1965); thickness and facies data in a regional compilation of the petroleum potentialities of Northern Canada (Douglas, Norris, Thorsteinsson, and Tozer, 1963); an account of the glacial history of the island (Blake, 1964); description of an unconformity between Middle and Upper Devonian (Kerr, McGregor and McLaren, 1965); interpretation of the tectonic history of eastern parts of Bathurst Island that lie within the Cornwallis Fold Belt (Kerr and Christie, 1965); and discussion of Devonian rocks of the islands in a regional paper (Kerr, 1967a).

Physiography

The physiography of the Bathurst Island group is strongly influenced by the underlying geologic stucture. It is an area of rather low relief. Nevertheless, with few parts of the area being more than 1,000 feet above sea level, much of the topography is rugged with deeply incised streams and V-shaped valleys, and is in a stage of late youth or early maturity.

Three main physiographic divisions of the Bathurst Island group designated by Roots (1963) are as follows:

1. A low plateau principally underlain by horizontal to gently dipping carbonates constitutes the southern quarter of the area. This plateau is rather flat, featureless and desolate in the central part, and is dissected into narrow, steep walled valleys and bluffs to the south, and along the east coast. The drainage pattern is dendritic. Two sandstone buttes occur along the west coast.

2. The central and northern parts of Cameron Island comprise an area of lowland where the elevation is generally less than 300 feet. Gently dipping, soft and poorly consolidated shale and sandstone underlie this region. The land slopes gently northward; streams are short and braided, and have wide gravel fans at their mouths.

3. Much the largest physiographic division is a ridged upland which includes all but northwestern and southeastern parts of the island group. This is an area of broad folds which are reflected to various degrees in the topography and drainage pattern.

A strip of the ridged upland division, about 10-15 miles wide, along the east-central and northeast coast of Bathurst Island is characterized by low hilly topography which seldom exceeds 600 feet in elevation. The underlying geologic structure is complex, this being the area of the Cornwallis Fold Belt, and also its intersection with the Parry Islands Fold Belt. The topography here reflects structure only moderately; irregular hills with a subtle northerly grain are developed on northerly trending structures of the Cornwallis Fold Belt. Much of this region is covered by felsenmeer or by glacial sands and gravels; exposures of bedrock are restricted to stream valleys, and to a few northerly trending ridges.

The ridged upland area is part of the Parry Islands Fold Belt, an area of elongate westerly trending folds that have conspicuously influenced topographic development. The synclines have developed into broad ridges, whereas the anticlines have been preferentially eroded into narrower valleys. The ridges are remarkably regular and continuous; they commonly extend from west to east across the whole island group, without change or offset even at the straits and inlets. The ridge crests are smooth in profile and average from 700 to 900 feet in elevation. The western part of the ridged upland area has a rectangular drainage pattern with the large trunk streams flowing along the east-west valleys, carved from the anticlinal cores. Tributaries enter the trunk streams at right angles, parallel to and apparently controlled by joints that are perpendicular to the strike of the bedrock (Pl. IV). Some of the tributary streams have cut rocky gorges as much as 500 feet deep.

Erskine, May and Young Inlets (Fig. 2), indent the Bathurst Island group from the north-northwest, and are at right angles to the regional strike of the strata. Roots (1963, p. 583) considered the larger two inlets to be erosional features. In contrast Workum (1962) suggested that the inlets result from erosion of northerly trending anticlines (Cornwallis Fold Belt) that existed prior to the westerly trending structures of the Parry Islands Fold Belt. The northerly trending anticlines become the loci of interference of fold trends. Erosion resulted in an inversion, whereby the structural highs became topographic lows. This inversion is very clear in the case of the westerly trending folds but only suggestive in the case of the northerly trending folds. The writer is in basic agreement with Workum's suggestion, and elaborates on it in a later chapter.

Exposure of rock within the island group is variable. On aerial photographs exposure appears excellent, but on the ground this is not always the case. In the larger tributary stream cuts exposure is usually excellent. In large flat areas underlain by limestone or sandstone, however, there usually are no outcrops, and the surface is composed entirely of frost-shattered, coarse felsenmeer (see Pl. I). In extensive flat areas where the bedrock is shale and shaly siltstone, the surface usually is covered by very fine rock fragments, and by much soil and plant cover.

The glacial history of Bathurst Island was summarized by Blake (1964) and the following four paragraphs are taken from his abstract.

> Bathurst Island, in the central part of the Arctic Archipelago, lacks the prominent glacial landforms such as drumlins and eskers that characterize certain more southerly islands. It does not appear to have been overridden by the continental North American (Laurentide) ice sheet during the last glaciation (classical Wisconsin). Nonetheless Bathurst Island bears undoubted evidence of glaciation in the form of till, erratics, and meltwater channels. Erratics, commonly of a quartzose sandstone that outcrops on the island, are widespread and occur at altitudes up to at least 1,100 feet (335 m), far above the limit of marine submergence. Other important features indicating glaciation are: striae, lakes in bedrock basins, areas of streamlined drift, end moraines, and areas of dead-ice topography.
>
> Apparently most of these features are related to locally-centred ice cap(s), but the occurrence of till containing shells above the marine limit at several localities along the east coast may possibly be the result of a glacier tongue in the straits having impinged upon the island.
>
> The rapid uplift that has taken place in postglacial time, as determined by radiocarbon dating of marine shells from the raised beaches, is believed to have resulted from glacial rebound. Thus the last glaciation of Bathurst Island is inferred to have taken place during Wisconsin time. The altitude of the marine limit is close to 300 feet (90 m) along the east-central and southeast coasts, but it reaches 400 feet (120 m) in the long inlets that indent the north coast, suggesting that the ice may have been thicker in the latter area.
>
> The radiocarbon dates on marine shells, plus one on peat, also indicate that much of the island was ice-free by 9,000 years ago. Since then peat deposits have formed in many localities, but in two places buried peats are more than 35,000 years old, suggesting that they are interglacial, or possibly interstadial, in age.

Regional Geological Setting

Stratigraphic-structural provinces in the Arctic Islands were outlined by Thorsteinsson and Tozer (1960) and with minor modification are shown in figure 3. Several major salients of the Precambrian Canadian Shield strike into the Arctic Islands beneath and between younger sediments. One of these, the Boothia Uplift (Kerr and Christie, 1965), lies just to the south of, and trends toward Bathurst Island. Since

Proterozoic Time various pulses of tectonic activity of the Boothia Uplift have had profound effects on Bathurst Island, and these will be discussed in a later section.

Bordering and overlying the Shield to the north and west is a province designated the Central Stable Region (after King, 1959) consisting of horizontal to gently dipping Paleozoic sediments, principally of carbonate facies. Farther north is the Franklinian Miogeosyncline, a thick sequence of Lower Paleozoic clastic and carbonate rocks, which was deformed into the Parry Islands Fold Belt in the west and the Ellesmere-Greenland Fold Belt in the east (Fortier, McNair, and Thorsteinsson, 1954). The fold belts are parallel to the miogeosyncline and extend for about 900 miles from western Melville Island to northwest Greenland. A period of folding which marked the end of the miogeosyncline probably occurred between Late Devonian and Middle Pennsylvanian (Thorsteinsson and Tozer, 1960; Kerr and Trettin, 1962). The Cornwallis Fold Belt (Thorsteinsson, 1958) trends north and is intersected at right angles by the Parry Islands Fold Belt on eastern Bathurst Island. It has been known for some time that the Cornwallis Fold Belt developed somewhat earlier than the Parry Islands Belt (Thorsteinsson and Glenister, 1963, p. 596). The present field work on Bathurst Island showed that there were three periods of Devonian activity within the Cornwallis Fold Belt, and these have been summarized briefly by Kerr and Christie (1965).

On northern Axel Heiberg and Ellesmere Islands is a thick assemblage of Lower Paleozoic sedimentary, igneous, and metamorphic rocks that has been called the Franklinian Eugeosyncline by Thorsteinsson and Tozer (1960). The geology of the eugeosyncline has been further described by Trettin (1967, 1970, and in press).

The Sverdrup Basin (Thorsteinsson and Tozer, 1960) is a deep sediment-filled depression that is superimposed unconformably on the older Franklinian Geosyncline and occupies a large part of the central and northern Arctic Islands. The thickness of strata in places is as great as 40,000 feet, and included are rocks of upper Paleozoic, Mesozoic and Tertiary ages. A deformational episode of Late Cretaceous and Tertiary age produced diapirs, folds, and thrusts in the Sverdrup Basin. Within the study area the southernmost part of the Sverdrup Basin is exposed on Cameron and Helena Islands.

Chapter II

STRATIGRAPHY

General Statement

Rocks of the Bathurst Island group were examined systematically first in 1955 during Operation Franklin of the Geological Survey of Canada, when several isolated small areas were visited. D.J. McLaren (1963b) studied the Paleozoic section of the Stuart Bay area in the central part of Bathurst Island (Sections 25 and 26, Fig. 2). Thorsteinsson and Glenister (1963) described the rocks from the Driftwood Bay area along the east coast of the island (Sections 30 and 31). Greiner (1963) examined the rocks on southwestern (Section 2) and southeastern Cameron Island, and Tozer, (1963b) examined the northern part of that island (Section 1). In addition, two reconnaissance traverses were made; one in the Crying Fox Creek area at Section 37 (McMillan, 1963b) and the other from the head of Erskine Inlet to Bracebridge Inlet at Section 7 (Norris, 1963). This work resulted in the setting up of several type and reference sections. The findings of Operation Franklin served as a framework for the present study, but this framework now must be modified to some extent.

Ordovician to Upper Devonian sedimentary rocks crop out over almost the entire study area (Map 000A). They were deposited in parts of two geological provinces, and the most satisfactory dividing line between them is shown in figure 2. In early parts of this sequence the entire Bathurst Island group and the region shown on figure 4 was within the Franklinian Miogeosyncline. In later times, commencing with deposition of the Lower Devonian Stuart Bay Formation, the eastern region was deformed into the Cornwallis Fold Belt; thenceforth it subsided less and became part of the Central Stable Region. The region to the north and west of this line was part of the Franklinian Miogeosyncline throughout its Devonian and older Paleozoic history. The stratigraphic sections in these two regions are generalized on Table I. Deposition of this thick and widespread Paleozoic sequence was terminated by a widespread major mid-Paleozoic orogeny. Angular unconformities within the sequence mark tectonic events of lesser significance.

The oldest rocks exposed in the map-area are gypsum and anhydrite assigned to the Bay Fiord Formation of the Cornwallis Group. These rocks are in tectonic contact with younger rocks in the cores of two anticlines in the northern part of the area. A thick unit composed mainly of halite, which is the oldest unit penetrated by the Caledonian River well, also is assigned to the Bay Fiord Formation. The two younger formations of the Cornwallis Group are, in ascending order, the thick limestone and dolomite of the Thumb Mountain Formation, and the thin argillaceous limestone of the Irene Bay Formation. RLC A

Conformably overlying the Cornwallis Group is the Cape Phillips Formation, a unit made up predominantly of black graptolitic shale and shaly limestone. This formation grades upward into the Bathurst Island Formation of Lower Devonian age. The Bathurst Island Formation is composed predominantly of calcareous, graptolitic shale and siltstone with some interbedded carbonate, and is slightly coarser and more calcareous than the Cape Phillips Formation. The Cornwallis, Cape Phillips, and Bathurst Island Formations probably were deposited throughout the mapped area, and are presently missing in certain regions due to post-depositional erosion.

A marked change in the pattern of sedimentation first becomes apparent with the Lower Devonian Stuart Bay Formation (Fig. 5). It is coarser than preceding units, being composed generally of sandstone, limestone and siltstone. In eastern parts of the area it contains coarse boulders, and patch reefs, and the base is an angular unconformity. Westward the Stuart Bay Formation gradationally overlaps the Bathurst Island Formation. Also to the west it grades to calcareous shale and siltstone with pebbles here being only to the base.

The Stuart Bay Formation in western parts of the area is overlain by the Lower and Middle Devonian Eids Formation, a recessive calcareous shale and shaly limestone. The Eids grades eastward to siliceous dolomite and limestone and then into the Disappointment Bay Dolomite. The Disappointment Bay Formation overlaps eastward onto an angular unconformity (Fig. 5). The Eids and Disappointment Bay Formations are overlain conformably by the Blue Fiord Formation, a Middle Devonian limestone unit that grades westward into calcareous shale of the Eids Formation. These rocks are conformably overlain by the Bird Fiord Formation, a widespread Middle Devonian unit of alternating calcareous sandstone and sandy limestone. The Melville Island Group consists of quartz sandstone and minor shale, and is separated into the Hecla Bay and overlying Griper Bay Formations.

Upper Paleozoic and Mesozoic rocks of the Sverdrup Basin occur in the northern part of the map-area. On Helena Island the Permian Belcher Channel Formation is preserved as a small erosional remnant comprising several hundred feet of limestone and dolomite which lie unconformably on the Melville Island Group. On Cameron Island the

Upper Devonian Griper Bay Formation is overlain by several hundred feet of younger Permian to Jurassic sediments, predominantly sandstone and shale. Mappable units in this succession on Cameron Island include the Permian Trold Fiord Formation, the Triassic Bjorne, Schei Point, and Heiberg Formations, and the Jurassic Jaeger Formation. The youngest bedrock formation so far found within the island group consists of sandstone, shale and interbedded basalt of Upper Cretaceous and possibly Tertiary age. It crops out in a graben in southeastern Bathurst Island. Nearby to the west are numerous basic dykes that are probably contemporaneous with the lava flows.

Description of Formations

MIDDLE AND UPPER ORDOVICIAN

CORNWALLIS GROUP

The name Cornwallis Formation was provisionally used on Cornwallis Island by Thorsteinsson and Fortier (1954). It was later defined by Thorsteinsson (1958, p. 33), and at that time a type section of three members was established on the north tip of the island. In ensuing years two older rock units were mapped as the Cornwallis Formation on Ellesmere Island (Fortier, et al., 1963; Christie, 1967). Kerr (1967b) redefined the Cornwallis Formation as the Cornwallis Group, and retained the original type section of Thorsteinsson as the type section of the new group. He elevated the three members to formations and designated type sections of these three new formations on Ellesmere Island.

The three formations of the Cornwallis Group can be traced in a belt extending some 600 miles from Bathurst Island to North Greenland. The formations maintain considerable lateral uniformity in the central and shelfward parts of the miogeosyncline. They have distinctive lithology, thickness and topographic expression as follows:

Irene Bay - greenish weathering shaly limestone; recessive; 30 to 200 feet thick.

Thumb Mountain - rusty-weathering, dark grey limestone; forms massive bluffs; about 1,700 feet thick.

Bay Fiord - thinly bedded, shaly limestone, siltstone, anhydrite, dolomite; recessive; 1,000 to 2,000 feet thick.

The lowermost age limit of the group, about Ashby (Table I), is based on the probability that the upper part of the underlying Eleanor River Formation on Cornwallis Island is Mohawkian, and also on the presence of Wilderness fossils in the upper part of the Bay Fiord Formation on Ellesmere Island. The uppermost formation, the Irene Bay, contains fossils of Caradocian age (about Maysville) which are abundant on most of the islands, but on Bathurst Island are rather rare. Lithologies and faunas of the Cornwallis Group indicate marine deposition in a widespread platform environment. Normal marine circulation was at first restricted, with Bay Fiord evaporites being deposited in a very long broad basin. As normal circulation was later restored carbonates were deposited. The preponderance of lime mud (micrite) in the Thumb Mountain Formation of Bathurst Island suggests calm quiet deposition. RLC A

Bay Fiord Formation

The Bay Fiord Formation (Kerr, 1967b), the lowest unit of the Cornwallis Group, is a widespread recessive unit of Middle Ordovician age. Its thickness at the type section northeast of the head of Irene Bay on Ellesmere Island is 1,650 feet, and thicknesses remain on that order of magnitude on most of Ellesmere Island. The Bay Fiord Formation contains evaporites, silty and shaly limestone, gypsiferous shale, dolomite and calcareous siltstone, and exhibits marked lateral lithic variations. During deposition of the Bay Fiord Formation an evaporitic basin developed along the shelfward side of the miogeosyncline. On Ellesmere Island gypsum and anhydrite are prevalent in the lower part of the formation in a narrow belt. The evaporite basin seems to have been much broader southwest of Ellesmere Island and to have contained halite, for on Bathurst Island thick halite in a drilled well (Section 38) has been assigned to the Bay Fiord Formation.

On Cornwallis Island evaporites of the Bay Fiord Formation crop out only sporadically and are restricted to gypsum-anhydrite. Where the Bay Fiord Formation is exposed, the overlying Thumb Mountain Formation is collapsed and brecciated; this led Thorsteinsson (1958) to suggest that large amounts of evaporites had been leached from the Bay Fiord Formation. A thick section of halite subsequently was encountered in a well on Bathurst Island (Section 38) in what most likely is the Bay Fiord Formation. This probably is equivalent to halite that was leached to produce the collapse on Cornwallis Island. The Bay Fiord Formation does not crop out in normal stratigraphic position in the map-area, nevertheless rocks from two different settings within the study area have been assigned to that formation, and are described below.

On northern Bathurst Island two breached anticlines, the Purcell Bay structure and the May Inlet structure (Fig. 11) contain cores of intrusive evaporites that are in tectonic contact with younger rocks. In the Purcell Bay structure (Pl. II, Section 18) an oblong mass of highly contorted light grey anhydrite and anhydritic shale is present, in an area about 2 miles long and 1 mile wide. About 300 feet of evaporite is overlain by a caprock, about 100 feet thick, of highly fractured, dark grey, shaly limestone and limy dolomite infilled with anhydrite. The evaporite is recessive but is protected from erosion by the resistant caprock. It is not certain whether the non-evaporitic material in the caprock came from the underlying evaporitic formation or from a younger unit that was carried along by the evaporites. Farther north in the May Inlet structure (Pl. XVII, Section 19) an area of about 1 square mile is underlain by gypsum-anhydrite in exposures that exceed 300 feet in height.

The two intrusive evaporites described above are tentatively assigned to the Bay Fiord Formation for the following reasons. They must be older than the Cape Phillips Formation, which they intrude. Evaporites are known in two older formations in the general region, the Bay Fiord and Baumann Fiord Formations. The Bay Fiord Formation exposed on Cornwallis Island (Thorsteinsson and Kerr, 1968), and on nearby Grinnell Peninsula (Kerr, 1967b) contains anhydrite. The Baumann Fiord Formation is a Lower Ordovician gypsum and anhydrite unit that is 2,400 feet thick on Cornwallis Island (Thorsteinsson and Kerr, 1968). These evaporites possibly may have come from either or both of the above mentioned formations; however, it is more probable that they came from the Bay Fiord Formation, and they are tentatively assigned as such in this paper.

In the Caledonian River well on south-central Bathurst Island, (Section 38) the oldest unit penetrated is evaporite, and is at least 3,233 feet thick. It was first penetrated at a depth of 6,727 feet and extended continuously to the bottom of the hole at 10,000 feet. It was described as follows by A.J. Froelich in the completion report (Dominion Explorers Group, 1964).

> The 'Main Evaporite' series consists of alternating beds of rock salt interbedded with and permeating fractures in gypsiferous shale, dolomite, siltstone, and anhydrite. Most of the 'dolomites' are silty, argillaceous, anhydritic and very dense; however some dolomites between 6,800 and 8,100 feet are slightly to moderately porous and in part bituminous. One dolomite zone was tested but yielded only mud. Below 8,100 feet the interbedded dolomites are essentially dense. Three cores taken between 7,800 and 8,800 feet consist of interbedded salt, gypsiferous shale, and dolomite which are fractured, brecciated and have steeply inclined bedding. Contortions in the laminated shales and dolomites suggest that the salt series has been injected into position by flowage.

The main evaporite unit in the Caledonian River well is probably the lower evaporitic part of the Bay Fiord Formation. It is probable that this highly contorted part of the formation has been thickened considerably by tectonics. Overlying the main evaporite in the Caledonian River well between depths of 6,715 and 6,305 is a unit, 410 feet thick, which was described as a dense barren sequence of interbedded shale, anhydrite and dolomite. This is probably the upper member of the Bay Fiord Formation, which has a similar lithology on nearby Cornwallis Island, where it is 500 feet thick.

Thumb Mountain Formation

The Thumb Mountain Formation (Kerr, 1967b), is an extensive, bluff-forming limestone unit of Middle Ordovician (Barneveld and Eden) age, which occurs in the middle part of the Cornwallis Group and lies conformably between recessive formations. The type section of the formation is on Ellesmere Island, where it is 1,500 feet thick. In the central part of the miogeosyncline the formation is normally characterized by thick-bedded, dark grey-brown, argillaceous limestone, which weathers slightly rusty grey and forms bluffs. In the type section of the Cornwallis Group on northern Cornwallis Island it comprises at least 1,700 feet of rock (the upper part of which is dolomitized). Fossils, always sparse in the formation, occur mainly in the upper part, and all are representatives of the 'Arctic Ordovician fauna' of Middle or Late Ordovician age.

Distribution, Thickness and Lithology

The Thumb Mountain is the oldest formation exposed in normal stratigraphic position in the study area and the base is not exposed. Exposures are restricted to the region north of Bracebridge Inlet and east of Erskine Inlet. In the extreme northeastern part of Bathurst Island (Section 22) 320 feet of micritic, light to medium grey limestone of the uppermost Thumb Mountain Formation is exposed in the hanging wall of a southerly directed thrust fault. The thickest section of the formation is at Moses Robinson River (Section 30) where it consists of 1,800 feet of dense, light to medium grey, thick-bedded, micritic limestone, with minor amounts of skeletal limestone, light grey, sugary, dolomite, and dolomitic limestone. The formation weathers yellowish grey with some rusty staining. At the top are greenish shaly interbeds. At Driftwood Bay (Section 31) the formation is a little more than 1,700 feet thick, and is predominantly light grey, sugary to vuggy, medium-bedded, and resistant dolomite, with only minor amounts of limestone. The extensive local dolomitization of the section may be a consequence of its having been overlain at one time unconformably by the Lower Devonian Disappointment Bay Dolomite; this has since been eroded away. Still farther south, at the head of Goodsir Inlet (Section 34), the entire Thumb Mountain Formation is dolomite. The lowest exposure consists of 425 feet of dolomite that is tan to brown, sugary, finely porous to vuggy, and has a strong petroliferous odour. This is overlain by 1,000 feet of sugary, finely porous to vuggy, light to medium chocolate brown, thick-bedded to massive dolomite. This section may have been dolomitized when overlain by an unconformable cover of Disappointment Bay Formation that has since been removed by erosion.

At the mouth of Stuart Bay (Section 24), 1,345 feet of the Thumb Mountain Formation is exposed in the north flank of a dome. The lowermost 450 feet of this exposure is petroliferous and fetid dolomite that is porous and slightly limy; it is dark chocolate-brown, weathering chocolate-brown mottled with light tan, weathering tan. The dolomite-limestone contact seems to be everywhere at the same stratigraphic level in this structure, thus the dolomite probably is not a local replacement of limestone, but could have a large areal extent. Successively younger units include: 670 feet of dark chocolate brown, light grey brown and light grey, thick-bedded shaly limestone; and

225 feet of thin- to medium-bedded, medium grey-brown shaly limestone with abundant grey-brown shaly and silty interlayers which weather light grey-green. The formation is overlain abruptly but conformably by a recessive greenish shale, the Irene Bay Formation. At Section 14, west of May Inlet, the Thumb Mountain Formation is mainly limestone, but contains an interval, about 475 feet thick, composed of petroliferous bedded limestone (see Appendix).

Irene Bay Formation

The Irene Bay Formation (Kerr, 1967b) is a thin succession of generally recessive, thinly bedded limestone with some interbedded shale which is extensively represented in the Arctic between Melville and Ellesmere Islands. The type section is in the reference section of the Cornwallis Group northeast of Irene Bay on Ellesmere Island. A greenish weathering colour and recessive nature are distinctive of the formation. Prolific faunal collections of very large specimens have been made in the Irene Bay Formation, including coiled and straight cephalopods, brachiopods, receptaculitids, gastropods and colonial and solitary corals. This has been widely referred (B) to as the 'Arctic Ordovician fauna' of about (A) Eden and (A) Maysville age. In general the Irene Bay Formation, about 200 feet thick, and abundantly fossiliferous, occurs over wide regions in the Queen Elizabeth Islands. The formation is similar on northern Bathurst Island where the thickness ranges from 125 to 180 feet and fossils also are abundant. However, in other exposures in the central and eastern parts of the Bathurst Island, fossils are rare and thicknesses range from 30 to 65 feet. Because of its extreme thinness the Irene Bay Formation is combined with the Thumb Mountain Formation on the geological map (Map 000A). Both upper and lower contacts are everywhere conformable, and usually abrupt.

RLC

Distribution, Thickness and Lithology

The Irene Bay Formation in the report area is a thin widespread sheet of soft limestone, with abundant, interbedded greenish shale layers. It is quite distinctive in its weathering behaviour, occupying a thin recessive interval between the thick, resistant Thumb Mountain Formation below and a thin, resistant dolomite or limestone interval at the base of the overlying Cape Phillips Formation.

At Section 22 in the extreme northeast of the map area, the recessive Irene Bay Formation is 125 feet thick and consists of thinly-bedded, medium grey limestone, with fossil fragments, interbedded with greenish weathering shaly interlayers. The limestone weathers rusty grey. Large fossils of the 'Arctic Ordovician fauna' lie loose on the formation. Farther west, in the Stokes Range (Section 14), the lithology of the formation is again typical. Its thickness there is 180 feet and fossils of the 'Arctic Ordovician fauna' are abundant.

A KLC

In Section 30 at Moses Robinson River the Irene Bay Formation is 30 feet thick, comprising fossiliferous, recessive, green, calcareous shale, with thin limestone interbeds. A few beds of green calcareous shale are interspersed in upper part of the underlying Thumb Mountain Formation. The upper contact of the Irene Bay Formation with a basal dolomite of the Cape Phillips Formation is abrupt but conformable. About 5 miles to the south at Driftwood Bay (Section 31), the lithology is similar and the thickness is 40 feet. At the head of Goodsir Inlet (Section 34) the Irene Bay Formation is 50 feet thick and is recessive. There it is mainly dolomite that is finely crystalline, thin-bedded, medium grey, with greenish shale interbeds. It is probable that this formation has been dolomitized, for the entire underlying Thumb Mountain Formation also is dolomite in this section. At the mouth of Stuart Bay (Section 24) the Irene Bay Formation consists of 50 feet of very soft, non-calcareous green shale with minor shaly limestone interbeds and scattered pyrite crystals. About 8 miles to the south (Section 27) the formation is 65 feet thick and has its typical lithology.

Age and Correlation

In the study area the Irene Bay Formation contains large fossils, mainly cephalopods, corals, receptaculitids, gastropods, and brachiopods. These are not listed here because collections from this formation at numerous other localities have been published earlier (Kerr, 1967b, 1968a). These fossils belong to the 'Arctic Ordovician fauna', which generally is considered to be boreal in origin. It is typified by the faunas of the Red River Formation of Manitoba, Cape Calhoun Formation of northwest Greenland, Bighorn Formation of Wyoming, and several other well-known formations of North America. In view of the uncertainty of precise dating of shelly faunas at this level of the geologic column, the writer will (see Kerr, 1967b) follow Thorsteinsson (1963a, p. 38), who tentatively regarded the fauna as late Caradocian (about Eden and Maysville) in age, and the top of the Irene Bay Formation as the boundary between the Caradocian and Ashgillian. The top of the Irene Bay Formation and Cornwallis Group is at the boundary of the Middle and Upper Ordovician according to the European standard section, whereas according to the North American standard section it lies within the lower Upper Ordovician (Table I).

The Irene Bay Formation is very widespread in the Canadian Arctic Islands, extending over 900 miles from eastern Ellesmere Island to Melville Island. It is a thin unit, with a sharp but conformable upper boundary, which more than any other boundary in the lower Paleozoic rocks here, may approximate a time horizon. This boundary marks a pronounced change in the sedimentary pattern within the study area, and as well over an extensive area in the southern and eastern Queen Elizabeth Islands. Below this boundary there are widespread carbonate and evaporite formations in which lateral variations in thickness and lithology are gradual. Above the boundary the entire succession of rocks up to and including Upper Devonian shows great lateral facies and thickness variations.

UPPER ORDOVICIAN, SILURIAN AND LOWER DEVONIAN

Cape Phillips Formation

The type section of the Cape Phillips Formation is at Cape Phillips on northern Cornwallis Island, and was first described by Thorsteinsson (1958), who divided it into three members. The lower, Member A, comprises mainly dolomite, argillaceous limestone, petroliferous shale, and cherty argillaceous limestone. A persistently developed stratum of dolomitic limestone, 30 to 50 feet thick, marks the base of this member; this is overlain by fissile shale, and then by argillaceous limestone. Member B, overlying Member A with gradational contact, is composed mainly of cherty argillaceous limestone, argillaceous limestone, cherty calcareous shale, cherty limestone, limestone, calcareous shale, and minor amounts of shale. Member B grades imperceptibly into the overlying Member C, which consists of an extremely monotonous succession of alternating calcareous shale, argillaceous limestone, limestone, and shale. Concretions with graptolites occur throughout this member but are most common in the lower beds. Member C is much the thickest and accounts for roughly three quarters of the aggregate thickness of the formation. The thickness of the Cape Phillips Formation at its type section on the north coast of the island is 7,500 feet with no upper contact exposed (Thorsteinsson and Kerr, 1968). Based on information obtained from correlations with other sections they concluded that the maximum thickness of the Cape Phillips Formation in the general area may be on the order of 9,800 feet. The presence of graptolites in the Cape Phillips Formation throughout nearly its entire span indicates that it was deposited under long-persisting euxinic conditions. On Cornwallis Island the entire Cape Phillips Formation grades southward into a thicker succession comprising two formations composed almost entirely of carbonates; the Allen Bay Dolomite and overlying Read Bay Limestone.

The Cape Phillips Formation of Bathurst Island is equivalent, both lithologically and faunally, to Members A, B, and a lower part of Member C of Cornwallis Island.

Distribution, Thickness and Lithology

The Cape Phillips Formation on Bathurst Island is a generally dark grey, graptolitic shaly rock ranging from 1,020 to 2,704 feet in thickness. Near the base it is usually more calcareous and contains interbedded black limestone and dolomite; it becomes increasingly silty toward the top. The formation crops out only in the cores of the more deeply dissected anticlines where it is poorly exposed except in narrow, cross cutting stream valleys. The Caledonian A R. well has penetrated the entire formation. RLL The Cape Phillips Formation is an easily recognizable unit in outcrop because the shale weathers to distinctive grey, paper thin, brittle flakes; streaks of dark yellowish orange occur where dolomite is present in the section.

The most complete and best exposed section of the Cape Phillips Formation in the report area is at Twilight Creek (Section 25, see Appendix and Pl. III). McLaren's (1963b) description of this key section is supplemented by new data and interpretations. The age range shown for the Cape Phillips Formation on Table I is that of the Twilight Creek section. The formation consists of black calcareous shale and mudstone with some argillaceous limestone beds and minor amounts of dolomite. Members were not distinguished but several distinctive lithological units were recognizable. There is a marked difference in thickness between the type section on northeastern Cornwallis Island where a maximum of 9,800 feet was reported, and the Twilight Creek development where little more than 1,500 feet was measured. It is concluded that this is partly because the formation on Cornwallis Island includes younger beds and partly because deposition was more rapid there.

The lowest beds exposed at Twilight Creek in the core of the Stuart Bay anticline consist of 75 feet of black and grey, variably argillaceous fine-grained limestone, with interbedded black calcareous mudstone and shale. Some of the limestone beds are strongly petroliferous and others are nodular, mottled, and micritic. These beds present a strongly banded appearance in the valley sides.

The succeeding 130 feet consist of black calcareous shale with varying amounts of interbedded argillaceous, fine-grained and laminated limestone; this rock weathers to thin flagstones. Above are 360 feet of predominantly black, calcareous mudstones and shales with thin beds of argillaceous limestone in the lower 20 feet. Weathered surfaces are pale yellowish brown to orange-brown in colour.

The upper part of the formation is 950 feet thick. In these beds the faunal zones are more widely spaced and the fossils are less well preserved, indicating more rapid deposition than for the lower strata. The succession consists of black mudstone and shale, which are largely non-calcareous, although dolomitic in the lower part. In the upper 200 feet of the formation the shales are interbedded with equal amounts of thin-bedded and laminated, dark grey, argillaceous to calcareous siltstone that weathers to a pale reddish brown colour.

The Cape Phillips Formation is overlain by the Lower Devonian Bathurst Island Formation at Twilight Creek. The contact is gradational and is drawn where silt and sand begin to become important rock constituents, and shales become subordinate. In fresh exposures in valley bottoms the contact is far from obvious, but where the beds are weathered there is a marked contrast between the thin-bedded shaly character of the typical Cape Phillips beds and the more blocky brown flagstones of the Bathurst Island Formation.

Thorsteinsson and Glenister (1963) described the Cape Phillips Formation in the Driftwood Bay area of eastern Bathurst Island (Sections 30 and 31) where the principal rock types are dark grey to black, calcareous shale, shale, and aphanitic to fine-grained, thin-bedded, argillaceous limestone. Minor constituents include beds of dark grey to black, aphanitic to fine-grained, thin-bedded, cherty limestone and limestone; dark grey to black, cherty, calcareous shale; medium dark grey, fine-grained, medium-bedded, porous dolomite; and medium dark grey siltstone. The chert occurs as nodular replacements and as interbeds of irregular to regular, very thin individual strata. The Cape Phillips Formation is approximately 1,400 feet thick in the Driftwood Bay area. The three members that were recognized in the Cape Phillips Formation on Cornwallis Island probably occur in this part of Bathurst Island. They grade into one another even more imperceptibly than on Cornwallis Island and only Member A is clearly discernible. Most noticeably there is much less chert and only rare limestone concretions. Thorsteinsson and Glenister (1963, p. 589) summarized the members in ascending stratigraphic order as follows:

Member A comprises an alternating series of thin-bedded argillaceous limestone, calcareous shale, shale, cherty limestone, limestone, cherty calcareous shale, dolomitic limestone and dolomite.

Member B is similar to Member A but it is distinguished from it by the predominance of cherty limestone and cherty calcareous shale,as well as by the absence of dolomite and dolomitic limestone.

Member C is formed of calcareous shale and shale with minor amounts of argillaceous limestone and siltstone.

The ~~present~~ writer~~s~~ ~~have~~ has A re-examined and redescribed the section of Driftwood Bay (Section 31). At the base of the Cape Phillips Formation is a unit of dolomite, 50 feet thick, that is the lower part of Member A. It is sugary, mottled, dark grey and grey-brown, and petroliferous. Lower and upper contacts are sharp. This unit is overlain by a poorly exposed interval, 550 feet thick, that includes at the face a thin black fissile shale that is still part of Member A and which contains Pseudogygites sp., and biserial graptolites. The remainder of the unit is thin bedded, very shaly, medium to dark brownish grey cherty limestone, weathering to a light tan brown colour; it is interbedded with much calcareous dark brownish grey, graptolitic shale and siltstone. The unit is recessive and becomes progressively more shaly toward the top. An overlying unit, 800 feet thick, consists of dark grey shale that is very limy, containing limestone interbeds at the base and non-calcareous in upper parts; at the top it grades sharply to the overlying Bathurst Island Formation by appearance of siltstone with a calcareous matrix, and a colour change to moderate brown on fresh surfaces and tan-brown on weathered surfaces. The sections at Twilight Creek (Section 25) and Driftwood Bay (Section 31) are quite similar in thickness, lithology, and faunal distribution.

West of Goodsir Inlet (Section 34) the Cape Phillips Formation is 1,775 feet thick and comprises four units in ascending order as follows. Unit 1 is 155 feet thick, consisting of dark chocolate brown dolomitic shale, calcareous dolomitic siltstone with tan sugary dolomite interbeds, and containing limestone nodules up to one foot in diameter. Unit 2 is a resistant unit 320 feet thick, consisting of shaly chert that is thin to medium bedded and often nodular as well as medium to chocolate brown, cherty dolomite and interbeds of siltstone. The chert in this unit decreases upward. Unit 3 is 400 feet thick, consisting of siltstone that is dolomitic, slightly calcareous and cherty. It is medium dark brown on fresh surfaces weathering tan; the rock is thinly bedded and outcrop is poor and rubbly. Unit 4 is 900 feet thick, consisting of thin bedded to fissile, siltstone, that is medium chocolate brown on fresh surfaces and weathers rusty brown; interbeds of medium to light brown dolomitic siltstone. The entire Cape Phillips Formation here is much more dolomitic and cherty than the shales and siltstones characteristic of the Cape Phillips Formation farther north. The formation grades by increasing amounts of calcareous quartz siltstone interbeds to typical calcareous siltstones of the conformably overlying Bathurst Island Formation.

The Cape Phillips Formation was penetrated in the Caledonian R. well (Section 38, see Appendix) and was described in the well completion report[1] by A. Froelich. The formation was subdivided into three members, which are tentatively correlated with the three members described earlier in the present report. The lower, Member A, has a porous dolomite at the base 44 feet thick; the remainder of the member consists of bituminous shale and limestone, cherty dolomite, cherty limestone, and cherty shale, totalling 720 feet in thickness. Member B consists of marl, limestone, and cherty shale totalling 605 feet. Member C consists of shale, limestone and siltstone, and is 1,325 feet thick. The contact with the underlying member is abrupt and apparently conformable. At the top the formation is transitional into the overlying Bathurst Island Formation. The total thickness of the Cape Phillips Formation encountered in this well is 2,694 feet. The thickness in this well is considerably greater than to the north and in the lower part ~~there~~ is considerably more carbonate, occurs.

---

[1] Dominion Explorers - Canso et al. Bathurst Caledonian R. J-34, completion report; on open file with Canada Department of Indian Affairs and Northern Development.

On the Hosken Islands (Section 13) north of Bathurst Island, the Cape Phillips Formation is only 1,020 feet thick,and five field units were recognized as follows. Unit 1, 30 feet of dark shale containing biserial graptolites, rests conformably on typical rocks of the Irene Bay Formation. Unit 2 is 70 feet of rubbly, petroliferous limestone. Unit 3, 230 feet thick, consists of fissile, sooty, black, recessive shale; in upper parts it grades to thin to medium-bedded hard siltstone. Unit 4, 600 feet thick, consists of thin to medium bedded, very resistant siltstone. Unit 5, 90 feet thick, consists of fissile and recessive shale. Conformably overlying the Cape Phillips Formation in this section is at least 500 feet of the typical Bathurst Island Formation.

On Bathurst Island the Cape Phillips Formation everywhere rests sharply but conformably upon the Irene Bay Formation. The base of the Cape Phillips Formation usually is marked by a thin carbonate unit which comprises about 35 feet of sugary petroliferous mottled dark grey and grey brown dolomite. This carbonate unit is probably a northerly carbonate tongue connected with the Allen Bay Formation. These beds are succeeded conformably by very limy dark grey shales and siltstones in the main part of the formation. In Section 27 a discrete limestone bed 25 to 43 feet thick occurs within the main shale part of the formation about 75 feet above the base. In Section 24 a similar limestone bed is 25 feet thick and occurs 195 feet above the base of the formation. Even greater amounts of discrete limestone occurs in the Cape Phillips Formation in a (A) cursorily examined section at Purcell Bay. Several thin sections of typical Cape Phillips shale were found to be very finely laminated and composed of fine silt or clay size particles of quartz and calcium carbonate in a matrix of brown organic material. The proportion of quartz to calcium carbonate varies considerably, the rock varying from shale to almost a pure limestone. Some of the calcium carbonate is detrital,occurring as discrete particles among the grains of quartz.

Age and Correlation

Following field investigations on Bathurst Island in 1955, Thorsteinsson (in McLaren, 1963b, p. 599) dated the Cape Phillips Formation at Twilight Creek (Section 25) as Ashgillian to Ludlovian. At that time (1955) three subseries of the Ludlovian (lower, middle, and upper) constituted the Late Silurian (see Munch, 1952). The "middle subseries" is now included in a new Late Silurian series, the Pridolian (Bouček et al., 1968; Martinsson, 1969). The "upper" Ludlovian is now regarded as basal Devonian. Thus the lower age limit for the formation still holds, but the world-wide revisions have necessitated changes in the upper age limit (Tables I and II).

Table II - Series and faunas near the redefined Silurian-Devonian Boundary (after Bouček et al., 1968, and Martinsson, 1969).

	SERIES	ZONE
DEV.	GEDINNIAN	Monograptus yukonensis Monograptus uniformis
SILURIAN	PRIDOLIAN (DOWNTONIAN)	Monograptus angustidens Monograptus ultimus
	LUDLOVIAN	Monograptus fecundus Monograptus nilssoni

The lowest fossil collected in the Cape Phillips Formation at Twilight Creek is a graptolite that was collected about 15 to 25 feet above the lowest exposure. It was assigned to Orthograptus n. sp. by R. Thorsteinsson. This species occurs in the basal beds of the formation on Cornwallis Island and Little Cornwallis Island in association with the 'Arctic Ordovician fauna', and is dated as Late Ordovician. The

A ~~present~~ writer~~s~~ confirms from comparison with more complete sections, that the basal beds of the Twilight Creek Section indeed probably are the basal limestone beds of the Cape Phillips Formation.

Graptolites from upper parts of the Cape Phillips Formation have been examined by Thorsteinsson (pers. com., 1971), and certain revisions of identification and dating have been made from those originally reported by him (in McLaren, 1963b). At 760 feet above the base of the Cape Phillips Formation at Twilight Creek is a lower Ludlovian fauna containing Monograptus bohemicus, (GSC loc. 25815). At 970 feet above the base of the Formation (GSC loc. 25820) occurs Monograptus cf. M. transgradiens praecipuus: At 1,500 feet above the base of Section 25 (see Appendix) occurs Monograptus cf. M. uniformis Přibyl (GSC loc. 25824). M. uniformis is now regarded as the index fossil of the lowermost Devonian (Gedinnian). The highest fossils in the Cape Phillips Formation, occurring at a height of 1,510 feet above the base (GSC loc. 25824), were also identified as Monograptus cf. M. uniformis Přibyl. There is doubt about exact placement of the intersystemic boundary at Twilight Creek (Section 25); however GSC loc. 25824, which occurs at the 1,500 foot level in the Cape Phillips Formation and which contains M. cf. M. uniformis Přibyl clearly is close to the boundary. Thus the Silurian-Devonian boundary probably occurs just between GSC loc. 25824 and GSC loc. 25820, which occur respectively at heights of 1,500 feet and 970 feet in Section 25 at Twilight Creek. Based upon the above considerations the maximum age range of the Cape Phillips Formation in the report area, represented at Twilight Creek (Section 25) is from Upper Ordovician (Ashgillian) to Lower Devonian (Gedinnian).

Three facies belts of the Cape Phillips Formation are represented in the report area. On the Hosken Islands in the north (Section 13), the formation is only 1,020 feet thick and probably does not range as young as it does farther south, before being gradationally overlain by the Bathurst Island Formation. In central parts of the area as at Twilight Creek (Section 25) and Driftwood Bay (Section 31), the Cape Phillips Formation is of intermediate thickness, 1,400 to 1,500 feet. It is mainly graptolitic shale, siltstone and fissile shaly limestone, ranging in age from latest Ordovician to early Devonian, and is overlain conformably by the Bathurst Island Formation. Farther south at the Caledonian River well (Section 38) the Cape Phillips Formation is considerably thicker, being 2,694 feet. Its age range here is less certain but it probably occupies about the same span of time as the Cape Phillips Formation in the intermediate belt. In Core No. 2, from Member C, at a height of 1,580 to 1,598 feet in the formation Monograptus transgradiens Perner, and Linograptus sp. were identified by R. Thorsteinsson and dated as the penultimate zone of the Pridolian. The section in the well contains considerably more dolomite and chert than farther north, and is thicker; it resembles the formation on Cornwallis Island (Thorsteinsson, 1958) and Truro Island (Section 41). It would appear that the Bathurst Island Formation gradationally overlaps the Cape Phillips Formation from north to south. Also the Cape Phillips Formation grades southward on Bathurst Island into a more dolomitic section.

The absence of any benthonic fossils or any other evidence of bottom dwelling life within this sequence indicates that stagnant conditions were prevalent; normal marine circulation was cut off over wide areas from the Late Ordovician into the Devonian. Several factors could account for this. Perhaps the growth of carbonate banks on the south and east prevented the normal circulation of the sea, resulting in large areas with stagnant bottom conditions. Another possibility is that the underlying crust began downwarping here more rapidly than in areas to the south and east, which remained as carbonate platforms while the developing basin became starved. It is also possible that both factors combined to produce this isolated euxinic basin.

The lack of coarse clastics in the Cape Phillips Formation indicates the absence of nearby land with any appreciable relief. Detrital quartz increases in amount to the north and is presumably from some unknown area which is now covered by the Sverdrup Basin. Carbonate increases to the south and east where the formation is thickest. Organic material, which makes up another large part of the formation is most prevalent in central regions where the rock is predominantly shale of a euxinic environment.

The Cape Phillips Formation is exposed in central Melville Island, over two hundred miles to the west (Tozer and Thorsteinsson, 1964). To the east it is present on northern Cornwallis Island (Thorsteinsson and Kerr, 1968), and also on Ellesmere Island to the northeast (Thorsteinsson and Kerr, 1962). On central Cornwallis the Cape Phillips Formation changes abruptly southward to dolomite of the Allen Bay Formation (Thorsteinsson, 1958). Similar abrupt facies changes to carbonates are present in southwest Ellesmere and on western Melville Island (Tozer and Thorsteinsson, 1964). On Grinnell Peninsula of Devon Island, a few miles to the northeast of Bathurst, equivalent rocks are also in a carbonate facies (Thorsteinsson, 1963c) as they are on Prince of Wales Island (Blackadar and Christie, 1963). Thus, the black shale facies of the Cape Phillips Formation on Bathurst is enclosed, at least to the east and south, by a carbonate facies.

LOWER DEVONIAN

Sherard Osborn and Driftwood Bay Formations (Abandoned)

A brief review of some aspects of Lower Devonian stratigraphy is necessary because early work of Thorsteinsson and Glenister (1963) has been revised in this paper (see Fig. 6). Thorsteinsson and Glenister (op. cit.) measured two sections in the Driftwood Bay area of eastern Bathurst Island, and set up a composite stratigraphic column for the region that is shown in figure 6a. Because of structural complications their interpretation of stratigraphic relationships of Devonian rocks was incorrect. The revised section for this area is shown in figure 6b.

At Ptarmigan Creek Thorsteinsson and Glenister (1963, Fig. 50) interpreted a contact at their locality G to be an angular unconformity separating the Ordovician Cornwallis Formation from an overlying Silurian or Devonian sandstone that they called the "Driftwood Bay Formation". The "Driftwood Bay Formation" in turn was regarded as overlain conformably by Middle Devonian limestone of the Blue Fiord Formation. They thought that this unconformity dated the orogeny that produced the Cornwallis Fold Belt. We have reinterpreted their unconformity as a fault. The sandstone unit named the "Driftwood Bay Formation" at their locality G is preserved in a small graben, and is separated from both the Cornwallis Formation and the Blue Fiord Formation by faults. It probably is part of the Griper Bay Formation, for when traced to the north, it rests unconformably on the Bird Fiord Formation. The name "Driftwood Bay Formation" has been discarded, and the sandstone unit is regarded as probably Griper Bay Formation.

Thorsteinsson and Glenister (1963, pp. 591-2) also named the "Sherard Osborn Formation" to include a sequence of mixed rock types resting on the shales of the Cape Phillips Formation at Nightfall Creek (a branch of Moses Robinson River). It is now felt that the lower part of the Sherard Osborn Formation is part of the Bathurst Island Formation (McLaren, 1963b), and the upper part is the Disappointment Bay Formation of Thorsteinsson (1958). The two are separated by an unconformity in Nightfall Creek. The name Sherard Osborn Formation was abandoned because it is unnecessary and because of the unconformity that it contains in the type area.

Bathurst Island Formation

The Bathurst Island Formation is widely exposed in the eastern part of the report area. Its type section is at Twilight Creek (Section 25), where the formation was originally described by McLaren (1963b, p. 604) as fairly fine-grained quartzose sandstones, variably argillaceous and calcareous, and calcareous mudstones. The thickness in the Twilight Creek Section is 3,410 feet.

The base of the type section of the Bathurst Island Formation is of Early Devonian age, for the formation rests upon Lower Devonian rocks of the Cape Phillips Formation, and also has yielded Early Devonian graptolites (<u>see</u> Appendix). The type section is succeeded with apparent conformity by the Stuart Bay Formation, which resembles it in gross lithology, the contact being drawn at the base of the lowest of three limestone pebble beds. The top of the Bathurst Island Formation is diachronous, being youngest in the west (Figs. 4 and 5). In eastern Bathurst Island the formation is Lower Devonian everywhere; it is thinner than farther west and contains westerly projecting tongues of thin limestones and pebble beds in the upper part. These shallower water features are the first evidence that a new pattern of sedimentation was beginning, in which the Cornwallis Fold Belt was active. On the eastern side of the island the Bathurst Island Formation is overlain unconformably by the Lower Devonian Stuart Bay Formation. In westerly exposures this interval was represented by widespread continuous sedimentation, except in one and perhaps more local areas where there is local angular unconformity separating it from the overlying Stuart Bay Formation.

Distribution, Thickness and Lithology

The Bathurst Island Formation is widely exposed in the eastern and central part of the report area, where it forms rounded grey-brown coloured hills and ridges. Good exposures are restricted to cross-cutting stream valleys. Due to the considerable thickness of this unit there are very few sections in which both the base and the top are exposed, so that complete thicknesses were rarely obtainable.

In central parts of the Bathurst Island group the Bathurst Island Formation is composed almost entirely of silt-sized detrital material, but ranging in grain size from shale to sand with minor carbonate cement. It is a rather monotonous alteration of clastic rock types (Pl. IV). The rock types alternate between paper thin, olive brown to black, calcareous and micaceous shales, and flaggy 2-inch to 1-foot beds of fine-grained lithic arenite flagstones, siltstone and shale, with minor interbeds of dolomite and limestone. The formation is a flysch-like deposit exhibiting graded bedding. It is sparsely fossiliferous, containing only few graptolites, tentaculitids and small amounts of calcareous skeletal debris.

In eastern parts of Bathurst Island, marked facies variations in the upper part of the Bathurst Island Formation and overlying Stuart Bay Formation signify major tectonic events in and surrounding the basin. At Scoresby Hills, west, (Section 35, Fig. 5) only the uppermost 1,600 feet of the Bathurst Island Formation is exposed above a fault. The section consists predominantly of graded beds. The lowest layers of each bed consist of a mixture of coarse sand-sized quartz grains, and calcareous skeletal debris of various types (including crinoid stems, tentaculitid, mollusc, and other shell fragments. Each grades upward to silt size quartz particles and finally to dark brown or black calcareous silty shale (see Pls. Va, b, and c). Ungraded intervals of well laminated, grey to black calcareous shale, siltstone, and fine-grained quartz sandstone also occur throughout. In the upper part of Bathurst Island Formation distinctive but gradational changes in lithology and texture take place, as graded units decrease in abundance and are finally absent. Thin layers of detrital skeletal limestone and rare intervals of lump-pellet limestone are interbedded with the clastics. In these eastern areas (e.g. Sections 33 and 35) the contact with the overlying Stuart Bay Formation is drawn beneath the oldest patch reef or conglomerate bed. The reefs are discontinuous bodies usually less than 40 feet thick, containing stromatoporoids, corals, and brachiopods, and having dolomite, chert and limestone boulders up to 4 feet in diameter.

In Section 30, the Bathurst Island Formation rests gradationally upon the Cape Phillips Formation and is 525 feet thick. It is chocolate brown, fine-grained, argillaceous and calcareous, quartzose siltstones, and calcareous mudstones.

At the head of May Inlet there was local erosion of the Bathurst Island Formation from a small domal uplift before deposition of the Stuart Bay Formation. This is shown by the great thickness contrast in a distance of 2 1/2 miles between Sections 27 and 28 (Fig. 5).

The lowest rocks exposed on Helena Island (Section 12) are assigned to the Bathurst Island Formation. This is 1,000 feet thick, consisting of thin bedded quartzose, calcareous siltstone that is dark grey weathering to slightly brownish grey, and in places containing limestone nodules. These rocks, which are overlain by the Eids Formation, were assigned to the Bathurst Island rather than the Stuart Bay Formation because there is no evidence of pebble or reefal intervals. Moreover this assignment is in keeping with observed trends, which show that the Stuart Bay Formation thins and probably disappears to the north (Fig. 4) and to the west (Fig. 5).

The Bathurst Island Formation for the most part is a generally uniform unit of fine-grained calcareous quartz siltstone, which was spread widely throughout the report area. It varies greatly in thickness (Figs. 4 and 5) largely because of the greatly varying age of its upper contact. The formation represents a basinal, deep water deposit of graded beds, and only in upper part of the formation, in the southeastern parts of the area, is there evidence of shallowing.

The largely pelagic nature of the Bathurst Island Formation indicates a deep basinal environment into which much of the sediment was transported by turbidity currents. The origin of the skeletal debris found in the graded sediments is probably from shelf areas to the east and south, where material was swept off periodically into the basin, perhaps as a result of the unstable nature of this area which was undergoing uplift. The black organic material within the shale probably originated in place or was carried in from any direction. The origin of the clastic quartz grains which make up a large part of the formation is problematical. Much of it was perhaps derived from the north, because equivalent rocks to the east, west, and south, are at least in part in a carbonate facies.

Age and Correlation

Thorsteinsson (in McLaren, 1963b, p. 605) identified two new species of monograptids from the Bathurst Island Formation at Twilight Creek (Section 25). One species occurring at a height of 3,000 feet above the base of the formation was identified as Monograptus n. sp. aff. M. hercynicus Perner. M. hercynicus was formerly regarded as indicative of an upper Ludlovian age; it is now considered Siegenian (Lower Devonian) in age (Jaeger, 1962, p. 127). The other, occurring at heights of from 2,490 to 3,310 feet above the base, was originally called Monograptus n. sp. A; however, Thorsteinsson now (pers. com., 1971) regards the species as Monograptus yukonensis Jackson and Lenz 1963, which is late Siegenian to early Emsian in age. The Gedinnian and Siegenian age assignment of the Bathurst Island Formation at Twilight Creek is based in part upon the monograptids, and in part upon the stratigraphic position of the Bathurst Island Formation, above the Cape Phillips Formation and below the Stuart Bay Formation.

In Section 20 McGregor and Uyeno (pers. com., 1971) dated the Bathurst Island Formation as probably Siegenian, from microfossils. In the north and west the formation includes much younger rocks, there containing equivalents of the Stuart Bay Formation. In the west (Section 15, Fig. 5) this was determined largely by lateral tracing of beds. In the north (Section 12, Fig. 4) this was determined from the fact that the formation is overlain directly by the Eids Formation and lies within 300 feet of the Eifelian and Givetian Bird Fiord Formation. Thus in the extreme north at Section 12 the Bathurst Island Formation probably ranges up into Emsian parts of the Lower Devonian.

Stuart Bay Formation

The Stuart Bay Formation is largely dark grey, calcareous, quartz siltstone and fine-grained sandstone, and evaporitic dolomite; usually at the base there is a pebble or boulder conglomerate or reef conglomerate. The formation has yielded shelly faunas and graptolites of late Early Devonian (Siegenian and Emsian) age. In eastern Bathurst Island two members are separable in the formation. The lower is siltstone and thin bedded dolomite with coarse boulders of chert, dolomite, and limestone as well as reefoid horizons, red dolomitic siltstone, and other shallow water features. It is unconformable upon the Lower Devonian Bathurst Island Formation. The upper member is dolomite and dolomitic siltstone that is quartz sandy.

Both lower and upper members grade westward and northward to a mainly siltstone section of which Twilight Creek (Section 25) is typical. Farther west it grades into and is inseparable from the Bathurst Island Formation. The basal unconformity disappears westward where the Stuart Bay Formation is concordant with the Bathurst Island Formation except for a small area at the head of May Inlet. Here the Stuart Bay Formation rests with local angular unconformity upon the Bathurst Island Formation and is separated from it by an intra-Lower Devonian unconformity (Fig. 5).

Distribution, thickness and lithology

The Stuart Bay Formation was described by McLaren (1963b) with the type section in Twilight Creek (Section 25) near Stuart River. It resembles the underlying Bathurst Island Formation in gross lithology, and consists largely of calcareous, argillaceous sandstones, with some sandy mudstones and siltstones, and irregular beds of bioclastic limestone. The base of the formation was drawn beneath the lowermost pebble beds; the pebbles are well rounded grey chert and brown aphanitic limestone in a calcareous sandy matrix. They mark a change from graded beds of the Bathurst Island Formation to slightly coarser and more limy rocks. Along strike the pebble beds grade into irregular beds of pale-brown, fine-grained limestone. The upper contact is sharp, but conformable with the overlying Eids Formation.

In western parts of the area the Stuart Bay Formation is much like the underlying Bathurst Island Formation in rock type, weathering characteristics, and physiographic expression. They have been mapped separately because of the intervening pebble conglomerate and because the Stuart Bay consists of somewhat coarser detritus, which when traced eastward rests unconformably on progressively older rocks. The writer followed McLaren in drawing the base of the Stuart Bay Formation at the lowest pebble beds. Where the pebble beds are absent locally the contact was projected from where it is known along strike. In eastern and southern parts of Bathurst Island the Stuart Bay Formation rests with angular unconformity on older rocks; the top of the formation also is at an unconformity with the overlying Disappointment Bay Formation.

In central and western parts of Bathurst Island (Sections 25 and 28) the Stuart Bay Formation consists of tan, brown and grey, one- to six-inch beds of calcareous and argillaceous, fine-grained quartzose siltstone, interbedded with sandstone and grey to black, micaceous, sandy mudstone. Lenses of dark grey, micritic to skeletal limestone that abruptly pinch and swell from less than one to several feet in thickness are interbedded in the mudstone, siltstone and sandstone. Conglomerate beds, from 6 inches to 2 feet thick and containing chert and limestone pebbles, are present near the base of the formation. The type section at Twilight Creek (Section 25) is marked by three of these horizons which do not persist any great distance laterally. Indeed, this entire sequence of varied rock types has no distinctive horizons that can be traced very far. The different rock types grade into one another or are lenticular and pinch out in short distances. A thick interval of sandstone or limestone may be observed on one flank of a fold but may be absent on the other.

In the southern part of the map area at Dyke Ackland Bay (Section 42) the Stuart Bay Formation is 1,850 feet thick, and both lower and upper contacts are unconformities. In ascending order it comprises: (1) quartz sandstone, dolomitic (100 feet); (2) quartz sandstone, grading up to dolomitic siltstone (125 feet); (3) dolomite, with limestone interbeds (575 feet); (4) dolomite light coloured (200 feet); (5) dolomite, dark coloured (150 feet); (6) dolomite, dark weathering (700 feet). It is not known just which part of the total original formation the preserved interval represents.

A restored section drawn from west to east illustrates stratigraphic relations in the Stuart Bay Formation (Fig. 5). East of May Inlet on the south limb of the Half Moon Bay structure (Section 27), the Stuart Bay Formation is 1,460 feet thick. At the base is a conglomerate about 100 feet thick with pebbles of white chert and crinoidal fragments in a siltstone matrix. The underlying Bathurst Island Formation was eroded locally prior to Stuart Bay deposition and is 2,000 feet thinner than it is a mile or two to the east where the conglomerate is absent. This angular unconformity is probably quite local, because traverses across the contact farther west failed to show any evidence of a break in sedimentation. The basal contact gradationally overlaps westward. Limestones, pebble beds and coarser clastic sediments ~~are~~ represent an influx from the east ~~that~~ These units die out ~~disappear~~ westward, and are ~~being~~ absent at Dundee Bight (Sections 15 and 16), where it accordingly is difficult to separate the Stuart Bay and Bathurst Island Formations. In the west the Stuart Bay Formation represents with a minor exception (Section 27), a continuation of the siltstone sedimentation of the Bathurst Island Formation, with only minor influxes of pebbles from the uplifted and deformed Cornwallis Fold Belt to the east.

The thickest section of the Stuart Bay Formation is 6,892 feet thick and occurs just off the west flank of the Cornwallis Fold Belt (Section 35, see Appendix and Fig. 5). The contact with siltstones of the underlying Bathurst Island Formation is below the lowest reef limestone and conglomerate interbed, 0 to 40 feet thick. Two members are present in this section. The lower member is dolomitic siltstone with interbeds of limestone and chert boulder conglomerate, reef limestone, and dolomite. The upper member is mainly dolomite, with quartz sandstone and pebble conglomerate interbeds that increase in abundance upward. The trend in the Stuart Bay Formation ~~in~~ A this section is to even shallower deposition upward, culminating in emergence and unconformity that is overlain by the Disappointment Bay Formation. In Section 34 only the lower member of the Stuart Bay Formation is present; the formation here is quite dolomitic siltstone and contains abundant patch reefs at two levels. These crop out as high stack-like erosional remnants that are aligned (Pl. VI). The formation is thin here and rests on a marked angular unconformity. Conglomerate lenses of chert and limestone pebbles are present. This section represents an encroachment eastward onto an unconformity.

At Moses Robinson River (Section 30), the Stuart Bay Formation is 550 feet thick and is separated from underlying and overlying formations by unconformities. The formation comprises mainly shaly, bioclastic limestone, that is thin- to medium-bedded, light grey, to slightly brownish or dark grey brown; interbeds of chocolate brown, calcareous shaly siltstone are abundant.

At Young Inlet east (Section 20, Pl. VII and Fig. 4) the Stuart Bay Formation includes numerous ~~commonly contains~~ conglomerate lenses that contain pebbles and boulders of chert and limestone. Most of the limestone boulders are composed of algae, stromatoporoids, corals, and other reef building fossils. There are rare layers of conglomeratic mudstone whose internal structure suggests that they are soft sediment mud flows.

Beds of fine to medium-grained quartz sandstone 6-12 inches thick, and locally ripple-marked, are interbedded with light grey skeletal, pellet and detrital limestone. In some areas quartzitic dolomite forms an important part of the section. Many limestone clasts contain corals, pellets, oolites and other evidence of shallow water origin.

The chert making up a large part of the conglomerate of the Stuart Bay Formation probably had its source in the Cape Phillips Formation which is very cherty in the area of the Cornwallis Fold Belt. The reefoid limestone boulders probably are the product of reefs that fringed the Cornwallis Fold Belt and were later eroded during subsequent uplift.

The variety, succession and distribution of rock types in the Stuart Bay Formation (Fig. 5) indicates unstable tectonic conditions ~~at~~ on the Cornwallis Fold Belt. The Cornwallis Fold Belt is an area that was high relative to flanking regions. At times the entire area may have been uplifted, with the fold belt being uplifted more than the flanking basins. At other times there may have been general subsidence, with the fold belt subsiding less, and still behaving relatively as a positive feature. Uplift began while the Bathurst Island Formation was being deposited, and accelerated during the deposition of the Stuart Bay Formation. Abnormally great thicknesses accumulated just west of the Cornwallis Fold Belt (Section 35) because of the extreme relief that existed there. The fold belt and uplift plunged more gently to the north for the northward increase thickness ~~increase~~ ~~in~~ of the Stuart Bay Formation is much more gradual in that direction and the total thickness also is less. The Stuart Bay Formation evidently was related to the Boothia Uplift and Cornwallis Fold Belt and probably was not deposited in northern and western parts of the report area where it gradationally overlaps and grades into the Bathurst Island Formation. The first sign of uplift was shallowing of water, shown by

(A) A

limestone and/or conglomerate interbeds at the base of the Stuart Bay Formation. As uplift continued, erosion removed parts of older formations in the east, spreading the detritus westward as conglomerates of the Stuart Bay Formation. As relative uplift diminished, ~~upper parts~~ younger sediments of the Stuart Bay Formation encroached back eastward onto the fold belt. Stratigraphic relationships suggest local and erratic pulses of uplift and accompanying erosion, rather than a constant and uniform rise of a single large land mass.

Age and Correlation

Faunas collected from limestone and pebble beds between the base and 570 feet in the type section of the Stuart Bay Formation (Section 25, GSC locs. 25834, 25836, and 25835) were regarded by Cumming as Early Devonian (McLaren, 1963b, p. 607). Boucot, Johnson, and Harper confirm an Early Devonian age ~~but~~ and date them more precisely as probably Emsian (pers. com., 1971; see Appendix). This type section has not been shown on a restored section but it probably is similar in stratigraphic relationship to Section 20 (Fig. 4) and Section 28 (Fig. 5). In Section 34 (see Appendix) three collections were made from a 60 foot thick reef knoll at a height of 100 to 160 feet above the base (Pl. VI and Fig. 5, GSC locs. 67038, 67039, and 67040). These collections were identified by J.G. Johnson who dated them as early Siegenian, ~~but~~ or more precisely as Quadrithyris Zone age. Shelly faunas from Sections 32 and 33 have been identified by Boucot and Johnson (pers. com., 1971). In Section 33 a prolific fauna occurs 350 feet above the basal unconformity (GSC loc. 67141), and was dated as Early Devonian (probably early Siegenian, Quadrithyris Zone). Another prolific shelly fauna occurring at a height of 705 feet above the base of the formation in Section 33 (GSC loc. 67145) is probably early Emsian. Three graptolite faunas are interbedded between the shelly faunas of Section 33, and are GSC locs. 67142, 67143, and 67144, and have not yet been studied.

In Section 32 (see Appendix), a silicified faunule 1,025 feet below the top (GSC loc. 59037) is Emsian; a collection 1,570 feet below the top (GSC loc. 59036 is probably early Emsian; and a collection at 1,960 feet below the top (GSC loc. 59035) is Siegenian or Emsian.

At the base of Section 30 (GSC loc. 67004) is Leptaenopyxis cf. bouei Barr., and Icriodus pesavis, which Johnson and Uyeno (pers. com., 1971) date as Siegenian. Higher in this section are shelly faunas dated by Boucot and Johnson as early Devonian (see Appendix). McGregor and Uyeno (pers. com., 1971) have collected spores and conodonts in the Stuart Bay Formation at Section 20. They dated it as mostly Emsian, with possibly some late Siegenian at the base (see Appendix). The age of the Stuart Bay Formation is Siegenian and Emsian (Table I). The lower contact apparently is diachronous; it is oldest just west of the Cornwallis Fold Belt in deeper parts of the basin, and becomes younger toward the west as far as the formation can be traced.

LOWER AND MIDDLE DEVONIAN

Disappointment Bay Formation

The type section of the Disappointment Bay Formation was designated by Thorsteinsson (1958, p. 105) on northern Cornwallis Island, where it rests on an angular unconformity. The formation was restudied on Cornwallis Island by Thorsteinsson and Kerr (1968) who differentiated three principal lithofacies that generally represent the formation: a basal conglomerate ranging from 0 to 400 feet in thickness and bearing chert clasts; a middle unit that is mainly dolomite with minor quartz sandstone and conglomerate; and an upper unit that is mainly dolomite and commonly porous. Thorsteinsson and Kerr (1968) considered the formation to be Middle Devonian; however, since that time Thorsteinsson has collected fossils from the formation on Cornwallis Island and these have been dated by J.G. Johnson as Emsian (pers. com., 1971). The Disappointment Bay Formation of Bathurst Island is strikingly similar to the same formation of Cornwallis Island. On Bathurst Island it is dated as late Lower Devonian (Emsian) and probably Middle Devonian (Eifelian), from fossils in enclosing and equivalent formations. Thorsteinsson and Kerr would tentatively reassign the Disappointment Bay Formation of Cornwallis Island a similar Emsian and Eifelian age.

Distribution, Thickness and Lithology

A complete section of the Disappointment Bay Formation is well exposed at Moses Robinson River (Section 30, Fig. 4), where it is 610 feet thick. It lies unconformably upon the Stuart Bay Formation, and has a basal sandstone 10 feet thick. The remainder of the formation is dolomite, very light grey to cream, weathering light yellowish cream, finely crystalline, medium- to thick-bedded. It grades upward to limestone of the overlying Blue Fiord Formation. The basal clastics vary greatly in thickness, 3 miles south of Section 30 being as much as 100 feet of conglomerate. Farther south near Polar Bear Pass (Section 33) the basal clastics are 500 feet thick and are interbedded with dolomite. Northward from Section 30 the Disappointment Bay Formation increases gradually in thickness, being 1,300 feet thick at Section 22. It is cream coloured dolomite that is generally porous throughout, being vuggy at the base and more finely porous upward. Both lower and upper contacts are conformable. No fossils ~~could be~~ were found in the above sections.

South of Bracebridge Inlet two sections of the Disappointment Bay Formation were examined. At Misty River (Section 39) the formation is very poorly exposed and is represented almost entirely by felsenmeer. The basal contact is not exposed, but regional mapping suggests that it probably is an angular unconformity. It is estimated that the formation is 1,150 feet thick. The lower unit, 650 feet thick, comprises about 80% dolomite, that is very light tan, fine-grained, with quartz sand in the upper part; it contains about 20% quartz sandstone, that is fine grained, dolomitic, and slightly calcareous. An upper unit, 550 feet thick, is sandy dolomite with dolomitic sandstone interbeds. The upper contact with the Eids Formation is covered but is probably conformable. At Dyke Ackland Bay (Section 42) the Disappointment Bay Formation is 2,000 feet of dolomite. This abnormally great thickness may be explained by the fact that the partly equivalent Eids Formation is not present and that the entire interval is probably represented instead by the Disappointment Bay Formation.

The Disappointment Bay Formation is a distinctive, resistant unit on Bathurst Island. In the north, exposure is good along creeks; however, in the south part of the island it is nearly all felsenmeer (Pl. VII), and underlies wide areas of the plateau country. The formation is commonly entirely dolomite, with textures that vary considerably from place to place. The base of the formation varies from a thin to thick discrete basal clastic unit to a gradational contact. Where there are basal clastics they grade upward into dolomite. The dolomite varies from very fine- to microcrystalline dolomite, to a coarse, vuggy, dolomite. Porous beds are common and sometimes are stained with bitumen and smell petroliferous. Rare beds are brecciated, typical of carbonate deposits in which evaporite horizons have been leached out. Fossils occasionally are preserved as vague outlines or internal casts,but in general the dolomitization has obliterated all primary structures and textures. Near the top of the formation beds of micritic and pellet limestones are interbedded with the dolomite, and within a few tens of feet the formation grades to limestone of the overlying Eids or Blue Fiord Formations.

In the present study area the Disappointment Bay Formation is restricted to areas on and near the Cornwallis Fold Belt. It grades ~~out~~ westward into the Eids Formation. In the extreme south and east the lower contact is an angular unconformity or disconformity, and this becomes a conformable contact north and west (Figs. 4 and 5). The upper contact with the Blue Fiord Formation apparently is gradational and conformable everywhere. The Disappointment Bay Formation is a shallow water facies, mainly dolomite. It has a basal conglomerate that filled pre-existing topographic lows. The formation was deposited on and near the Central Stable Region in the south, but near the eastern shore of the island it extends well toward the northern coast where its distribution roughly coincides with the position of the elevated Cornwallis Fold Belt (Fig. 7).

The basal unconformity and facies patterns indicate clearly that the Disappointment Bay Formation was deposited by a sea that transgressed from the west and finally covered the older structural highs along the east coast of Bathurst Island (Figs. 4 and 5). Primary textures and structures indicating the depositional environment are very sparse, but available evidence suggests that the Disappointment Bay is a very shallow marine sequence. The dolomite grades westward to shaly and dolomitic limestone of the Eids Formation. These facies relationships indicate a change from a shallow platform in the east to a gradually deepening basin to the west.

Age and Correlation

Although ~~The~~ Disappointment Bay Formation of Bathurst Island lacks diagnostic fossils, ~~but~~ it ~~nevertheless~~ is dated as Emsian and Eifelian. from ~~Dating and correlation are by~~ the ages of enclosing and equivalent formations that have abundant faunas. The Eids Formation of Section 20 at Young Inlet has been dated by McGregor and Uyeno as Late Emsian and Eifelian (in press). The lower part of this formation is traceable laterally into the upper part of the Disappointment Bay Formation of Section 22 (see Fig. 4). The underlying Stuart Bay Formation of Section 20 has also been dated by McGregor and Uyeno as Sigenian-Emsian. It therefore can be stated that the Disappointment Bay Formation of Section 22 is of Emsian and Eifelian age. Trilobites were discovered by Ormiston (1967, p. 18) in the Eids Formation at Twilight Creek, and on this evidence he favoured an Emsian age for the Eids Formation of eastern Bathurst Island. Apparently what he regarded as the Eids Formation at that time includes both Eids and Disappointment Bay Formations as presently considered. A

Because the basal Disappointment Bay Formation and upper parts of the Stuart Bay Formation of eastern Bathurst Island are Emsian, it is possible to date as Emsian the angular unconformity that separates them (Table I), and as well the short pulse of deformation of the Cornwallis Fold Belt that it reflects. As submergence of the fold belt occurred and the Disappointment Bay Formation was deposited upon it, the basin evidently became deeper toward the west where the Eids Formation was deposited. Whereas the Disappointment Bay Formation is a shelf type rock deposited in shallow water, the Eids is predominantly shaly and silty limestone and calcareous shale.

Eids Formation

The Eids Formation at its type section on southwestern Ellesmere Island (McLaren 1963a) is largely limy shale, limy siltstone, black calcareous mudstone, minor dolomitic and minor bioclastic limestone. The formation is recessive and forms low-lying, gently undulating terrain. It is underlain by dark grey shales of the Cape Phillips Formation (Kerr, 1968b), and the contact is transitional. The top of the type section, transitional into the overlying Blue Fiord Formation, is at the base of the lowest well-developed limestone, and is a diachronous boundary.

The Eids Formation also was reported on Bathurst Island (McLaren, 1963b), where at Twilight Creek (Section 25) it is 1,050 feet thick. The Eids Formation there is recessive, consisting largely of grey limy mudstone and shales, with some beds of argillaceous limestone, and is often gypsiferous. The contact with the underlying Stuart Bay Formation is fairly sharp, however, the upper contact with the Blue Fiord Formation is transitional.

The Eids Formation is of late Lower and early Middle Devonian age on Bathurst Island (Table I). It is the basinal equivalent of nearly all of the Disappointment Bay and Blue Fiord Formations of the shelf. Two facies of the formation have been separated on Bathurst Island. In deeper western parts of the basin it is mainly recessive limy shales. Farther east, where it is transitional with the Disappointment Bay Formation, it is resistant, siliceous, dolomitic limestone. Both facies are thin bedded, but the western facies is recessive and the eastern is resistant.

Distribution, Thickness and Lithology

The Eids Formation, restricted to the north-central and northwestern parts of the report area, constitutes two facies that interfinger with each other (Figs. 5 and 7). Thin sections of rocks representing both facies of the Eids Formation are shown ~~as~~ in Pl. IX. The typical facies of the Eids occurs in the western or deeper parts of the basin.; ~~It is~~ this comprises thin bedded~~, containing~~ calcareous siltstone, limy shale, soft grey to green calcareous micaceous shale, and minor ~~thin-bedded~~ shaly limestone. Gypsiferous layers are present in basal parts of this sequence west of Young Inlet. The typical facies is thin bedded, very recessive, and characteristically breaks readily underfoot with a soft crumbly sound. It characteristically forms valleys that are eroded out along the strike, and contain streams. Solifluction slopes are common and there are few fresh exposures except in cross cutting streams. The type section of the Eids Formation of southwestern Ellesmere Island (McLaren, 1963a) as well as the key section of the Eids Formation of Bathurst Island at Twilight Creek (Section 25), belong in this facies. X-ray analysis of a specimen of this facies [Pl. X (a); see also Appendix, Section 28] shows the composition; calcite 49%, quartz 34%, dolomite 6%, illite 5%, feldspar 3%, kaolinite 2%, pyrite 1%, and a trace of chlorite.

The transitional facies of the Eids Formation is largely carbonate and resistant. It grades westward into the typical facies of the Eids Formation, and grades eastward into the Disappointment Bay Formation (Fig. 7). The transitional facies is characterized by thin bedded shaly and siliceous limestone, shaly and siliceous dolomite, and limy mudstone. It is very resistant and breaks underfoot with a clinkery sound. In the transitional facies in central Bathurst Island, the lower part is a resistant thin-bedded to fissile, tan to black, siliceous dolomite while the upper part is more limy. Still farther east along the eastern coast of Bathurst Island the lower part grades to dolomite of the Disappointment Bay Formation, and the upper to limestone of the Blue Fiord Formation.

X-ray analysis of specimens from the transitional facies of the Eids Formation in Section 20 (see Appendix) are as follows: Specimen 8385-calcite 66%, quartz 28%, dolomite 3%, illite 2% and kaolinite 1%; Specimen 8386-calcite 80%, quartz 17%, and dolomite 3%.

The incompetent nature of the Eids Formation in the west and its gradation to resistant beds farther east has had an important bearing on subsequent structural deformation within the study area as will be pointed out in a later chapter. The two facies of the Eids Formation were not differentiated on the geologic map (Map 000A) but have been shown in plan view (Fig. 7) and in a restored section (Fig. 5).

A key section of the typical facies of the Eids Formation is at Twilight Creek (Section 25), where McLaren, (1963b) described the formation as 1,050 feet thick, largely grey calcareous mudstones and shales with some beds of argillaceous limestone weathering pale grey brown. Together with the Blue Fiord Formation it forms a prominent marker on air photographs. A similar section of the typical facies of the Eids Formation occurs at Half Moon Bay, west (Section 27). Here the Eids is about 1,400 feet thick ~~and~~ lies conformably on the Stuart Bay Formation, and is overlain conformably by the Blue Fiord Formation. It is quartz, siltstone and mudstone that is very limy medium grey to tan, crumbly, recessive with gypsiferous intervals. Limestone interbeds occur near the top and the formation grades abruptly to limestone of the overlying Blue Fiord Formation. Cross laminae occur near the base, where it is gradational with the underlying formation.

At Young Inlet, east (Section 20, see Appendix), the entire Eids Formation is of the transitional type, and is 1,845 feet thick. The lower 1,000 feet is thin bedded to fissile shaly limestone that is very siliceous; it contains occasional chert nodules; dark brown on fresh surfaces and weathers very light brownish grey. It has a sharp clinkery sound upon being struck with a hammer or stepped upon. The upper 845 feet, gradational with the lower, is quite similar except in being thin to medium bedded. It is dark chocolate brown shaly and siliceous limestone and calcareous mudstone, which exhibits a conchoidal fracture on broken surfaces and weathers light brownish grey. The transitional facies of the Eids Formation is a prominent marker on air photographs because of its light weathering colour and because it stands out as a resistant unit compared to the overlying and underlying formations. This resistant characteristic contrasts with the recessive behaviour of the typical facies of the Eids.

Certain sections of the Eids Formation contain substantial representation of both facies through interfingering. A fine example of this situation is at Heart Lake (Section 36) where the formation is 1,900 feet thick. Here the lower 600 feet of the Eids Formation is of the transitional facies, the succeeding 1,025 feet of rock belongs to the typical facies, and the uppermost 275 feet belongs to the transitional facies. Both upper and lower contacts of the Eids Formation are gradational in all sections.

The Blue Fiord Formation grades into the Eids Formation in such a way that the contact is younger to the west and north (Fig. 4). It seems clear that the Cornwallis Fold Belt which had been high earlier, continued to be relatively high, and with shallow water during deposition of the Eids Formation allowing the Disappointment Bay Dolomite and Blue Fiord Limestone to be deposited upon it. McLaren (1963b) reported two fragmentary faunas in the Eids Formation at Twilight Creek (Section 25) and dated the formation there as Lower or Middle Devonian. In the same section Ormiston (1967, p. 18) discovered trilobites 90 feet above the base of the Eids Formation and regarded the formation as Lower Devonian (probably Emsian). Conodont collections from the base and at a height of 20 feet in the Twilight Creek section are regarded by Uyeno (pers. com., 1971, and see Appendix) as Emsian. A lower age limit of Emsian for the base of the Eids Formation at Twilight Creek is thus obtained reliably from the contained fossils, and from the Emsian dating of fossils in the underlying Stuart Bay Formation (see Appendix).

Conodonts and spores collected at various levels in the Eids Formation at Young Inlet, east (Section 20, Fig. 4) led McGregor and Uyeno (pers. com., 1971) to date the formation there as late Emsian and Eifelian and to state (in press) that at least the upper two thirds of the formation is Eifelian in age. The Eids Formation commonly contains Tentaculites sp. and Styliolina sp., and at Young Inlet, southeast (Section 21) that genus is particularly abundant. Stratigraphic evidence suggests that the basal beds of the Eids Formation at Twilight Creek and Young Inlet, east, may be about the oldest beds of the Eids Formation on Bathurst Island (Fig. 4).

The Eids Formation of Helena Island (Section 12, Fig. 4) is thin, but probably contains the youngest beds of the formation exposed in the map-area. No fossils were found in the formation but a tentative upper age limit of Eifelian is assigned to it for the following reasons. The formation lies conformably below the Bird Fiord Formation which widely is of Eifelian and Givetian age; moreover it is the lateral facies equivalent of the uppermost Blue Fiord Formation, which is as young as Eifelian.

In the present map-area the Eids Formation is of Emsian and Eifelian age, but its exact age span varies from place to place. The Eids Formation is equivalent to dolomite of the Disappointment Bay Formation and limestone of the Blue Fiord Formation farther east and south in the report area. To the west and north it appears to largely grade out to the Bathurst Island Formation (Figs. 4 and 5).

Blue Fiord Formation

The type section of the Blue Fiord Formation on southern Ellesmere Island is 3,800 feet thick (McLaren, 1963a). A lower limestone and shale member, 2,400 feet thick, consists of brown to brownish grey nodular limestones as much as 400 feet thick interbedded with grey calcareous mudstones and shales. It becomes more shaly downward~~s~~ and grades without break into the underlying Eids Formation, the contact being drawn beneath the lowest well developed limestones. An upper brown limestone member, 1,400 feet thick, consists of brown and brownish grey limestone, mainly strongly bioclastic and coarse grained. It is overlain with probable conformity by the Bird Fiord Formation. Farther south the Blue Fiord Formation is 1,900 feet thick and was not divided into members. There is consists of dolomite, limestone, and shale. The Blue Fiord Formation in southwest Ellesmere Island was dated as probably early Middle Devonian (Eifelian) by McLaren (op. cit.). Recent revisions in age assignments of fossils led J.G. Johnson (Harper et al., 1967, p. 430, footnote) to suggest that the lower part of the type section of the Blue Fiord Formation should more properly be assigned an Emsian age.

On Bathurst Island the Blue Fiord Formation is a variable limestone unit containing micrite, micritic skeletal, skeletal, and pellet limestone. The Driftwood Bay area typifies the formation here, comprising mainly micrite which is thick-bedded and resistant; very light grey to cream and containing little argillaceous or quartzose material. It is best developed on the Central Stable Region and Cornwallis Fold Belt (Fig. 8) where complete thicknesses range from 600 to 900 feet. Thicknesses vary and increase To the north and west, at the just marginal ~~to~~ of the Central Stable Region, there are variable thickness increases. Westward the formation also becomes much more shaly and thin bedded, and then grades out very gradually into shaly and silty limestone of the Eids Formation. Uppermost beds of the Blue Fiord Formation generally are the most extensive. The Blue Fiord Formation is restricted to an Eifelian age throughout ~~almost the~~ most of the entire study area. In extreme northeast parts of the area it also is in part of late Emsian age.

Distribution, Thickness and Lithology

The Blue Fiord Formation was deposited only in eastern and southern parts of the map area (Fig. 8). Within that area it is well exposed on the flanks of westerly trending folds of the Parry Islands Fold Belt. It is preserved in fault blocks and synclines of the Cornwallis Fold Belt.

The lateral variations of the Blue Fiord Formation can be outlined by describing three sections shown on figure 4. Section 20 is representative of westerly sections. It is of intermediate thickness (905 feet), well bedded, and quite fossiliferous, having beds containing abundant brachiopods. The lower unit, 347 feet thick, is limestone, crinoidal in places, shaly, medium brown, medium bedded, weathering very light brown, in places crinoidal. The remainder is largely covered but is variable limestone, medium light grey to dark grey, shaly, fossiliferous. To the west the formation disappears through lateral gradation, and to the east it increases in thickness. This section is rather similar to the one at Twilight Creek (Section 25), and probably lies in a similar position relative to depositional basins.

Section 22 in the Green River anticline, being 1,500 feet thick, is the thickest reported section of the Blue Fiord Formation on Bathurst Island. It typifies the thick limestone development on the margin of the depositional basin adjacent to the Central Stable Region. A lower unit, 900 feet thick, is limestone, micritic, cream, medium bedded and with very little argillaceous material. It grades westward into the Eids Formation. The upper unit, 600 feet thick, is thin to medium bedded, brown, shaly limestone. Brachiopods are abundant in this unit and are concentrated in certain beds. This upper unit is on strike with Section 20, nine miles to the northwest, and the two are very similar lithically.

Section 30 at Moses Robinson River is typical of the Blue Fiord Formation of the Central Stable Region, where shale is minor, micrite is common, and beds of abundant brachiopods do not occur. The section is 600 feet thick, consisting of limestone that is very light grey to light cream, weathering very light grey, thick bedded and micritic at the base, becoming medium bedded and slightly fragmental toward the top. The upper and lower contacts are gradational.

A key section of the Blue Fiord Formation at Twilight Creek (Section 25) is 770 feet thick (McLaren, 1963b). It is composed of well bedded, variably bioclastic limestones, and black and grey calcareous shales; the entire rock weathers light brown. It grades upward from the underlying Eids Formation without a sharp break, but the contact with the overlying Bird Fiord Formation is well marked and abrupt both on the ground and on airphotographs. In this section the formation is poorly to fairly resistant, being the more recessive where it is shalier; it has a light weathering colour resembling that of the Eids Formation. Westward from this section, the shaly interlayers of the Blue Fiord Formation increase in proportion, most rapidly in the lower part of the formation; finally most of the formation grades into the upper part of the Eids Formation. This section is typical of western exposures of the formation and lies in approximately the same position with respect to depositional belts as Section 20 (Fig. 4).

The thickness of the Blue Fiord Formation diminishes to a feather edge and disappears northward from the shelf and westward from the Cornwallis Fold Belt. It does this by gradation into the Eids Formation, which is a shaly limestone, limy siltstone and shale deposit of the deeper parts of the basin. Beds of the typical Blue Fiord limestone extend varying distances westward into the Eids Formation. In mapping, the writer has considered to be Blue Fiord those exposures in which limestone predominates, is medium bedded, and moderately resistant. Exposures were regarded as the Eids Formation if they were fissile, recessive mainly limy shales and shaly limestone. When the Blue Fiord is traced westward it darkens in colour, the lower part of the sequence becomes argillaceous and it grades into the underlying and equivalent Eids. The fissile interbeds become more frequent until the formation disappears.

At Dundee Bight (Section 27, Fig. 2), the Blue Fiord Formation is less than 100 feet thick, having thinned mainly by the lower part grading into the Eids. At Helena Island (Section 11), as much as 140 feet of Blue Fiord Formation occurs near the southeast coast, while elsewhere on the island the formation is absent, or very thin and covered. In southern parts of the report area south of Bracebridge Inlet, the Blue Fiord Formation thickens and does not shale out to the southwest. At Sections 39 and 42 for example it remains a light grey micritic and micritic skeletal limestone, with detrital skeletal limestone interbeds.

Several types of limestone are found within the Blue Fiord Formation along the east coast of Bathurst Island. The lower part of the formation is composed of light grey to tan, micritic and micritic skeletal limestone [Pl. X (a) and (b)]. The skeletal material is usually non-fragmental, and colonies of corals, along with bryozoa and brachiopods, occur little disturbed within the micrite. Part of this sequence commonly has a 'birdseye' texture with patches of sparry calcite scattered through a structureless micritic matrix [see Pl. X (a)]. Rare beds of pellet and pellet-lump limestone occur. Upward, the formation changes to a detrital-skeletal limestone [Pl. X (c)], with fragmental skeletal material making up the bulk of the deposit. The Blue Fiord Formation has the characteristics of a shallow marine deposit laid down during a time of relative tectonic quiescence. The lower part of the unit, at least along the east coast, indicates quiet, lagoonal or back reef deposition. On the Cornwallis Fold Belt where the Blue Fiord Formation is rather thin and consists of evenly bedded micritic limestones, relatively slow deposition persisted. Westward and northwestward, along the margin of the miogeosyncline, the Blue Fiord Formation grades to thicker, biostromal limestones. Still farther from the fold belt it grades into deeper water shales and shaly limestones of the Eids Formation. The increasingly clastic nature of the upper part of the formation indicates a return to turbulent conditions.

Age and Correlation

The Blue Fiord Formation in the Stuart River area (Sections 25 and 26) was regarded by McLaren (1963b) as Eifelian. Ormiston (1967), on the basis of trilobites, also considered the Blue Fiord Formation of Bathurst Island to be Eifelian, and not to include Emsian rocks as it does on Devon and Ellesmere Islands. His studies, however were limited to central Bathurst Island west of the longitude of Young Inlet, and his Eifelian dating for the formation in that area is probably correct. This date is supported by conodonts collected by the writer low in the Blue Fiord Formation in southwest Bathurst Island (Section 39, see Appendix), which were dated by Ormiston (pers. com., 1971) as Eifelian.

McGregor and Uyeno dated spores and conodonts from the Blue Fiord Formation of Section 20 and determined that the formation there is Eifelian. The present writer traced Section 20 a few miles to the east into Section 22, where the Blue Fiord Formation contains substantially older rocks. A few miles farther east, 2 miles west of Paine Point, outcrops regarded as probable Blue Fiord Formation yielded GSC loc. 67146, of late Emsian age. The dating is by Ormiston (pers. com., 1971), who states that the collection contains *Dechenella paragranulata*, *Ancyropyge* aff. *arcticas*, and *Spathognathodus exiguus* Philip (the latter species was identified by Klapper). Thus the base of the Blue Fiord Formation becomes older eastward on northeast Bathurst Island, where it probably contains rocks as old as late Emsian.

The upper age limit of Eifelian for the Blue Fiord Formation of Bathurst Island is based upon the fact that both it and the overlying Bird Fiord Formation contain Eifelian fossils at widely separated localities. The lower limit of an Emsian age is compatible with the findings of Klapper and Ormiston that the basal part of the Blue Fiord Formation of Devon Island is Emsian in age.

MIDDLE AND UPPER DEVONIAN

Bird Fiord Formation

The type section of the Bird Fiord Formation at Bird Fiord on southwestern Ellesmere Island (McLaren, 1963a) is 2,950 feet thick. It is limestone, often nodular, often sandy, with common interbeds of calcareous quartz sandstone, argillaceous limestone, and sandy and micaceous mudstone. Limestone is predominant at the base; in upper parts sandstones increase in importance and approach in appearance those of the overlying Okse Bay Formation. The top of the Bird Fiord Formation was drawn at a gradational contact below the soft varicoloured shales with thin coal beds of the basal Okse Bay Formation.

On Bathurst Island the Bird Fiord Formation is a unit of fossiliferous, marine, commonly micaceous, calcareous quartzose sandstones, and arenaceous limestone, interbedded with sandy mudstones. It rests sharply but conformably upon the Blue Fiord Formation and grades upward into the Melville Island Group. The sandstone beds commonly are dark green, light greenish grey, or dark brown; generally they are resistant and weather light yellowish brown. Much more recessive are the interbedded shales, which generally weather dark green. The formation presents a characteristically banded appearance from the air and on airphotographs comprising alternating light weathering resistant and dark weathering recessive beds. This formation was deposited over the entire report area, being about 600 feet in thickness in the southern part of the Driftwood Bay area, thickening gradually both westward and northward.

The Bird Fiord Formation of Bathurst Island was dated by McLaren (1963b) as late Mid-Devonian (Givetian) and possibly early Mid-Devonian (Eifelian). This age range was substantiated by Ormiston (1967) and the present writer agrees.

Distribution, Thickness and Lithology

The Bird Fiord Formation has a wide distribution in the map area, which suggests that it was deposited over the entire region occupied by the Bathurst Island group. It occurs around synclines and in fault blocks of the Cornwallis Fold Belt in the east. In the Parry Islands Fold Belt it occurs on the flanks of anticlines, and in the western parts is the oldest rock in the cores.

A complete section of the Bird Fiord Formation 1,620 feet thick was reported (McLaren, 1963b) at Cut Through Creek on Bathurst Island (Section 26). The lower 850 feet is alternating sandy, bioclastic limestone, calcareous sandstone, argillaceous sandstone, and sandy mudstone. It is followed by a large covered interval 640 feet thick with a few outcrops of brown sandstone in the lower 100 feet of the interval. The succeeding 30 feet is medium grained calcareous sandstone. The uppermost 400 feet of the formation is composed of yellow, thick-bedded sandstone alternating with thin-bedded argillaceous and micaceous sandstone with worm trails and some plant fragments. The succeeding Okse Bay Formation appears to grade up from the Bird Fiord conformably and without a sharp break.

The Bird Formation also was reported at Driftwood Bay (Section 31) by Thorsteinsson and Glenister (1963) where the present writer regards it as 600 feet thick. It is poorly exposed but is an alternating sequence of very limy quartz sandstone, soft dark greyish green shale, and brownish green sandy limestone. Prevailing fresh-surface colours of the coarser clastic rocks and limestone include light grey and pinkish grey. The shale weathers mainly dark greenish grey. The shale is recessive and also supports more plant growth than the other rock types. This alternation has imparted a distinctive banded appearance to the formation that is especially apparent on aerial photographs (Pl. III).

The Bird Fiord Formation is a sequence of green to brown, medium- to thick-bedded calcareous, micaceous, quartzose sandstone, and sandy skeletal limestone, interbedded with thin bedded, green, calcareous, micaceous shale. The basal contact is sharp and is drawn where quartz sand and shaly interlayers appear. Shale and mudstone intervals are more frequent near the base of the section. Both the finer grained clastics and calcium carbonate decrease in the younger beds, the formation becoming sandier until it grades into the orthoquartzite of the overlying Hecla Bay Formation. The upper contact is gradational and is drawn at the uppermost limit of calcareous cement. Little systematic variation in the overall general lithology could be distinguished within the report area except that sand increases to the north and west. The resistance to erosion varies relatively. In western and northwestern parts of the report area the Blue Fiord and Disappointment Bay Formations are absent, making the Bird Fiord Formation one of the more resistant units, and generally it is fairly well exposed there. To the east, where resistant Devonian and Ordovician carbonates are common, and the Bird Fiord Formation is much thinner, it is relatively recessive and occupies the low lying areas. Thicknesses are greatest in the western and central parts of the island group, reaching 2,300 feet at Section 6, and more than 2,300 feet at Section 27. Thicknesses decrease gradually eastward, being 1,620 feet at Cut Through Creek (Section 26), and still less on the Cornwallis Fold Belt where at Driftwood Bay it is 600 feet (Section 31). Thicknesses also decrease to the north from the maximum mentioned, being approximately 1,000 feet at Section 29, and 1,104 at Section 20. In the extreme north on Helena Island, thicknesses again are less, being 1,450 feet at Section 11 and 1,120 feet at Section 12.

Age and Correlation

Fossils are abundant in the Bird Fiord Formation especially in the more calcareous beds, there being brachiopods, molluscs, corals, and trilobites, as well as trails and tracks. The abundant benthonic fauna of the Bird Fiord Formation indicates deposition in a well aerated shallow marine environment. The Bird Fiord Formation is distinguished from the underlying Blue Fiord Formation by a major influx of detrital quartz sand. This sand continued throughout the Devonian and is the principal constituent of the thousands of feet of additional clastic sediment that occur above the Bird Fiord Formation in the map-area. Lack of major facies changes within the Bird Fiord Formation, coupled with its increased thickness to the west, suggest that subsidence of the basin relative to the Central Stable Region continued and that subsidence kept pace with sedimentation.

Ormiston (1967) regarded the basal 200 feet or so of the Bird Fiord Formation at Twilight Creek as Eifelian and younger parts as Givetian. This largely agrees with the earlier suggestion of McLaren (1963b).

New evidence supports the suggestion that the Bird Fiord Formation extends down to include Eifelian rocks. McGregor and Uyeno dated spores and conodonts from the Bird Fiord Formation of Section 20 as Eifelian-Givetian (see Appendix). On Helena Island (Section 11) the Bird Fiord Formation contains three spore florules at heights of 275 ft., 500 ft., and in the upper 250 ft. All are regarded by McGregor as Eifelian or Givetian, and more likely Givetian in age. About 9 miles to the east (Section 12) no fossils were collected in the Bird Fiord Formation, but the overlying Hecla Bay Formation yielded spore assemblages at two levels (see Appendix), and McGregor regarded them as of probable Givetian age. Thus the top of the Bird Fiord Formation at least in the north is Givetian. There have been suggestions by McLaren (1963b) and Ormiston (1967) that the base of the Bird Fiord Formation is time transgressive. This seems probable because the great range in thickness of the underlying Blue Fiord Formation is in part at the expense of the Bird Fiord; however little has been added from paleontological dating in the present study to clarify the matter. Tozer and Thorsteinsson (1964, Fig. 6) suggested that the Bird Fiord Formation of Bathurst Island is a lateral equivalent of the Weatherall Formation of Melville Island.

MELVILLE ISLAND GROUP

The Melville Island Group was established on Melville Island (Tozer and Thorsteinsson, 1964) with three formations, in ascending order the Weatherall, Hecla Bay, and Griper Bay. The sequence is entirely clastic and attains a thickness of about 15,000 feet. Much of the rock is probably of nonmarine origin, but late Middle Devonian (Givetian) fossils occur in the middle of the Weatherall, and a marine band in the Griper Bay Formation contains Famennian invertebrates (Tozer and Thorsteinsson, 1964, p. 84).

The two youngest formations of the Melville Island Group, the Hecla Bay and Griper Bay, are widespread in the present report area, occurring generally as the youngest unit of the synclines (Pl. XI). The Weatherall Formation as such is not present; however, its equivalents are considered to be in the earlier clastic rocks including the Bird Fiord, Eids, and possibly even the Bathurst Island Formations. These rocks formerly were assigned to the Okse Bay Formation (Fortier et al., 1963), which McLaren, (1963a, p. 328) erected on southern Ellesmere Island. In the present report they are reassigned to the Melville Island Group because of the close similarity in age and lithology.

On central Helena Island (Section 12) a well exposed and complete section of the Melville Island Group is 8,875 feet thick. It rests conformably on the Bird Fiord Formation, and is overlain with angular unconformity by the Permian Belcher Channel Formation.

The Hecla Bay and Griper Bay Formations probably were deposited over the entire Bathurst Island Group and Byam Martin Island, for their exposures are scattered through the entire report area (Map 000A). Locally, between Driftwood Bay and Reindeer Bay on the east coast of the Bathurst Island, the Griper Bay Formation is unconformable upon older rocks including the Hecla Bay Formation. Correlation within the Melville Island Group has been discussed by Kerr, McGregor, and McLaren (1965) and is elaborated on below.

Hecla Bay Formation

The type section of the Hecla Bay Formation, about 2,600 feet thick, is on southeast Melville Island (Tozer and Thorsteinsson, 1964, p. 75). It is composed of light grey to white, fine- to medium-grained sandstone and sand, and was regarded as a nonmarine deltaic deposit. The range of thickness on Melville Island was considered to be 1,700 to 2,600 feet.

The Hecla Bay Formation in the Bathurst Island Group is divisible into two members (Pl. XI). The lower member is a massive and crossbedded, pink- to reddish-orange orthoquartzite; it is a moderately resistant ridge forming unit. The upper member is normally unconsolidated, white quartz sand that is very recessive and apparently was deposited by wind. It weathers to sand-covered valleys or locally forms hoodoos. Few complete uneroded thicknesses of these members are known.

The Hecla Bay Formation is preserved primarily in synclines of the Parry Islands Fold Belt, where it occurs as the surface formation over large areas, especially in the northern and western part of the Bathurst Island group. It is also present, but much less extensively, along the eastern coast of Bathurst Island. It lies conformably and gradationally above sandstone of the Bird Fiord Formation and either conformably or unconformably beneath sandstone of the Griper Bay Formation.

Distribution, Thickness and Lithology

The Hecla Bay Formation covers wide areas of the western part of the report area because it is one of the younger formations present, and the general plunge is westward. In this area both lower and upper members commonly are preserved. A few exposures occur in the eastern part of the area and there only the lower member is preserved. Frost action has shattered and broken this formation into fields of felsenmeer so that fresh undisturbed outcrops of the Hecla Bay Formation are rare. Seldom can more than two or three reliable dips be obtained from a traverse across this whole thick section of sandstone. An exception to this is in the extreme southwestern part of the area where flat lying areas of the upper member forms mesas (Pl. XII).

An isopach map of the Hecla Bay Formation could not be constructed because not enough complete sections were measured; however a general pattern emerged (Fig. 9). The thicknesses of complete sections are shown. Thicknesses of partial sections where the formation is partly removed, or only partly exposed, have also been shown and these are regarded as minima for the areas they represent. In the western part of the Bathurst Island Group, north of Bracebridge Inlet, thicknesses commonly are on the order of 3,500 feet. To the north there is an abrupt decrease in thickness across Massey Island being 2,900 feet thick on the south side and only 1,235 feet thick on the north side. A similar pattern of northward thinning exists on eastern Melville Island (Tozer and Thorsteinsson, 1964), where the thickness is 2,600 feet in the extreme southeast and 1,800 feet farther north. The thickest section of the Hecla Bay Formation is on Helena Island, 4,080 feet thick. It appears that there is a line of maximum thickness curving from Helena Island through the thick sections north of Bracebridge Inlet. We have no information on the original thickness pattern immediately adjacent to and on the Cornwallis Fold Belt, because of lack of preservation. The suggestion from figure 9 is that thinning takes place in that direction, as is the case with other Devonian formations.

The lower member of the Hecla Bay Formation is composed of tightly packed, fine- to medium-grained, angular to subrounded quartz grains, stained very light red, yellow, reddish orange or reddish brown. The rock is cemented either by yellow clayey material (gives a kaolin trace on the X-ray diffractogram) or more commonly by limonite or hematite. Frequently the ferruginous material occurs as secondary bands or veins up to several inches wide that penetrate the sandstone in a seemingly random nature (see Pl. XIIIa). Except for the concentration along these bands, there is little cement and excellent intergranular porosity.

The upper member of the Hecla Bay Formation, gradational with the lower, is composed almost entirely of fine grains of quartz, for the most part completely uncemented (Pl. XIIIb). It crops out only rarely except in two mesas in the southwest, where large planer cross beds are present (Pl. XII). Several thin sections made by impregnating hand specimens with epoxy resin show a mosaic of fine subangular to rounded grains of unstrained quartz and up to 10% chert. A few of the grains are frosted, but most are not. Mica is present but very rare. The grains of quartz are very tightly packed, some of the contacts are sutured, and show evidence of pressure solution along grain boundaries.

Where the section is complete both members of the Hecla Bay Formation invariably are distinguishable. On Helena Island (Section 12, see Appendix) the formation is 4,080 feet thick, the lower member being 2,380 feet and the upper member 1,700 feet. The lower member is resistant quartz sandstone, slightly feldspathic and micaceous, with occasional greenish sandy and shaly interlayers. The upper member is soft weathering quartz sandstone and sand, that is very pure, and light cream on both fresh and weathered surfaces.

As much as 700 feet of rocks assigned to the lower member of the Hecla Bay Formation are present at Driftwood Bay (Section 31). The top is not preserved, so the original thickness is unknown. It comprises very light grey to white, moderately soft and friable quartzose sandstone, weathering slightly rusty light grey. It is predominantly medium-grained and medium-bedded; about 10 per cent of the rock is ferruginous and ranges in colour from very pale orange to dark yellowish orange. Crossbedding is common.

Large quartz sand bodies such as the Hecla Bay Formation usually are associated with either desert or littoral environments, but distinguishing between the two is difficult. In modern sands plots of mean grain size against skewness resulted in a complete separation of the fields representing dune and beach sands (Friedman, 1961; Mason and Folk, 1958). According to Friedman (1961), beach sands had negative skewness, whereas dune sands had a positive skewness; moreover of his 114 dune sand samples none had a mean grain size diameter above .35 mm (1.50 phi).

Four samples of the largely unconsolidated sand of the upper member of the Hecla Bay Formation were analyzed in the manner of Mason and Folk (1958). For each sample about 30 grams were weighed and sieved, using sieves at intervals from 1.50 to 4.00 phi. Residues were weighed to the nearest .01 gram; weight percentages were calculated, cumulative curves plotted and mean and skewness values were thus obtained (Fig. 10

Textural analyses of modern sands cannot be applied with certainty to the Hecla Bay Formation however, the mean and skewness values still suggest that this member of the Hecla Bay Formation is aeolian. Diagenetic effects such as solution along grain boundaries and breakdown of feldspar grains, would tend to reduce the mean grain size of the ancient rocks, increase the tail of fines, and shift the original skewness towards more positive values.

Any subsequent alteration of the Hecla Bay Formation would have shifted mean and skewness values toward the "dune environment", so the conclusion is with some qualification It is, however, supported by the presence of aeolian type crossbedding (Pl. XII). Moreover, the spatial and sequential relationships of the Hecla Bay Formation (see below) reinforce the suggestion of an aeolian origin for its upper member.

Age and Correlation

The age Hecla Bay Formation in the report area is Givetian and Frasnian. It rests conformably on the Bird Fiord Formation that is as young as Givetian. Spores at two levels in the lower member on central Helena Island (Section 12, see Appendix) are of late Givetian or Frasnian age, more probably late Givetian. The overlying Griper Bay Formation on Helena Island contains early Frasnian spores. The Hecla Bay Formation of Bathurst Island correlates with lower parts of the Okse Bay Formation of southern Ellesmere Island (McLaren, 1963a; Kerr, 1968b). The Hecla Bay Formation of Melville Island (Tozer and Thorsteinsson, 1964) has a similar thickness and thickness pattern to the formation on Bathurst Island.

Griper Bay Formation

The type section of the Griper Bay Formation on northeast Melville Island is about 3,000 feet thick, consisting mainly of sandstone, siltstone, and shale, but with thin coal seams and conglomerate beds also present (Tozer and Thorsteinsson, 1964, p. 83). The most distinctive lithic feature of the Griper Bay Formation is the colour; it is mainly dark green, but also includes minor dusky red, pink, grey and white.

In the report area four members are distinguishable in the Griper Bay Formation and persist widely as recognizable units. All fossils so far collected from the Griper Bay Formation are of Late Devonian age (Kerr, McGregor, and McLaren, 1965). The Griper Bay Formation is widespread and thick in the western part of the report area, but is thin and only locally preserved in the east. The formation is unconformable on folded older rocks; with an unconformity that is most extreme in the east and disappears westward. No apparent stratigraphic break occurs beneath or within the formation in western parts of the report area, or in the type section of the formation on eastern Melville Island. Tectonism producing the unconformity probably occurred within Frasnian time during a period of relative uplift of the Cornwallis Fold Belt. Basal beds of the Griper Bay Formation transgressively overlapped eastward.

Distribution, Thickness and Lithology

Total depositional thicknesses of the Griper Bay Formation are not known because the upper contact everywhere is erosional. The thickest section which was measured on Helena Island, is 4,875 feet thick. About 3,000 feet of this formation is preserved on the Governors General group of islands and western Bathurst Island. Generally less than 1,000 feet remain on eastern Bathurst Island.

Except for two small areas on Cameron and Helena Islands, the Griper Bay Formation is the youngest formation preserved in the report area. It crops out in scattered areas of eastern Bathurst Island, but for the most part is confined to areas farther west in the cores of the Parry Island synclines where they plunge westward into the sea. Like the underlying Hecla Bay, the Griper Bay Formation is widely distributed, and although now eroded from many areas, probably was deposited throughout the entire report area.

The formation is composed predominantly of greyish-green, and olive-brown, fine- to medium-grained lithic arenite (Pl. XIIIc), interbedded with medium- to coarse-grained, olive-green to dusky yellow feldspathic arenite[1]. Interbeds of green shale containing plant remains, worm burrows, and trails, are intercalated with the sandstone, as are lenses of pebble conglomerate. The mineralogy of the sandstones and conglomerates from various areas is rather uniform. Detrital quartz grains, including 10-20% chert, make up from 60 to 70% of the rock; feldspar and lithic grains average 10-25%, but in one or two samples occur in amounts of up to 40%; there is usually less than 10% of matrix material. Lithic fragments are usually dark greyish green, and where large enough to be determined are consistently of volcanic origin. All of the feldspar fragments are plagioclase. Several X-ray determinations of matrix material gave characteristic kaolin peaks and in one case the presence of chamosite was indicated.

---

[1] Following the Williams, Turner, and Gilbert sandstone classification (1954); a subgreywacke and subarkose following Pettijohn (1957).

The four members of the Griper Bay Formation are best represented south of Pell Inlet (Section 5). The preserved rocks of the formation are 2,450 feet thick and are assigned to the four members of the formation as follows: Member A (350 feet) is resistant and blocky quartzose sandstone; Member B (950 feet) is sandstone, siltstone and shale intimately interbedded, recessive, dark weathering; Member C (450 feet) is arkosic sandstone and pebbly sandstone, light weathering, moderately resistant; Member D (700 feet) is sandstone with minor shale, recessive, dark weathering.

An important reference section of the Griper Bay Formation at Reindeer Bay (Section 29, Fig. 4) on the northeast coast of Bathurst Island was established by Kerr, McGregor, and McLaren (1965). Two members of the formation were distinguished in this section. Member A, which rests with angular unconformity upon the Hecla Bay and older formations, comprises 200 ft. of light cream quartz sandstones that form a prominent, resistant ridge. On fresh surfaces it is cream with faint rusty bands, and weathers to a faintly rusty tan; it is thick-bedded with medium, subrounded grains.

Member B of the Griper Bay Formation in the Reindeer Bay reference section is a variable rock of grey-green, argillaceous quartz sandstone, and dark grey-green, siltstone and shale. At the base of this member is an argillaceous quartz sandstone unit about 300 feet thick that is gradational with the rather pure quartz sandstones of Member A. The interval from 150 to 250 feet above the base is covered. A northerly-trending normal fault, whose displacement diminishes northward, is exposed to the south of the reference section. This normal fault probably dies out before reaching the reference section; however, it may possibly be present with minor displacement in the short covered interval in the lower unit of Member B. The remainder of the section, about 660 feet thick, is argillaceous quartzose sandstone, weathering grey green, alternating with dark grey-green shales.

The Griper Bay Formation is exposed at Driftwood Bay (Section 31) where it rests with marked angular unconformity upon older Devonian rocks. Only Member A is present in this area where it is 1,500 feet thick, and bounded on the top by a fault.

On Helena Island (Section 12), the Griper Bay Formation is more than 4,795 feet thick, resting sharply and with apparent conformity upon the Hecla Bay Formation. It is marked by variable rock types but with a generally medium to dark greenish grey colour. The three lower members are present in this section. Member A comprises two parts here. At the base is 2,175 feet of variably argillaceous quartzose sandstones and siltstones interbedded with shales, medium to dark greenish grey throughout; crossbedding, ripple marking, chert-pebble beds, and plant fragments are common, suggesting shallow water near shore deposition. This is succeeded by a prominent coarse pebbly sandstone 500 feet thick, bearing angular black and white chert fragments throughout and a pebble conglomerate at the base. At the base of Member B is 120 feet of shale, coaly, dark grey-green, with medium-grained, greenish grey impure quartzose sandstone; a particularly coaly shale at the base yields spores (GSC plant loc. 7014). Separated from the shale by a fault of minor displacement is an overlying unit, about 800 feet thick, comprising impure quartzose sandstone, greenish grey, showing shaly interlayers throughout, and bearing carbonized plant fragments. Member C constitutes the uppermost 1,200 feet of the Griper Bay Formation and is rather pure quartzose sandstone, medium-grained, varicoloured, mainly orange to very light grey. It is overlain with slight angular unconformity by the Permian Belcher Channel Formation.

The Griper Bay Formation is primarily a nonmarine sequence with coaly beds containing plants and spores. Evidence of marine deposition is known from the few limy sandstone and shale interbeds near the top of the formation that contain a marine shelly fauna. Available evidence suggests that the Griper Bay Formation is a product of paralic sedimentation along coastal plains and deltas, with occasional marine incursions.

In middle and late Devonian times a regressive marine sequence developed. The shallow marine Bird Fiord Formation is overlain by a beach and dune sequence in the Hecla Bay, and then by a deltaic coastal plain sequence in the Griper Bay as the deltaic environment encroached progressively southward and the basin filled up. The Melville Island Group and underlying Bird Fiord Formation form a clastic sequence totalling 10,000 to 12,000 feet and covering thousands of square miles of the Arctic Archipelago. This huge mass of sediment, composed largely of detrital quartz, probably originated from older sedimentary rock.

Age and Correlation

The age of the Griper Bay Formation is Frasnian and Famennian, as discussed by Kerr, McGregor and McLaren (1965). Two key sections that have diagnostic spore assemblages as well as shelly faunas are at Helena Island (Section 12) and Reindeer Bay (Section 29). Thus relationships of these two sections are shown on figure 4. Spores were identified and dated by McGregor (pers. com., 1971), and the shelly faunas, except where otherwise stated, were identified and dated by McLaren (pers. com., 1971).

On Helena Island spores from a height of 950 feet in Member A (GSC plant loc. 7026) are probably early Frasnian, and those from a height of 1,800 to 2,175 feet in the member (GSC plant loc. 7027) are mid to late Frasnian (see Appendix). A carbonaceous shale at the base of Member B (GSC plant loc. 7014) yielded a spore assemblage assigned an age of a mid to probably late Frasnian.

At the reference section at Reindeer Bay only the upper sandstone of Member A is present. Member B has yielded spore assemblages at several levels. The oldest, at a height of 305 feet (GSC plant loc. 7524), was dated as late Frasnian or early Famennian, probably early Famennian. Successively younger collections were all dated as probably early Famennian. In the next major stream four miles to the south of the reference section about three miles inland from the coast, a collection was made in Member B at about 1,300 feet above the base of the formation (GSC loc. 59040). A marine invertebrate fauna from this locality has been assigned an early Famennian age by McLaren (pers. com., 1971); spores from the same locality were assigned a Famennian, probably early Famennian age by McGregor. In view of the foregoing fossil evidence and the unconformable relationship with the Hecla Bay Formation, the entire Griper Bay Formation at the reference section is considered to be of Frasnian and Famennian age.

There is little doubt from the foregoing dates that Section 12 contains older beds than Section 29. The faunal and stratigraphic evidence shows conclusively that there was a mid-Frasnian uplift of the Cornwallis Fold Belt, producing erosion and unconformity at Reindeer Bay, and that by late Frasnian or early Famennian time the fold belt once more had been encroached upon from the west (Fig. 4).

The Griper Bay Formation occurs widely on Melville Island (Tozer and Thorsteinsson, 1964, p. 84) where the lithology and age apparently are similar to Bathurst Island. It also has been reported on Cornwallis Island (Thorsteinsson and Kerr, 1968) where it is very thin and rests upon an angular unconformity. The latter occurrence is on the Cornwallis Fold Belt and probably is similar to the occurrence at Reindeer Bay. The uppermost member of the Okse Bay Formation of southwestern Ellesmere Island (McLaren, 1963a; Kerr, 1968b) has a similar lithology and stratigraphy to the Griper Bay Formation, and may in fact be correlative.

PERMIAN

Belcher Channel Formation

The type section of the Belcher Channel Formation is on northern Grinnell Peninsula, where it was described by Thorsteinsson (1963c). Nassichuk (1965) redescribed the Belcher Channel Formation of that area and reported two sections whose thicknesses are 600 and 650 feet, comprising limestone, dolomite, and minor interbeds of sandstone. On Grinnell Peninsula the Belcher Channel Formation is conformable on the Canyon Fiord Formation; however at Sabine Bay on Melville Island the two are separated by a disconformity. The upper contact of the formation at Grinnell Peninsula is a regional unconformity, and at Sabine Bay is a disconformity. Harker and Thorsteinsson (1960) dated the Belcher Channel Formation as Permian, but Nassichuk (1965) assigned it more exactly to the Lower Permian, including Asselian, Sakmarian, and early Artinskian.

A small erosional remnant of the Belcher Channel Formation occurs on northern Helena Island and 11 units were separated (Section 10, see Appendix). The formation rests with a slight angular unconformity on Griper Bay rocks (see Map 000A) and has a total preserved thickness of 510 feet. Outcrop is sparse and nearly all felsenmeer. It consists almost entirely of dolomitic limestone that commonly is porous to vuggy. Fresh surface colours are variable, usually light grey to brownish grey, but the weathering colour consistently is very light grey. Corals and a few brachiopods occur at several horizons and commonly are chertified. They were identified by E.W. Bamber and dated as Lower Permian (see Appendix).

Trold Fiord Formation

The Trold Fiord Formation (Thorsteinsson and Tozer, 1970; Nassichuk and Christie, 1969) has its type section at Canyon Fiord, Ellesmere Island, where it is green glauconitic sandstone with minor skeletal limestone beds. It is widespread and of variable thickness in the Sverdrup Basin, and is best developed near the southern and southeastern margins of the basin where it is pale green, glauconitic sandstone, with some limestone and chert.

The Trold Fiord Formation is of Late Permian (early Guadalupian) age. In places it is conformable on older rocks, and in places it transgresses south and southeast.

Within the report area the Trold Fiord Formation occurs only on Cameron Island. These rocks were assigned to the Assistance Formation by Greiner (1963b), but have been reassigned to the Trold Fiord Formation (Nassichuk, pers. com., 1971). Greiner described the formation as poorly exposed, fossiliferous, medium-grained glauconitic sandstone, containing a thin chert zone near the top. From graphic measurements he estimated the maximum thickness to be about 140 feet in the northern part of the area of exposure, and perhaps 75 feet in the southwest. The formation rests with angular unconformity on the Griper Bay Formation. Nassichuk, Furnish and Glenister, (1965, p. 10) reported that the Trold Fiord Formation of Cameron Island yielded the holotype of Neogeoceras macnairi, and those authors regarded the formation to be of Late Permian (Guadalupian) age. According to Nassichuk (pers. com., 1971) two collections from the Trold Fiord Formation of Cameron Island (GSC locs. 73151 and 73153) yielded Guadalupian brachiopods identified and dated by R.E. Grant.

TRIASSIC

Bjorne Formation

At its type locality on Bjorne Peninsula, southern Ellesmere Island, the Bjorne Formation is about 1,700 feet thick, consisting of medium- to fine-grained, medium- to thick-bedded, and locally crossbedded sandstone (Tozer, 1963a, p. 367). The sandstone is essentially quartzose, commonly with fragments of light brown ferruginous material mostly of sand size, but occasionally forming flakes up to half an inch across. It is of Lower Triassic age (Tozer, 1963c).

Tozer (1963b, p. 641, footnote) assigned about 200 feet of rock on northwestern Cameron Island to the Bjorne Formation, and described it as follows. It is light olive-grey, fine-grained, quartzose sandstone that commonly is soft and has well developed crossbedding. The beds are very irregularly indurated and contain discontinuous bands up to a foot thick of dark, dusky red sandstone that shows white weathering grains of kaolinized feldspar on weathered surfaces. Calcareous nodules and intraformational conglomerate were noted in one section.

Greiner (1963b) reported an unnamed unit of poorly exposed, mainly unconsolidated sands in southwestern Cameron Island. On what was regarded as the lower part of the unit were loose blocks yielding Permian fossils. The writer suggests that these blocks probably came from the underlying formation. Exposure is poor and no unquestionable contact could be determined. The upper part of this unnamed unit resembles the Bjorne Formation farther north, and the writer has assigned the entire unit to the Bjorne Formation (Map 000A).

Schei Point Formation

At its type section on Bjorne Peninsula of Ellesmere Island the Schei Point Formation is 600 feet thick and includes very calcareous siltstone that locally grades into bioclastic, crinoidal, silty and sandy limestone (Tozer, 1963a, p. 368). Light grey phosphatic nodules occur in the lower part. Poor outcrops of dark grey calcareous shale were observed near the base, but the basal contact was not observed. The Schei Point Formation is Middle and Upper Triassic in age (Tozer, 1963c).

Tozer, (1963b) described the Schei Point Formation of Cameron Island. It consists of calcareous sandstone overlain by bioclastic limestone. The contacts with the underlying Bjorne Formation and the overlying Heiberg Formations were not observed. The whole unit is abundantly fossiliferous on Cameron Island where it is of Upper Triassic and probably Middle Triassic age.

Heiberg Formation

The type section of the Heiberg Formation on Axel Heiberg Island has two lithological divisions and is several thousand feet thick (Souther, 1963, p. 432). The lower member is predominantly thin-bedded sandstone and interbedded shale, while the upper member is predominantly massive-bedded sandstone with less shale and much greater carbonaceous material.

In the present map-area the Heiberg Formation is confined to northern Cameron Island, where it is a poorly exposed sequence of grey, crossbedded, fine-grained quartz sandstone with thin hard bands of red ferruginous sandstone. A 3-foot band of coal is present. Tozer (1963b) stated that the thickness of the Heiberg Formation on northern Cameron Island exceeds 70 feet, but the total thickness is unknown. He described a section of the Heiberg Formation as follows:

		Thickness (feet) Unit	Total
1.	Sand: quartzose, grey, fine-grained, crossbedded, with thin grey clay partings and some carbonized wood; lower part is locally indurated to form thin bands of dark dusky-red-weathering ferruginous sandstone; fossil wood present	50	50
2.	Coal: deeply weathered and very friable	3	53
3.	Sand: quartzose, grey, fine-grained, crossbedded, with thin carbonaceous laminae	15	68

Overlying sediments of the Jaeger Formation apparently rest unconformably on the Heiberg as there is evidence of truncation along the contact. The formation was dated as Upper Triassic, because of its similarity to the type section of Upper Triassic age and because Upper Triassic fossils were found in float nearby.

JURASSIC

Jaeger Formation

The type area of the Jaeger Formation is on Jaeger River, Eastern Cornwall Island, where it is 1,000 feet thick (Greiner, 1963a, p. 535). It consists mainly of medium to dark reddish brown to dusky red-purple consolidated sandstones. Some beds contain pebbles, others are glauconitic, and ironstone nodules are common. Dusky red conglomerates and sandstone beds are at the base of the formation. The type section of the Jaeger Formation was dated as belonging to the upper part of Lower Jurassic (Toarcian) on the basis of ammonites identified by Frebold.

Tozer (1963b) reported very poorly exposed beds on Cameron Island that he assigned to the Jaeger Formation. The only outcrops occur about 1/2 mile northeast of Rendezvous Hill where about 5 feet of hard olive grey, dusky-red-weathering, fine-grained sandstone, containing small grey phosphatic nodules, conformably overlies the soft sands of the Heiberg Formation. Above this sandstone is a covered interval upon which mudstone concretions and loose pelecypods and belemnites are abundant. On Cameron Island the formation was dated as early Middle Jurassic (Bajocian) on the basis of ammonoids identified by H. Frebold. The Jaeger formation is considered to have overstepped older formations on Cameron Island.

UPPER CRETACEOUS AND TERTIARY(?)

Eureka Sound Formation

Lignite-bearing, nonmarine sandstones that occur widely on Ellesmere Island were named the Eureka Sound Group by Troelson (1950). Tozer (1963d, p. 93), and Souther (1963) designated the Eureka Sound as a formation. Souther designated a type section of the Eureka Sound Formation on western Axel Heiberg Island, where it is 8,200 feet thick and consists of sandstone, siltstone, shale, mudstone and coal.

On Fosheim Peninsula, Ellesmere Island (McMillan, 1963a, p. 405) reported that the Eureka Sound Formation contains at least one hundred layers of shale, each with sandstone beds at the base and overlain by underclay and coal. He regarded the repetition of such layering as undoubtedly the result of cyclical deposition.

On Bathurst Island the Eureka Sound Formation is mainly sand and shale with an interbedded andesite flow, and is present only as a small exposure in a graben (Section 40). The base probably rests unconformably on dolomite of the Devonian Disappointment Bay Formation, and the top forms the present erosional surface. Outcrops in the report area have been dated as Late Cretaceous (probably Maestrichtian) by Hills and Wallace, (1969).

Distribution, Thickness and Lithology

The Eureka Sound Formation occurs in the report area only as a north-dipping remnant in a downfaulted block at the head of Freemans Cove on southeastern Bathurst Island (Section 40, Pls. XIV and XV). At the base of the section (Pl. XIV) is a few feet of coal containing whole tree trunks, and this is overlain by white, medium- to fine-grained, uncemented quartz sand with stringers of brown lignitic shale. The next unit is about two feet of tan, slightly feldspathic quartzose sandstone which contains leaves and stems of fossil plants. Above the sandstone is 15 feet of dark grey to black micaceous organic shale. A ten to twenty-foot thick interbed of andesite lies above the foregoing succession, and in turn is capped by several inches of yellow clay, 6 inches of black coal, and 5 to 10 feet of tan quartzose sandstone and white sand (Pl. XV). Preservation on Bathurst Island is very limited but evidence suggests that sedimentation there was of a cyclic nature in a paralic environment. The white sand and coal of unknown age described by McLaren (1963b, p. 616) from an outcrop in the Stuart River valley may also be the Eureka Sound Formation.

Age and Correlation

On Bathurst Island the Eureka Sound Formation has yielded abundant microflora from both above and below the interbedded volcanics (see Appendix, Section 40). These have been identified and dated by Hills (pers. com., 1971), who states that they undoubtedly of Late Cretaceous age and probably are Maestrichtain (see Hills and Wallace, 1969) In a sandstone bed slightly lower in the section plant megafossils were collected by Temple (GSC loc. C-4323, see Appendix). Dorf and Hickey state (pers. com., 1970) that this flora by itself indicates a Late Cretaceous or Early Tertiary age; however, in view of the Late Cretaceous microflora slightly higher in the section they consider that this flora also is Late Cretaceous.

The Eureka Sound Formation of Axel Heiberg and Ellesmere Islands was regarded as Tertiary by Tozer (1963c), although it had earlier been described as Upper Cretaceous(?) and Tertiary (Tozer, 1963d, p. 92). Dating of the Eureka Sound Formation of Bathurst Island was the first conclusive evidence that the formation is in part of Late Cretaceous age (Kerr and Christie, 1965, p. 916).

Lower Tertiary sediments of the Eureka Sound Formation are found on many of the Arctic Islands, and in places, such as on Ellesmere and Axel Heiberg Islands, they are several thousands of feet thick. Since this time however, rocks assigned to the formation on Griffith Island south of Resolute have been dated as Late Cretaceous (Thorsteinsson and Kerr, 1968). An occurrence of the formation north of Intrepid Bay on western Cornwallis Island is considered to be of early Tertiary age (Thorsteinsson and Tozer, 1960, p. 8).

A volcanic flow interbedded in the Eureka Sound Formation of southeastern Bathurst Island indicates that volcanic activity was concurrent with sedimentation there in Late Cretaceous (Senonian) Time. The source of this volcanic material may have been the dyke swarm nearby that is related to normal faulting. Thus the Eureka Sound Formation of Bathurst Island apparently was associated with igneous activity and faulting. Volcanics have not been observed interbedded with the Eureka Sound Formation in other parts of the Queen Elizabeth Islands.

Igneous Rocks

A swarm of basic dykes and plugs occurs on southeastern Bathurst Island, within the region of late Cretaceous and Tertiary (?) normal faulting. The largest plug is approximately 1/4 mile in diameter, but many are only a few tens of feet. Usually they are circular in plan and the dip is steep to vertical. The dykes, steeply dipping and often 2 to 3 feet wide, commonly are closely associated with plugs, and radiate out from them. The country rock, almost invariably dolomite of the Disappointment Bay Formation, shows little evidence of alteration except for a bleached zone a few feet wide.

Radiogenic age determinations which used the whole rock K-Ar method were made of samples from two dykes (Wanless, et al., 1967, p. 53-4). Sample descriptions are by H.P. Trettin. The first determination (GSC 65-60) is from a small dyke at Lat. 75°03'54"N., Long. 98°13'W, about 8 miles northeast of Bedford Bay. On airphoto A16203-87 the locality occurs 3.7 cm E and .2 cm N of the photo centre. The rock is a dark (but light greenish weathering), massive to slightly vesicular keratophyre, consisting of microphenocrysts of clinopyroxene in a groundmass of feldspars, clinopyroxene, iron ore and some quartz. There is some alteration, but this is considered to be magmatic to early post-magmatic and therefore should not influence the age determination. An age of 48 ± 11 m.y. was obtained on this specimen. Wanless (pers. com., 1965) pointed out that the rock contains a high proportion of K-feldspar and is highly altered. Thus it is not a suitable specimen for K-Ar age determination, and the "age" quoted is questionable. Age determination GSC 65-61 was made on a small dyke at Lat. 75°10'48"N., Long. 98°15'W., 2 miles northwest of the head of Freemans Cove. On airphoto A16203-6 this point occurs 7.75 cm W. and 9.15 cm N. of the photo centre. This sample is a light greenish grey keratophyre consisting of phenocrysts of clinopyroxene, iron ore, red-brown oxy-hornblende, orthopyroxene and sanidine, in a groundmass of plagioclase laths, clinopyroxene, iron ore, potash feldspar and quartz. It was assigned an age of 47 ± 8 m.y. (Wanless, et al., 1966, p. 54). A dyke that occurs a few miles northwest of Round Hill at Lat. 75°13'N., Long. 98°27'W, was dated by Geochron Laboratories for Imperial Oil Limited. The age determined was by the K-Ar method and is 60 ± 3 m.y. (de Mille, pers. com., 1971). The age determinations of 47 ± 8 and 48 ± 11 m.y. suggest an Eocene age according to the time scale of the Geological Society of London (1964, pp. 260-262). The figure of 60 ± 3 m.y. that was reported by de Mille suggests a Paleocene age.

The flow interbedded in the Eureka Sound Formation at the head of Freemans Cove was confidently dated as Late Cretaceous (Maestrichtian) by microfloras that occur both above and below it stratigraphically. Independent evidence indicates that the igneous intrusives and flows are of similar age, and may be part of the same episode of igneous activity. The discrepancy in age between the flows and dykes is not great, and may reflect unreliable radiogenic age datings due to rock alteration.

The close proximity of plugs and dykes to the flow interbedded in the Eureka Sound Formation and the closeness in ages suggest that the intrusions were feeders for the flow. On this line of evidence the igneous rocks and faults of southeastern Bathurst Island are considered to belong to a tectonic event of Late Cretaceous to Tertiary age, that was partly contemporaneous with deposition of the Eureka Sound Formation. Basic intrusions of the Bathurst Island group may be related to basalts that Blackadar (1964) reported to intrude Mesozoic sediments of islands to the north and west in the Sverdrup Basin.

Summary of Basin Development

The evolutionary development of the Franklinian Miogeosyncline in the Bathurst Island group from middle Ordovician through Devonian time can be divided conveniently into four broad phases which are as follows:

1. Until late Ordovician time (pre-Ashgillian), there was widespread tectonic stability with the deposition of a platform facies of carbonate and evaporite (Cornwallis Group). Sedimentation kept pace with subsidence.

2. From late Ordovician to early Devonian time, relative tectonic stability continued to prevail, but circulation became restricted and a starved basin resulted. Subsidence exceeded sedimentation, and euxinic black graptolitic shales, shaly limestone, and chert of the Cape Phillips Formation were deposited.

3. In early Devonian time a period of considerable tectonic instability began, when the rate of sedimentation increased and overtook subsidence. This produced the Bathurst Island through Eids Formations. During this latter phase the north-south trending Cornwallis Fold Belt developed as a relative high along the east coast of Bathurst Island. Two pulses of relative uplift exposed this high, and it became denuded; each time it was encroached upon by an unconformity. Still it remained a relatively positive feature throughout this time.

4. In late Devonian time there was even more marked increase in both the rate of subsidence and sedimentation. A great influx of sandstones occurred with deposition of the Bird Fiord Formation and the Melville Island Group. Sedimentation exceeded subsidence in this phase, and was followed by uplift, emergence, and southward folding of the Ellesmerian Orogeny.

This long evolutionary pattern of sedimentary development with its four broad phases, successively a platform facies, starved basin facies, flysch facies, and molasse facies, is very similar to succession in other Paleozoic geosynclines.

Chapter III

STRUCTURAL GEOLOGY

General Statement

Pre-Permian rocks of the report area are deformed into two separate sets of folds, the east-west trending Parry Islands Fold Belt (Fortier and Thorsteinsson, 1953), and the north-south trending Cornwallis Fold Belt (Thorsteinsson, 1958). These intersect along the east side of Bathurst Island and their relations were discussed by McNair (1961). The intersection resulted in some complicated and unusual structures (see Map 000A, and Fig. 11). The two fold belts will be described separately, and subsequently the intersection of the two where it is best exposed at Driftwood Bay and the Scoresby Hills. The factual descriptive treatment will be followed by an interpretation of the origin and structural history.

The folds of Bathurst Island developed very largely by concentric or flexural slip folding. It is seldom possible in studies of a fold belt deformed by this mechanism that one can come up with a single solution that explains adequately the observed geometry in terms of movement pattern and stress field. From studying the intersection of the fold belts on Bathurst Island it is possible to come up with such a single satisfactory solution.

Parry Islands Fold Belt

Introduction

Regionally, the Parry Islands Fold Belt (Fig. 3) is similar to other fold belts of the world, that lie in foreland orogenic chains. It is about 350 miles in total length covering most of the Bathurst Island group, and continuing westward to include Byam Martin Island and most of Melville Island. Farther east, the Ellesmere-Greenland Fold Belt extends from Devon Island northeastward through Ellesmere Island to North Greenland, a distance of over 600 miles. These two are similar and are part of a single fold system that is interrupted by the Cornwallis Fold Belt. The Parry Islands Fold Belt is at least 120 miles wide, for it covers the entire north-south extent of Bathurst Island. It probably is wider, for on the north and south it is covered by either younger sediments, or seawater.

The Parry Islands Fold Belt was deformed by a major orogeny that Thorsteinsson and Tozer (1970) have named the Ellesmerian orogeny. It probably varied in age somewhat from place to place. The youngest rocks beneath the unconformity are Upper Devonian (Famennian) rocks of the present report area. The oldest rocks above the unconformity are Middle Mississippian (Visean) rocks of northern Axel Heiberg Island (Kerr and Trettin, 1962). In the present report area the deformation of the Parry Islands Fold Belt that resulted from the Ellesmerian Orogeny is bracketed on Helena Island by an unconformity separating the Famennian Griper Bay Formation from the Lower Permian Belcher Channel Formation.

Description

The Parry Islands Fold Belt in the Bathurst Island group is a sub-parallel succession of anticlines and synclines that strikes east northeast (Pls. III and XVI; also see cross-sections ABC, and DE, Map 000A). Traced to the northeast they gradually take a more easterly trend before the whole system terminates abruptly against the north-south striking the Cornwallis Fold Belt. The geometry of individual folds in the Parry Islands Fold Belt varies considerably. Most are narrow and elongate and continue through the width of the island group, but some are dome shaped and terminate abruptly. Some have sharp culminations along their axes, while others undulate only slightly and plunge more or less consistently to the west. The fold geometry varies also, depending on the level of beds exposed. The anticlines usually are asymmetrical; often the asymmetry changes from north to south along strike. Folds are more intense in the northern part of the report area. The distance between anticlinal axes is remarkably uniform, being about ten miles. Normal faults trend along the belt but their direction of dip varies. High angle reverse faults all strike east-west, and dip either north or south; however all but one of the thrusts dip north.

Several generalizations can be made about folds of the Parry Island Fold Belt, despite the variations. 1. The folds are almost always of the flexural slip type (Donath and Parker, 1964), characterized by uniformity of formation thickness. An exception is where the western facies of the Eids Formation is an incompetent formation, and is involved in folding. In the west it was folded instead by flexural flow, which is characterized by variations in formational thickness. The Eids is thickened in the axes of some folds and sometimes is thin or missing on the flanks. The Formation acted as a layer of discontinuity between intensely folded beds below and less intensely folded beds above, this being particularly so in the Purcell Bay and May Inlet structures (Fig. 11). In these folds flexural flow seems confined to the Eids Formation.

2. Anticlines of the Parry Islands Fold Belt gradually increase in complexity northward. In the southern part of the Bathurst Island group they are relatively simple, but in the north they are so complex that it is only in gross geometry that they are anticlines at all. They become multiple folds, evaporite intrusions appear, dips steepen, and faults increase in number and intensity.

3. Two distinctive patterns of fold geometry are repeated in several structures, and these are described in the following paragraphs. The first is a pattern exemplified by the Caledonian River, Polar Bear Pass, and Bracebridge Inlet structures (see Fig. 11 and Map 000A). These are elongate, asymmetric, westward plunging anticlines which on their eastern ends, flare out, culminate in domes, and merge into north trending structures of the Cornwallis Fold Belt. On the north flank of each of these three anticlines is a fault that begins in the west as a bedding plane fault in the soft facies of Eids Formation. Presumably westward the faults merge into zones of flexural flow in the incompetent Eids Formation. Where they are bedding plane faults they separate the gently dipping, mainly carbonate and sandstone beds of the syncline to the north from the more steeply dipping shale and siltstone beds of the anticlinal core to the south. Traced eastward these faults abruptly cut across formations, cutting down into older units and terminating in the domes.

Another distinctive pattern is that of double anticlines, exhibited in four structures farther north: the Dundee Bight, Stuart Bay, Purcell Bay and May Inlet anticlines (Figs. 11, and Map 000A). Although deformation increases in intensity northward, these all have very similar gross geometry.

The southernmost of these, the Dundee Bight structure, is simply two parallel anticlines that start from two small, west plunging anticlines at Driftwood Bay and continue to the west at least 40 miles. Both folds die out westward against a system of east-west striking faults that down-dropped the north side. Another anticline en echelon with the Dundee Bight structure continues westward to the end of the island.

The Stuart Bay structure is also composite, including two anticlines separated by a narrow faulted syncline. Essentially there are two large anticlinal limbs with a contorted axial zone depressed between them. West of Erskine Inlet the pattern of two anticlines with a fault between disappears.

The Purcell Bay structure is an overall anticline broken by faults and with an intrusive evaporitic core. It is two and locally three parallel anticlines separated by sets of oppositely directed reverse faults with a common depressed footwall. The central part of the structure contains a network of faults that have broken the Silurian and Devonian shales and siltstones into narrow, tight folds and steeply dipping blocks. Each pair of faults embraces an anticline. The intrusive evaporitic core is diapiric gypsum with a limestone cap rock (Pl. II). On the north it is bounded by a fault and an anticline. On the south it is bounded by a fault and by rocks dipping towards it. This indicates collapse by removal of the evaporitic core by solution. The southern limb rolls over and dips north before being broken by a large east-west striking reverse fault that has a dip separation of several thousand feet. A large reverse fault forms the southern boundary of the northern sequence. On the northern side the soft Eids Formation contains a steep dip slip bedding plane fault. The Purcell Bay structure plunges both east and west, and the faults die out in both directions. East of Young Inlet it is a relatively simple anticline. Westward on the east shore of May Inlet the structure plunges suddenly and apparently does not continue west of the inlet.

The May Inlet structure exposes diapiric gypsum, along strike about 3 miles southwest of cross-section ABC (see Map 000A). The May Inlet structure consists of a pair of anticlines that are separated by diapiric gypsum in the east and by a thrust fault farther west. Near the point where the forelimb of the fold breaks and begins to ride out southward over younger sediments, a southeast striking transverse fault begins, at right angles to the thrust (Pl. XVII). This is either a normal fault with the west side down or a left lateral wrench fault, probably the latter. Highly contorted diapiric gypsum - anhydrite occurs west of this fault. The May Inlet structure continues as a thrust west of May Inlet, where it brings Thumb Mountain Formation to the surface and exposes sheared gypsum-anhydrite along the fault trace.

Genesis

Workum (1965) outlined a developmental history of the various kinds of structures present in the Parry Islands Fold Belt in the Bathurst Island group. The present writer concurs with many of Workum's ideas and conclusions. The following is a developmental history of Parry Islands Folds (Fig. 12), and includes considerable paraphrasing of Workum, with certain reinterpretation. The two most noticeable variations in interpretation are that (a) the evaporite is here regarded as the Bay Fiord Formation, and (b) it is considered that three separate periods of deformation affected the belt. The nature of the structure beneath the evaporites is unknown. It is probable that the Eleanor River and Baumann Fiord Formations that are exposed on Cornwallis Island (Thorsteinsson and Kerr, 1968) are present deep in these structures, and they may be folded into more gentle structures than are the rocks exposed in the map area.

A typical column of Ordovician to Upper Devonian rocks in the Parry Islands Fold Belt on Bathurst Island is shown (Fig. 12a). This column does not contain unconformities except locally between the Bathurst Island and Stuart Bay Formations. An unconformity has been documented at only one locality, and that is at Half Moon Bay where a local dome developed in Early Devonian Time and is overlain unconformably by the Stuart Bay Formation. This probably resulted from salt and evaporite flowage that occurred in Early Devonian time. Other such local unconformities may be present in the subsurface. This may possibly have been initiated by an intra Early Devonian folding which produced northerly trends of the Cornwallis Fold Belt. Thus mild northerly trends probably were produced within the Parry Islands Fold Belt at this same time.

The main and overwhelmingly predominant structures of that Parry Islands Fold Belt were formed by younger north to south compressional events and trend east-west. The first of these episodes was in post-Late Devonian, pre-Middle Pennsylvanian time, and a later one was Late Cretaceous or Tertiary. It has not been possible to separate the effects of these two north-south compressional episodes, for they apparently are coincident in structural trend with the second amplifying the first. The following developmental history is the one we have proposed, and it spans the two deformational episodes.

With the beginning of compressive stress the section overlying the salt was folded gently (Fig. 12b). Salt flowage is shown as commencing almost as soon as folding was initiated. All units but the Eids Formation were folded by a flexural slip mechanism, the Eids being folded by a flexural flow mechanism. Thinning of the Eids is most extreme on the back or north limbs, where locally it was thinned to zero or faulted (Fold A, Fig. 12b). Faults on back limbs that have allowed the Eids to be thinned to zero are seen in the May Inlet, Purcell Bay, Stuart River, and Bracebridge Inlet structures.

As lateral compression continued, salt flowage accentuated (Fig. 12c). Competent units were folded concentrically, while the less competent Eids Formation yielded to flow, with thinning and secondary folds developing within it. Tectonic thinning was not observed in the Cape Phillips Formation and probably did not occur in it significantly.

Although it contains substantial shale and thin bedded limestone, the Cape Phillips Formation is much harder and more strongly lithified than the Eids Formation. As compression continued the evaporites migrated into the axes of the folds and began to intrude upward. In Fold A (Fig. 12c) a discrete plug began to ascend as a diapir. Where amplitudes of the folds were less extreme, diapirism was minor, but still normal faults developed along the crest of some anticlines (Fold B; Fig. 12c). In these stages because of the developing salt cores, the anticlines became narrower and more extreme, now being narrower than the intervening synclines.

As salt flowage continued and some of the anticlines developed crestal high angle strike faults, evaporites were leached out along the faults. This allowed collapse of the overlying strata (Fold B, Fig. 12d), with a resulting pair of anticlines separated by a fault. The Stuart Bay structure is now in this stage. Where deformation was more extreme and a discrete diapir developed, leaching of the evaporitic core resulted in collapse and downbuckling of the overlying formations to produce a pair of flanking anticlines (Fold A, Fig. 12d). This situation represents the present Purcell Bay anticline. In cases where still more folding occurred subsequent to this stage, thrust faults developed. Such a thrust is present in the May Inlet structure west of May Inlet apparently within the evaporitic core, and overriding rocks southward.

Cornwallis Fold Belt

The Cornwallis Fold Belt extends from the Central Stable Region northward across the trend of the Franklinian Miogeosyncline (Kerr and Christie, 1965). North of Parry Channel the fold belt is about 90 miles wide (Fig. 3) extending eastward from eastern Bathurst Island to include most of Grinnell Peninsula and all of Cornwallis Island. South of Barrow Strait, the Cornwallis Fold Belt is a band of deformed sediments flanking both sides of the Boothia Uplift, in part separated from the uplift by faults. The inner boundary of the Cornwallis Fold Belt and the outer boundary of the Boothia Uplift are arbitrarily defined where the sedimentary cover is folded or faulted against the Precambrian crystalline rocks. The Cornwallis Fold Belt is a folded sedimentary cover draped over the Boothia Uplift, and not only flanks the uplift south of Barrow Strait, but also continues northward beyond it. The structure of this belt represents the response of the sedimentary cover to the deeper uplift.

The Cornwallis Fold Belt occupies eastern Bathurst Island where it contains parts of four well defined anticlinal structures. They trend north and are en echelon, the more easterly ones extending farther north. The western boundary is at the line of culminations or domes that are at the intersection of the Cornwallis Fold Belt with the Parry Islands Fold Belt (Fig. 11). The boundary is drawn to include in the Cornwallis Fold Belt those areas where the predominant trend of structures is northerly. Thus it includes the eastern flanks of the Misty River structure and the Caledonian River structure in the south. Farther north it includes the Scoresby Hills structure, Queens Channel structure, and the Driftwood Bay structure.

Gentle northerly trends that produced Young, May, and Erskine Inlets farther west on Bathurst Island lie far west of conspicuous surface expression of the Cornwallis Fold Belt. These trends may be related to the Cornwallis Fold Belt; however, structures which may trend along them are largely obscured by a younger east-west trend. Thus the areas where these inlets lie are included in the Parry Islands Fold Belt, for the east-west trend is dominant.

The Cornwallis Fold Belt is a faulted anticlinorium. It thus resembles the Boothia Uplift that has abrupt margins. Steeply dipping anticlines at the western margin of the belt on eastern Bathurst Island are asymmetrical toward the west, and one of these, the Queens Channel structure, is locally overturned to the west. The western margin is also substantially faulted. Tightly folded north-south trending anticlines and associated faults in the fold belt are parallel with the overall trend of the fold belt itself. The asymmetrical structures at the western margin of the Cornwallis Fold Belt align with the reverse fault uplifting crystalline basement to form the Boothia Uplift south of Barrow Strait. It is probable that reverse faults uplifting the basement caused the Cornwallis Fold Belt to develop in the overlying zones. South of Barrow Strait the thin limestone cover reacted to reverse faulting of the basement by reverse faulting and flexure. North of Barrow Strait there was a thick column of limestone, dolomitic limestone, evaporites, and shale. There probably was fault displacement in lower parts of this thick sedimentary column, decreasing toward the surface and changing to distributed flow in the evaporites and other weak horizons. The result in this area is that asymmetrical folds rather than faults are predominant at the surface.

Overall uplift of the Cornwallis Fold Belt is demonstrated by the unconformities which occur within it, and by the fact that it periodically provided a source of sediments. Where they can be dated the pulses of uplift of the Cornwallis Fold Belt and times of inundation coincide with similar activity of the Boothia Uplift, (Kerr and Christie, 1965). On Bathurst Island two periods of relative uplift occurred in Early Devonian time and one in Late Devonian time. These produced the northerly trending folds.

Several zones of normal faults occur in the Cornwallis Fold Belt of eastern Bathurst Island, where they trend northerly. The Eureka Sound Formation is cut by the southeast Bathurst fault zone, so an upper Cretaceous or younger faulting episode is substantiated. It is not known whether the faults of that zone had part or all of their development at earlier times. It seems most probable that at least some of the faults presently exposed at the surface in the Cornwallis Fold Belt of eastern Bathurst Island are the result of reactivation of deeper basement faults.

Intersection of the Parry Islands and Cornwallis Fold Belts

The intersection of the Parry Islands and Cornwallis Fold Belts is exposed for approximately 100 miles along eastern Bathurst Island. Two areas that expose this intersection are the key to unravelling the structure of both belts. These are the Scoresby Hills and west of Driftwood Bay areas and are described below.

Scoresby Hills Area

The Scoresby Hills structure, about 8 miles west of Goodsir Inlet, is a north-striking anticline at the western margin of the Cornwallis Fold Belt. Two Lower Devonian deformations of this fold belt are documented by unconformities on this anticline. One occurred between deposition of the Bathurst Island and Stuart Bay Formations, and the other between deposition of the Stuart Bay and Disappointment Bay Formations (see Fig. 5). Th Cornwallis Group and the Cape Phillips and Bathurst Island Formations are exposed in the core of the anticline, and are asymmetric with the steep flank on the west. Two younger sequences that lie above and that are bounded by unconformities are less intensely deformed, the higher one being the least deformed. On the south, the Scoresby Hills structure is cut off abruptly by a prominent east-west trending lineament which is probably a fault trace. An oblique airphoto of the Scoresby Hills structure (Pl. XVIII) shows structure at the intersection of the fold belts, and a restored section (Fig. 5) shows the stratigraphic relations. The Scoresby Hills anticline, asymmetrical and with the steep flank on the west, formed during three pulses of deformation. It probably was caused by uplift of the underlying Precambrian basement. The anticline is presumed to drape over a steep basement fault in which the east side was uplifted and at high levels thrust slightly westward. An analogous uplifted structure has been documented farther south on the edge of the Boothia Uplift, and is in alignment with the Scoresby Hills structure (Kerr and Christie, 1965, Fig. 3).

Driftwood Bay Area

At first glance, the structure in the Driftwood Bay area presents a puzzling array of folds and faults radiating in several different directions (Map 000A). A northerly trending synclinal structure is bounded on the west by a northerly striking anticline called the Queens Channel structure, and on the east by a complicated breached anticline called the Driftwood Bay structure (Fig. 11). They are linked on the south by an east-west striking overturned anticline. Lower Devonian facies relationships indicate that these structures were approximately contemporaneous in development with the Scoresby Hills structure. These structures all are part of the Cornwallis Fold Belt and developed earlier than the Parry Islands Fold Belt which intersects it.

Several folds of the Parry Islands Fold Belt meet the Queens Channel structure approximately at right angles; these are the Dundee Bight, Half Moon Bay and Stuart Bay structures, all of which are interrupted, and do not continue farther east. The Queens Channel structure thus has anticlinal culminations where it is intersected by anticlines of the Parry Islands Fold Belt. At its junction with the Stuart Bay structure the Queens

Channel structure widens in an anticlinal culmination, with overturning to the west. A steep to vertical fault occurs along the crest, but dies out southward. The eastern termination of the Half Moon Bay structure is similarly marked by a slight widening of the north-south structure which is the surface expression of a local culmination. The intersection with the Dundee Bight structure is more complex and here there are two tight folds plunging west. The Cornwallis Group and parts of the Cape Phillips Formation of the Queens Channel structure are here overturned to the west. On its southern end the Queens Channel structure bends sharply to the east, breaks along a small fault, and continues east as a tight, almost isoclinal, overturned fold whose axial plane dips north at about 50°. The fold suddenly abuts the Driftwood Bay fault striking a few degrees east of north and continues for about 20 miles to the north as the Driftwood Bay structure, a breached anticline. Northward the western flank of the Driftwood Bay structure is cut off by another fault which strikes oblique to the Driftwood Bay fault and ends against it. Between the two is a graben of younger rocks of the Upper Devonian Griper Bay Formation. East of the Driftwood Bay fault Devonian beds also have a regional strike parallel to the fault and generally dip gently away from it toward the sea.

The Driftwood Bay fault is central to our interpretation of structure at the intersection of the fold belts. Vertical movement has taken place along it as shown by displacement of stratigraphic units; however, the sense of vertical movement differs along strike. For most of its length rocks on the west have moved up relatively in the south and down in the north. In the south the Driftwood Bay fault ends at an overturned east-west trending fold; however it probably continues into a nearby parallel fault farther south. On the north a graben is adjacent to and west of the Driftwood Bay fault. The structural pattern strongly suggests that the Driftwood Bay fault is primarily a left lateral strike slip fault, and that much of the vertical displacement across it is the result of strike slip movement.

The following interpretation is proposed for the area of intersection of the Cornwallis and Parry Islands Fold Belts in the Driftwood Bay and Scoresby Hills areas (Fig. 13). Early deformation had resulted in three north-south striking en echelon folds of the Cornwallis Fold Belt (Fig. 13a). In the north, in the Driftwood Bay area, were two anticlines, at least one plunging to the south. Farther south was a third anticline plunging north. The area between apparently had remained less folded. As pointed out earlier these early folds probably had developed in response to basement uplifts. In the Parry Islands deformation a new stress pattern existed (Fig. 13b), with the principal compressive stress oriented north-south. This produced the Parry Islands Fold Belt in the west, where no substantial folding had occurred before. The west flank of the Queens Channel structure thus was refolded and shortened along an axial fault; however, the east flank apparently was not shortened significantly. The east flank was part of Cornwallis Fold Belt, which acted as a buttress; deformation within it diminished to the east. Ruptures took place within the western part of the belt along pre-existing lines of weakness parallel to structure.

An allochthonous block west of the main Driftwood Bay fault, that included the Queens Channel structure, moved to the south as a single unit relative to the autochthonous block to the east. The southern end of the allochthonous block rolled up into an overturned east-west fold (Fig. 14b). The tight folds and wrench faults in front of the major overturned fold may be the result of the couple arising from the two northern anticlines moving toward the south (Fig. 13). The graben containing Griper Bay Formation north of Driftwood Bay shown in the northern part of figure 13 is located where the Driftwood Bay fault curves. This graben probably is the result of extension during left lateral offset of the allochthonous block.

The entire Queens Channel Structure and the folds of the Parry Islands Fold Belt to the west of it comprised part of the allochthonous block that moved southward relatively. Shortening in a north to south direction took place within this block. The Queens Channel anticline acted as a line of juncture, separating a region to the east which did not develop east-west folds, from a region to the west where such folds developed prominently. The shortening on the west side was accomplished by development of the Parry Islands Fold Belt. This shortening was the cause of the peculiar anticlinal culminations on the Queens Channel structure.

The several anticlinal culminations on the Queens Channel structure are located at the intersection of that structure with anticlines of the Parry Islands Fold Belt. The intersection with the Stuart Bay anticline (Fig. 15) shows the mechanism of formation of these culminations. The Queens Channel structure was the westernmost fold of the Cornwallis Fold Belt in this latitude. As such it marked the boundary between rocks to the west which could yield readily to folding by a north to south compression, and rocks to the east which would not. The axis of the Queens Channel structure thus became the locus of left lateral transcurrent movement, producing several anticlinal culminations. In the case of intersection with the Stuart Bay structure a fault developed presumably with left lateral offset (Fig. 15). In the case of the intersection with the Half Moon Bay structure, there was only folding. The very tight folds south of the area of intersection with the Dundee Bight structure presumably resulted from this same mechanism. It appears that the undeformed rocks on the west were folded readily by the late Paleozoic north-south stresses to form the Parry Islands Fold Belt, but folds of the Cornwallis Fold Belt could not be refolded, except for a small strip on the western flank.

This lack of further deformation of the north-south folds is readily understandable when it is recalled that movement within a concentric or flexural slip fold is confined to planes of anisotrophy along bedding planes. After a first folding, the extent to which additional movement can take place along the bedding planes depends upon (a) the tightness of the original fold, (b) the competence of the rocks involved, and (c) the angle between the original and the new stress direction. Relatively tight folds composed of competent strata thus would tend not to refold, at least by flexural slip, in reaction to a principal stress imposed parallel to the axes of the pre-existing folds. This apparently happened on eastern Bathurst Island, where folds of the Cornwallis belt acted as a buttress to the later folding, and strata within it were not folded to the same extent as the unfolded strata to the west. Assuming that the same north-south external stresses were applied everywhere in the region, then the relatively unfolded area to the west yielded much more readily. There may of course have been gentle north-south folds along the sites of the present Erskine and May Inlets as suggested earlier; however these probably were very gentle undulations and could have been refolded along the new trend.

The mechanics of movement outlined above require a décollement beneath the entire area west of the Driftwood Bay fault, with the western block moving south relative to the eastern. The Queens Channel structure lies entirely within an allochthonous block and it forms a zone of small differential movement within that block. The rocks west of the Queens Channel structure migrated farther south than those on the east. The most likely plane of detachment for the décollement is within evaporites of the Bay Fiord Formation.

South of the Driftwood Bay area the intersection of the Parry Islands and Cornwallis Fold Belts may have the same general pattern as described above. This is very tentative, however, because of the widespread Quaternary cover. Two northerly striking faults that begin southeast of the Driftwood Bay fault (Map 000A and Fig. 13), may also be left lateral wrench faults. The prominent east-west lineament through Polar Bear Pass that cuts the Scoresby Hills structure (see Pl. XVIII) could very well mark a thrust along which that north-south structure also has moved some distance southward. It then could be expected to connect with the supposed wrench faults to the east (Fig. 13).

Southeast Bathurst Fault Zone

The Southeast Bathurst fault zone containing steep to vertical northerly striking faults, extends for about 50 miles from the Polar Bear Pass region to the southern extremity of Bathurst Island. This complexly interlocking fault system is not yet entirely understood but it probably had at least two and probably three periods of deformation.

The earliest deformation that can be shown with certainty by the distribution of formations in the immediate area was in post-Hecla Bay - pre-Eureka Sound time. Cretaceous sediments and basalts at the head of Freemans Cove lie unconformably on the Disappointment Bay Formation. It is probable that the Hecla Bay Formation was deposited here and eroded prior to deposition of the Eureka Sound Formation, for it is known just a few miles to the north, west of Daniell Point. Farther north (Pl. XIX), to the west of the main fault zone, the Disappointment Bay Formation is widely exposed and is deformed very little. The most probable timing of the deformation indicated here by this pre-Eureka Sound deformation would be as part of the post-Devonian - pre-Pennsylvanian orogeny which produced the Parry Islands Fold Belt. The Southeast Bathurst fault zone is approximately aligned with wrench faults near Driftwood Bay and may also have behaved as wrench faults at that time. It was not possible to determine from exposures south of Polar Bear Pass whether the deformation of that episode here was by wrench faulting as it was farther north; however there is no evidence that it was not, and we suspect that it was. By analogy with the Driftwood Bay area, the Southeast Bathurst fault zone probably marks the eastern boundary of a major décollement. It is interpreted that the Southeast Bathurst fault zone was a continuation of the more northerly wrench fault system, in the post-Upper Devonian, pre-Middle Pennsylvanian orogeny.

The Southeast Bathurst fault zone had an important deformation in Late Cretaceous Time, that probably continued also in Tertiary Time. This episode included the formation of a major graben containing rocks of the Eureka Sound Formation. Igneous plugs and dykes in certain faults of the zone are essentially synchronous with flows that are interbedded in the Eureka Sound Formation. Thus faulting occurred simultaneously with deposition, and was recurrently active later as well. This deformation was part of an orogeny of Late Cretaceous and Tertiary age that was widespread in the Canadian Arctic Islands.

Three pulses of Devonian uplift described earlier, which produced the Cornwallis Fold Belt, very probably affected southeastern Bathurst Island and gave rise to a northerly structural trend. These Devonian uplifts are known to have produced the northerly grain of northeastern Bathurst Island and of eastern Prince of Wales Island to the south of the report area. There may have been faulting of parts of the Southeast Bathurst fault zone at that time, but this could not be shown from surface mapping. In any case it seems certain that the fault zone was located along the earlier trench.

Interpretation of the Parry Islands Fold Belt

There is strong evidence that the Parry Islands Fold Belt and western parts of the Cornwallis Fold Belt north of Polar Bear Pass are underlain by a décollement. Those parts of the fold belt farther west, on the north of Bracebridge Inlet, are underlain by this décollement as well. The décollement probably affected the region south of Polar Bear Pass and Bracebridge Inlet as well, but here the evidence is less conclusive. In this latter area, a décollement is suggested by the thickened evaporites in the core of the Bathurst Caledonian River. J. 34 Well, and by the fact that the Parry Islands folds south of Bracebridge Inlet appear to be a continuation of those to the north. These folds become less intense in southern Bathurst Island and indicate that displacement on the décollement diminished in the south.

From geometrical considerations concentric folding cannot continue downward indefinitely, but is underlain by a plane of detachment. Evaporites of the Bay Fiord Formation, mainly halite, probably acted as the zone of detachment for the folding in the entire Parry Islands Fold Belt in the report area. These evaporites apparently occur beneath the entire report area, for they are present in the Caledonian River dome, as well as in the Purcell Bay and May Inlet structures 60 miles farther north. Evaporites assigned to the Bay Fiord Formation also crop out widely on Cornwallis Island (Thorsteinsson and Kerr, 1968).

Interpretation of foreland fold belts historically has been split into two opposing schools of thought, which differ on the origin of the deformation. These are respectively the "basement" and "no basement" hypotheses (Rodgers, 1964), and have been discussed mainly in the Appalachians. The first school of thought holds that the deformation originated at great depth and was transmitted upward. The other holds that the deformed rocks have been stripped completely off a rather undeformed basement and transported as an allochthonous block along one or more great bedding-plane thrust faults. The term basement as used in the no basement hypothesis includes sedimentary rocks and refers to all the rock beneath the supposed décollement. Rodgers (1964) outlined how the Appalachians support the no basement hypothesis, and that hypothesis was elucidated and supported by Gwinn (1964). The presence of a décollement does not necessarily mean, however, that the rocks beneath it are not involved in the folding at all; it means only that the structures in the sub-décollement rocks did not cause the structures above, and that the geometry below and above the plane of décollement will be different. The basement hypothesis, put forth by Lees (1952) and Cooper (1964) holds that the structures observed in foreland fold belts resulted mainly by vertically acting tectonic forces originating in the basement, that operated over a long period of time, including much of the time of deposition of the sediments.

The Parry Islands Fold Belt formed as a superficial phenomena above a plane of décollement in the manner outlined by Rodgers (1964) and Gwinn (1964). The structure at the intersection of the Parry Islands and Cornwallis Fold Belts leads to the conclusion that the Parry Islands Fold Belt is a true cover phenomenon with little or no accompanying folding necessary in the rocks underlying the décollement. The most important piece of evidence that the sub-décollement rocks remained relatively undisturbed during the folding process is the fact that the Parry Islands Fold Belt does not continue beyond its juncture with the Cornwallis Fold Belt. If the east-west folds were controlled by deep seated deformation below the décollement, surely its influence would be seen east of the intersection.

The east-west trend of structures in the décollement constituting the Parry Islands Fold Belt is clear evidence that the principal compressive stresses were aligned north-south. The structures have greater amplitude in the north where they are most intense, and die out southward. This indicates that the compressive stresses were more intense in the north, and suggests that there was mass movement of material southward. It supports the conclusion of southward movement of the décollement that was indicated at the intersection of fold belts west of Driftwood Bay.

Theories of origin of thin skinned deformation have been discussed extensively ever since the classic work of Buxtorf on the Juras. Most modern theories favour a mechanism of gravitational gliding, initiated either by compression (Bucher, 1955), or simply by detachment and sliding from topographically higher areas (Kehle, 1970). Decreased friction along a plane of shear is now considered to facilitate sliding. Mechanisms for decreasing this friction are, abnormally high fluid pressures (Rubey and Hubbert, 1959), and the transformation of gypsum to anhydrite plus water (Heard and Rubey, 1963). The folds of the Parry Islands Fold Belt in the present study area appear to have formed by a gravitational mechanism that may not involve rocks beneath the décollement. Little could be added to clarify whether the initiation of gliding was by compression or by uplift to the north, because the critical source area to the north is covered by water, or by thick sediments of the Sverdrup Basin.

Deformation of the Parry Islands Fold Belt in the Bathurst Island group may be attributed to one or both of two deformations that are documented in the report area. These are the deformations bracketed here by the Upper Devonian Griper Bay Formation and the Lower Permian Belcher Channel Formation, and the post-Eureka Sound deformation. The earlier deformation is part of the Ellesmerian orogeny of Thorsteinsson and Tozer (1970), and the younger one is part of their Eurekan orogeny. In the two places where the earlier unconformity is exposed in the map area, Helena Island and Cameron Island, angular discordance is slight. This situation by itself would suggest that the Ellesmerian orogeny was mild in the report area. On Melville Island, however, the Ellesmerian Orogeny produced a severely deformed Parry Islands Fold Belt. The writers consider that the main deformation producing the Parry Islands Fold Belt in the report area took place during the Ellesmerian orogeny, and that post-Eureka Sound deformation of the belt was of less consequence.

Interpretation of the Cornwallis Fold Belt

The Cornwallis Fold Belt reflects movements of the underlying basement as was earlier described by Kerr and Christie (1965). A northerly trending horst-shaped salient of Precambrian igneous and metamorphic rocks, the Boothia Uplift, which lies to the south of the Bathurst Island group, has risen relatively as much as 10,000 feet above the general basement level during several pulses of activity. The western boundary of the uplift is a zone of steep north trending faults which raised Precambrian rocks on the east into contact with Paleozoic rocks. In upper levels these faults are high angle reverse faults which thrust Precambrian crystalline rocks onto the Paleozoic sedimentary formations. This western edge of the Boothia Uplift aligns with the Cornwallis Fold Belt on eastern Bathurst Island (see Fig. 3). An Early Devonian unconformity on the Boothia Uplift and on the Cornwallis Fold Belt indicates that they rose simultaneously. The Cornwallis Fold Belt and its structures probably formed in response to vertical movements of the underlying Precambrian basement.

An important feature of the report area is the distinctive north-northwestward trend of Erskine, May, and Young Inlets. These could be erosional features that developed perpendicular to trends of the Parry Islands Fold Belt, guided by the trends of a prominent jointing. On the other hand they may reflect the selective erosion of gentle broad structural highs that strike roughly parallel with the Cornwallis Fold Belt. The Parry Islands folds may have been superimposed on these pre-existing structures. No firm conclusion can be drawn, but the most compelling evidence suggests that the latter certainly took place in the southern part of May Inlet before the Parry Islands folding. This is shown by the fact that the Bathurst Island Formation was domed and eroded in Early Devonian time prior to Stuart Bay deposition. This dome is exposed in the core of the Half Moon Bay structure, where it culminates on the east side of May Inlet (<u>see</u> Fig. 5). There clearly was a structural high with a narrow east-west extent there before the east-west folding occurred. Additional stratigraphic evidence will be required to show whether this was no more than a local dome, or whether it extended as an anticline along May Inlet. Two other structures have culminations along or near to the May Inlet, Stuart Bay and Thornton Point structures. It is not known whether these culminations existed earlier, but they are some additional evidence that May Inlet is broadly coincident with an anticlinal trend. Glacial erosion probably was partly responsible for erosion of the inlets. Blake (1964) reports that glacial features are common in the Bathurst Island group, but that most are related to locally centred ice caps. Post glacial uplift has affected the entire report area. The amount of uplift, measured by the height of the marine limit, is close to 300 feet along the east-central and southeast coasts, but reaches 400 feet in the long inlets that indent the north coast, suggesting that those may have been thicker in the latter area.

Summary and Conclusions

Three orogenies occurred in the report area. The first, which resulted from differential vertical uplift of the underlying Precambrian basement, effected the northerly trending Cornwallis Fold Belt in the eastern part of the island, and probably also produced mild, broad folds of roughly parallel trend farther west. Three similar pulses of uplift are assigned to this orogeny, two in Early Devonian and one in Late Devonian Time.

The second orogeny, occurring between Late Devonian and Lower Permian Times, produced the Parry Islands Fold Belt, a southerly moving allochthon thousands of square miles in area. The plane of décollement probably occurs within halite, and gypsum-anhydrite of the Bay Fiord Formation. Deformation within the allochthonous mass was largely by flexural slip folding, except for western facies of the Eids Formation which deformed by flexural flow folding. Displacement of the allochthonous block and shortening within it diminished from north to south. The allochthon broke away from the western margin of the Cornwallis Fold Belt by left lateral tears and includes certain western parts of that fold belt.

The third orogeny was of Cretaceous and probable Tertiary age. It produced extensional phenomena on southeastern Bathurst Island, that include grabens and basic igneous activity that presumably occurred along the older Cornwallis trends. Regional considerations suggest that it may be this orogeny that was responsible for folding the rocks of the Sverdrup Basin on Cameron Island.

REFERENCES

Adams, A.L.
1875: On the fossil Saurian vertebra from the Arctic regions; Proc. Roy Irish Acad., 2nd Ser., vol. 2, pp. 177-179.

Berdan, J.M., Berry, W.B.N., Boucot, A.J., Cooper, G.A., Jackson, D.E., Johnson, J.G., Klapper, G., Lenz, A.C., Martinsson, A., Oliver, W.A., Jr., Richard, L.V., and Thorsteinsson, R.
1969: Siluro-Devonian Boundary in North America; Bull. Geol. Soc. Amer., vol. 80, No. 11, pp. 2165-71.

Blackadar, R.G.
1963: History of exploration, Bathurst Island group and southeastern Sabine Peninsula, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 579-80.

1964: Basic intrusions of the Queen Elizabeth Islands, District of Franklin; Geol. Surv. Can., Bull. 97.

Blackadar, R.G. and Christie, R.L.
1963: Geological reconnaissance, Boothia Peninsula, and Somerset, King William, and Prince of Wales Islands, District of Franklin; Geol. Surv. Can., Paper 63-19.

Blake, W.J.
1964: Preliminary account of the glacial history of Bathurst Island, Arctic Archipelago; Geol. Surv. Can., Paper 64-30.

Bouček, B., Chlupáč, I. and Horný, R.
1967: The proposal of a new delimitation of the Siluro-Devonian boundary; in D.H. Oswald, ed. International Symposium on the Devonian System, Alta. Soc. Petrol. Geol., Calgary, Alberta, vol. 2, pp. 863-6 [1968].

Boucot, A.J.
1960: Lower Devonian brachiopods of Belgium; Mem. de l'Inst. Geol. de l'Univ. de Louvain, T. XXI, pp. 293-324, Louvain.

1962: Diskussion zur Silur/Devon Grenze in Symposiums-Band Internationale Arbeitstagung uber die Silur-Devon Grenze und die Stratigraphie von Silur und Devon: Bonn-Bruxelles 1960. Ed. H.K. Erben, Bonn p. 307.

Bucher, W.H.
1955: Deformation in orogenic belts, in Crust of the Earth; Geol. Soc. Amer. Special Paper 62, pp. 343-368.

Christie, R.L.
1967: Bache Peninsula, Ellesmere Island, Arctic Archipelago; Geol. Surv. Can., Mem. 347.

Cooper, B.N.
1964: Relation of stratigraphy to structure in the Southern Appalachians, in Tectonics of the Southern Appalachians; Virginia Polytech. Inst. Dept. Geol. Sci., Mem. 1, pp. 81-114.

de Sitter, L.U.
1956: Structural Geology; McGraw-Hill, New York.

Dominion Explorers Group - Canso et al.
1964: Dominion Explorers - Canso et al. Bathurst Caledonian R.J-34, completion report; on open file with Canada Department of Indian Affairs and Northern Development.

Donath, F.A., and Parker, R.B.
1964: Folds and folding; Geol. Soc. Amer., Bull., vol. 75, No. 1, pp. 45-61.

Douglas, R.J.W., Norris, D.K., Thorsteinsson, R., and Tozer, E.T.
1963: Geology and petroleum potentialities of Northern Canada; Geol. Surv. Can., Paper 63-31.

Dunbar, M., and Greenaway, K.R.
1956: Arctic Canada from the air; Def. Res. Board, Canada, Ottawa Queen's Printer, 541 pp.

Fortier, Y.O., Blackadar, R.G., Glenister, B.F., Greiner, H.R., McLaren, D.J., McMillan, N.J., Norris, A.W., Roots, E.F., Souther, J.G., Thorsteinsson, R., and Tozer, E.T.
1963: Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320.

Fortier, Y.O., McNair, A.H., and Thorsteinsson, R.
1954: Geology and petroleum possibilities in Canadian Arctic Islands; Bull. Am. Assoc. Petrol. Geol., vol. 38, No. 10, pp. 2075-2109.

Fortier, Y.O., and Thorsteinsson, R.
1953: The Parry Islands Folded Belt in the Canadian Arctic Archipelago; Am. Jour. Sci., vol. 251, pp. 259-267.

Friedman, G.M.
1961: Distinction between dune, beach and river sands from their textural characteristics; Jour. Sed. Pet., vol. 31, No. 4, pp. 514-529.

Geological Society of London
1964: Geological Society of London Phanerozoic time scale 1964; Quart. of Geol. Soc. London, vol. 1205, pp. 160-162.

Gregory, A.F., Bower, Margaret E., and Morley, L.W.
1961: Geological interpretation of aerial magnetic and radiometric profiles, Arctic Archipelago, Northwest Territories; Geol. Surv. Can., Bull. 73.

Greiner, H.R.

1963a: Jaeger River, eastern Cornwall Island, in Geology of the north central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 632-639.

1963b: Southern Cameron Island, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 632-639.

Gwinn, V.E.

1964: Thin-skinned tectonics in the plateau and northwestern Valley and Ridge Provinces of the Central Appalachians; Bull. Geol. Soc. Amer., vol. 75, No. 9, pp. 863-900.

Harker, P. and Thorsteinsson, R.

1960: Permian rocks and faunas of Grinnell Peninsula, Arctic Archipelago; Geol. Surv. Can., Mem. 309.

Harper, C.W., Jr., Johnson, J.G. and Boucot, A.J.

1964: The Pholidostrophiinae (Brachiopoda; Ordovician, Silurian, Devonian); Senk leth., vol. 48, no. 5, pp. 403-461.

Haughton, S.

1857: Geology notes and illustration, in M'Clintock (1857) Reminiscences of the arctic travel in search of Sir John Franklin and his companions; J. Roy Dublin Soc., vol. 1, pp. 183-250.

Heard, H.C. and Rubey, W.W.

1963: Possible significance of transformation of gypsum to anhydrite plus water; Program of Geol. Soc. America Annual Meeting (Abstract).

Hills, L.V. and Wallace, S.

1969: Paraalnipollenites, a new form genus from uppermost Cretaceous and Paleocene rocks of Arctic Canada and Russia; Geol. Surv. Can., Bull. 182, pp. 139-145.

Holmes, A.

1960: A revised geological time scale; Trans. Edin. Geol. Soc., vol. 17, pp. 183-216.

Hubbert, M.K. and Rubey, W.W.

1959: Role of fluid pressure in mechanics of overthrust faulting; Bull. Geol. Soc. Amer., vol. 70, No. 2, pp. 115-166.

Jaeger, H.

1962: Das Silur (Gotlandium) in Thurengen und am Ostrand de Rheinischen Schiefergebirges (Kellerwald, Marburg, Giessen), in Symposiums-Band der 2. Internationalen Arbeitstagung uber die Silur/Devon-Genze und die Stratigraphie von Silur und Devon; Bonn-Bruxelles 1960; ed. H.K. Erben, Bonn, pp. 108-135.

Jenness, J.L.

1952a: Erosive forces in the physiography of Western Arctic Canada; Geog. Rev., vol. 42, pp. 238-252.

Jenness, J.L.

1952b: Problem of glaciation in the northwest islands of Arctic Canada; Bull. Geol. Soc. Amer., vol. 63, pp. 939-952.

Johnson, J.G.

1967: Toquimaella, a new genus of karpinskiinid brachiopod; J. Paleo., vol. 41, No. 4, pp. 874-880.

Kay, G.M.

1951: North American geosynclines; Geol. Soc. Amer., Mem. 48, p. 143.

Kehle, R.O.

1970: Analysis of gravity sliding and orogenic translation; Bull. Geol. Soc. Amer., vol. 81, pp. 1641-1664.

Kerr, J. Wm.

1964: Bathurst Island, in Jenness, S.E., Summary of Activities: Field 1963; Geol. Surv. Can., Paper 64-1, pp. 4-5.

1967a: Devonian of the Franklinian Miogeosyncline and adjacent Central Stable Region, Arctic Canada; Internat. Symp. Devonian System, vol. 1, Alta. Soc. Petrol. Geol., Calgary, Canada, Sept. 6-8, 1967, pp. 677-692.

1967b: New nomenclature for Ordovician rock units of the eastern and southern Queen Elizabeth Islands, Arctic Canada; Bull. Can. Petrol. Geol., vol. 15, No. 1, pp. 91-113.

1968a: Stratigraphy of central and eastern Ellesmere Island, Arctic Canada. Part I: Ordovician; Geol. Surv. Can., Paper 67-27, Part II.

1968b: Geology, southwestern Ellesmere Island, District of Franklin; Geol. Surv. Can., Map 10-1968 (1969).

Kerr, J.Wm., and Christie, R.L.

1965: Tectonic history of Boothia Uplift and Cornwallis Fold Belt, Arctic Canada; Bull. Amer. Assoc. Petrol. Geol., vol. 49, pp. 905-926.

Kerr, J. Wm., McGregor, C.D., and McLaren, D.J.

1965: An unconformity between Middle and Upper Devonian rocks of Bathurst Island, with comments on Upper Devonian faunas and microfloras of the Parry Islands; Bull. Can. Petrol. Geol., vol. 13, No. 3, pp. 409-431.

Kerr, J. Wm., and Temple, P.G.

1965: Stratigraphy and structure of Bathurst Island, in Jenness, S.E., Report of Activities: Field, 1964; Geol. Surv. Can., Paper 65-1.

Kerr, J. Wm., and Trettin, H.P.

1962: Mississippian rocks and the mid Paleozoic earth movements in the Canadian Arctic Archipelago; Jour. Alberta Soc. Petrol. Geol., vol. 10, No. 5, pp. 247-257.

King, P.B.

1959: The evolution of North America; Princeton Univ. Press, Princeton, N.J.

Klapper, G., and Ormiston, A.R.
1969: Lower Devonian conodont sequence, Royal Creek, Yukon Territory, and Devon Island, Canada, with a section on Devon Island stratigraphy; J. Paleo., vol. 43, No. 1, pp. 1-27.

Kulp, J.L.
1961: Geologic time scale; Science, vol. 133, pp. 1105-1114.

Kummel, B.
1961: History of the earth; W.H. Freeman and Company, San Francisco, 610 pp.

Lees, G.M.
1952: Foreland folding: Quat. Jour. Geol. Soc. London, vol. 108, pp. 1-34.

Leighton, M.W., and Pendexter, C.
1963: Carbonate rock types in classification of carbonate rocks; Amer. Assoc. Petrol. Geol., Mem. No. 1, pp. 33-62.

Martinsson, A.
1969: The series of the redefined Silurian System; Lethaia, vol. 2, pp. 153-161, Oslo.

Mason, C.C., and Folk, R.L.
1958: Differentiation of beach, dune and eolian flat environments by size analysis, Mustang Island, Texas; Jour. Sed. Pet., vol. 28, pp. 211-226.

McLaren, D.J.
1963a: Goose Fiord to Bjorne Peninsula, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 310-338.

1963b: Stuart River, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 596-620.

McMillan, J.G.
1910: Geographical Report; in Report on the Dominion of Canada Government expedition to the Arctic Islands and the Hudson Strait on board the D.G.S. Arctic (1908-09), by J.E. Bernier, Ottawa, Queen's Printer.

McMillan, N.J.
1963a: Slidre River area, Southern Ellesmere Island, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 400-407.

1963b: Crying Fox Creek area, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 620-627.

McNair, A.H.
1961: Relations of the Parry Islands Fold Belt and the Cornwallis Folds, eastern Bathurst Island, Canadian Archipelago; in Geology of the Arctic, Univ. of Toronto Press, pp. 421-426.

Munch, A.
1952: Die graptolithen aus dem anstehinden Gotlandium Deutschlands und der Tschechoslowakei; Geologica, Band, 7, Geol. Inst. Uni. Berlin, pp. 1-57.

Nassichuk, W.
1965: Pennsylvanian and Permian rocks in the Parry Islands Group, Canadian Arctic Archipelago; in Report of Activities: Field, 1964; Geol. Surv. Can., Paper 65-1, pp. 9-12.

Nassichuk, W.W., and Christie, R.L.
1969: Upper Paleozoic and Mesozoic stratigraphy in the Yelverton Pass region, Ellesmere Island, District of Franklin; Geol. Surv. Can., Paper 68-31.

Nassichuk, W.W., Furnish, W.M., and Glenister, B.F.
1965: The Permian ammonoids of Arctic Canada; Geol. Surv. Can., Bull. 131.

Norris, A.W.
1963: Southern Erskine Inlet to Bracebridge Inlet, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 627-632.

Ormiston, A.
1967: Lower and Middle Devonian trilobites of the Canadian Arctic Islands; Geol. Surv. Can., Bull. 153.

Parry, Sir W.E.
1821: Journal of a voyage for the discovery of a Northwest Passage from the Atlantic to the Pacific, performed in the years 1819-20 in H.M.S. Hecla and Griper: 2nd ed.; John Murray, London, 310 p.

Pettijohn, F.J.
1957: Sedimentary rocks: 2nd ed.; Harper and Brothers, New York, 718 p.

Rodgers, J.
1964: Basement and no-basement hypotheses in the Jura and the Appalachian Valley and Ridge; Virgina Polytech. Inst. Dept. Geol. Sci., Mem. 1, pp. 71-80.

Roots, E.F.
1963: Physiography, Bathurst Island group and southeastern Sabine Peninsula; in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 580-585.

Rubey, W.W., and Hubbert, M.K.
1959: Overthrust belt in geosynclinal area of Western Wyoming in light of fluid-pressure hypothesis; Bull. Geol. Soc. Amer., vol. 70, No. 2, pp. 167-206.

Souther, J.G.
1963: Geological traverse across Axel Heiberg Island from Buchanan Lake to Strand Fiord, in Geology of the north central part of the Arctic Archipelago, Northwest Territories, (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 426-448.

Taylor, A.
1956: Geographical discovery and exploration in the Queen Elizabeth Islands; Geog. Branch, Can., Mem. 3, 172 pp.

Temple, P.G.

1965: Geology of Bathurst Island group, District of Franklin, Northwest Territories; Ph.D. Dissertation; Department of Geology, Princeton Univ., Princeton, N.J.

Thorsteinsson, R.

1958: Cornwallis and Little Cornwallis Islands, District of Franklin, Northwest Territories; Geol. Surv. Can., Mem. 294 (1959).

1963a: Ordovician and Silurian stratigraphy, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 31-50.

1963b: Prince Alfred Bay, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 221-232.

1963c: Northern Grinnell Peninsula around Lyall River, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 250-256.

Thorsteinsson, R., and Fortier, Y.O.

1954: Report of progress on the geology of Cornwallis Island, Arctic Archipelago, Northwest Territories; Geol. Surv. Can., Paper 53-24, 25 pp.

Thorsteinsson, R., and Glenister, B.F.

1963: Driftwood Bay, in Geology of the north-centra; part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 585-596.

Thorsteinsson, R., and Kerr, J. Wm.

1962: Selected areas of Ellesmere Island; Geol. Surv. Can., Map 39-1962.

1968: Cornwallis Island and adjacent smaller islands, Arctic Archipelago; Geol. Surv. Can., Paper 67-64.

Thorsteinsson, R., and Tozer, E.T.

1960: Summary account of structural history of the Canadian Arctic Archipelago since Precambrian time; Geol. Surv. Can., Paper 60-7.

1970: Chapter VII, The Arctic Archipelago; in Douglas, R.J.W. (Ed.), Geology and economic minerals of Canada; Geol. Surv. Can., Econ. Geol. Series, No. 1, Fifth Edition.

Tozer, E.T.

1963a: Northwestern Bjorne Peninsula, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 363-370.

1963b: Northwestern Cameron Island, in Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 639-645.

1963c: Mesozoic and Tertiary stratigraphy, western Ellesmere Island and Axel Heiberg Island, District of Franklin; Geol. Surv. Can., Paper 63-30.

1963d: Mesozoic and Tertiary stratigraphy, in Geology of the north-central part of of the Arctic Archipelago, Northwest Territories (Operation Franklin); Geol. Surv. Can., Mem. 320, pp. 73-95.

Tozer, E.T., and Thorsteinsson, R.

1964: Western Queen Elizabeth Islands, Arctic Archipelago; Geol. Surv. Can., Mem. 332.

Trettin, H.P.

1964: Pre-Mississippian rocks of the Nansen Sound area, District of Franklin; Geol. Surv. Can., Paper 64-26.

1967: Devonian of the Franklinian Eugeosyncline; Internat. Symp. Devonian System. vol. 1; Alta. Soc. Petrol. Geol., Calgary, Canada, Sept. 6-8, 1967, pp. 693-701.

1970: Ordovician-Silurian flysch sedimentation in the axial trough of the Franklinian Geosyncline, northeastern Ellesmere Island, Arctic Canada; Geol. Assoc. Can., Sp. Paper, No. 7, pp. 13-35.

Troelsen, J.C.

1950: Contribution to the geology of Northwest Greeland, Ellesmere Island and Axel Heiberg Island; Medd. om Grønland, Bd. 149, No. 7, 85 pp.

1952: Geological investigations in Ellesmere Island; Arctic, vol. 5, pp. 199-210.

Trumpy, R.

1960: Paleotectonic evolution of the Central and Western Alps; Bull. Geol. Soc. Amer., vol. 71, No. 6, pp. 843-908.

Turner, F.J., and Verhoogen, J.

1960: Igneous and metamorphic petrology: 2nd Ed; McGraw-Hill, New York, 694 p.

Wanless, R.K., Stevens, R.D., Lachance, G.R., and Edmonds, D.M.

1967: Age determinations and geological studies, K-Ar Isotopic ages, Report 7; Geol. Surv. Can., Paper 66-17.

Williams, H., Turner, F.J., and Gilbert, C.M.

1958: Petrography, an introduction to the study of rocks in thin section; W.H. Freeman & Co., San Francisco, 406 pp.

Workum, R.H.

1962: Some observations on folding from western and Arctic Canada; J. Alta. Soc. Petrol. Geol., vol. 10, No. 5, May 1962, pp. 241-246.

1965: Lower Paleozoic salt, Canadian Arctic Islands; Bull. Can. Petrol. Geol., vol. 13, No. 1, pp. 181-191.

APPENDIX OF STRATIGRAPHIC SECTIONS

*1.	Northwestern Cameron Island
*2.	Southwestern Cameron Island
3.	Southeastern Cameron Island
4.	Central Massey Island
5.	South of Pell Inlet
6.	Erskine Inlet
*7.	Head of Erskine Inlet (Norris, 1963)
8.	Southern Byam Martin Island (north flank)
9.	Southern Byam Martin Island (south flank)
10.	Northern Helena Island
11.	Southwestern Helena Island
12.	Central Helena Island
13.	Hosken Islands
14.	Stokes Range
15.	Dundee Bight, west
16.	Dundee Bight, central
*17.	Purcell Bay
*18.	Young Inlet, west
19.	Young Inlet, south
20.	Young Inlet, east
21.	Young Inlet, southeast
22.	Green River
23.	Cape Kitson
*24.	Head of Stuart Bay
25.	Twilight Creek
*26.	Cut Through Creek
27.	Half Moon Bay, west
28.	Half Moon Bay, east
29.	Reindeer Bay
30.	Moses Robinson River
31.	Driftwood Bay (composite)
32.	Head of Bracebridge Inlet
33.	Polar Bear Pass
34.	Head of Goodsir Inlet
35.	Scoresby Hills, west
36.	Heart Lake
*37.	Crying Fox Creek (McMillan, 1963b)
38.	Bathurst Caledonian R. J-34 Well
39.	Misty River
40.	Head of Freemans Cove
41.	Truro Island
42.	Dyke Ackland Bay

* Not included in appendix

Section 3. Southeastern Cameron Island

The following is a north-dipping section on the southeast part of Cameron Island. It begins at 76°26'N, 103°05'W, 1.5 miles due west of the southeastern tip of the Island. Thicknesses were measured by scale on airphoto A-16151-158.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Trold Fiord Formation		
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
9	Sandstone, quartzose, grey-green, argillaceous; siltstone, grey-green; shale, dark grey; at a height of 600 feet is GSC loc. 65801 that includes: Schuchertella? sp. Productella sp. very large productellid, indet. Plicochonetes sp. Ptychomaletoechia? sp. Cyrtospirifer sp. pectinoid pelecypod small pelecypods Mooreoceras bradfordoides Flower (identified by D.H. Collins) Lobobactrites? sp. (identified by D.H. Collins): this faunule was dated by D.J. McLaren as Famennian (see Kerr, McGregor and McLaren, 1965) however, he now dates it more precisely as lower Famennian (pers. com., 1971). GSC loc. 65801 also yielded Aculeispores sp. Ancyrospora sp. Hystricosporites sp. ?Lophozonotriletes excisus Naumova, which were identified by D.C. McGregor and dated as Middle or Upper Devonian (pers. com., 1971)	650	3750
8	Sandstone, quartzose, grey-green, argillaceous; some pebble conglomerate, yellow-orange	450	3100

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
7	Shale, coaly, black, very recessive; at the base is GSC loc. 65799 which contains: ?*Ancyrospora* sp. *Apiculatasporites* sp. *Biharisporites* sp. *Leiotriletes microdeltoidus* McGregor *Lophozonotriletes curvatus* Naumova *L. grandis* Naumova *Lycospora magnifica* McGregor *Perotrilites perinatus* Hughes & Playford *Punctatisporites* sp. *Retusotriletes* sp. *Tholisporites densus* McGregor *Triangulatisporites rootsii* Chaloner, identified and dated by D.C. McGregor as mid Frasnian to early Famennian; at a height of 35 feet is GSC loc. 65800 which contains: ?*Ancyrospora* sp. (same species as in GSC loc 65799) ?*Archaeozonotriletes foveolatus* Naumova *Biharisporites* sp. *Calamospora* sp. ?*Dibolisporites* sp. ?*Foveosporites pertusus* Vigran *Lophozonotriletes cristifer* (Luber) Kedo *L. curvatus* Naumova *L. grandis* Naumova *L. macrogrumosus* Naumova *Lycospora magnifica* McGregor *Perotrilites perinatus* Hughes & Playford *Punctatisporites* sp. *Tholisporites densus* McGregor *Verrucosisporites* sp., identified and dated by D.C. McGregor as late Frasnian or early Famennian (pers. com., 1971)	50	2650
6	Sandstone, fine grained, quartzose, impure, argillaceous, medium to dark grey-green; siltstone and shale, dark grey-green, poorly exposed	500	2600
5	Sandstone, pebbly; fine grained conglomerate of well rounded chert fragments in arkosic sandstone matrix	100	2100

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Sandstone, arkosic, yellow-orange, pebbly sandstone common, some greenish sandstone	400	2000
3	Sandstone, fine grained, quartzose, argillaceous, medium to dark grey green, siltstone and shale, dark grey green, poorly exposed recessive unit, minor yellow-orange arkosic sandstone	400	1600
	Total preserved thickness of Griper Bay Formation	2550	
	<u>Hecla Bay Formation</u>		
	Upper Member		
	contact conformable		
2	Sandstone, quartzose, very pure, white to very light grey, weathering blue-grey; alternating with minor sandstone, cream, weathering rusty, medium to thick bedded, bluff forming; contact with overlying Griper Bay Formation is covered	550	1200
1	Sandstone, quartzose, cream to very light grey, weathering the same colour, with much rusty weathering hematitic interlayers, thick bedded, fairly recessive; in upper part there is much cross bedding and muscovite flakes	650	650
	Exposed thickness of Hecla Bay Formation	1200	
	Exposed thickness of Melville Island Group	3750	
	Lower limit of exposure at a fault		

Section 4. Central Massey Island

The following is a south dipping section which occurs on the north side of central Massey Island. It begins at 76°02' N, 103°05'W at the mouth of a stream, and continues from this point southward. Thicknesses were measured by scale on airphoto A-16761-95.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
	Member C		
8	Arkosic sandstone, yellow orange, weathering rubbly and mainly felsenmeer	200	4250
	Member B		
7	Sandstone, quartzose, impure, greenish, medium grained, commonly with coaly black shale interbeds	600	4050
6	Sandstone, siltstone, black shale interlayers, very finely grained thinly bedded	535	3450
	Member A		
5	Sandstone, quartzose, impure, greenish, medium grained, blocky	365	2915
	Preserved thickness of Griper Bay Formation	1700	
	Hecla Bay Formation		
	Upper Member		
	contact conformable		
4	Sandstone, quartzose, fine to medium grained, yellow orange, weathering yellow grey, blocky, very light grey to very light cream sandstone, with occasional red hematitic interbeds; recessive faintly reddish weathering	485	2550
	Lower Member		
3	Sandstone, quartzose, with some hematitic interlayers	750	2065
	Total thickness of Hecla Bay Formation	1235	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Preserved thickness of Melville Island Group	2935	
	<u>Bird Fiord Formation</u>		
	contact conformable		
2	Sandstone, quartzose with calcareous cement; the interval is mainly covered with occasional sandstone outcrops, much greenish weathering shaly interlayers	1300	1315
1	Sandstone, quartzose, calcareous, micaceous, light greenish grey to light grey, fine grained, weathering greenish yellow; brachs and trilobites common	15	15
	Exposed thickness of Bird Fiord Formation	1315	
	Lower limit of exposure		

Section 5. South of Pell Inlet

The following is a south dipping section which occurs south of Pell Inlet; it begins at 75°39'N, 102°20'W and continues from that point to the southwest. Thicknesses were measured by scale on air photo A-16761.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
	Member D		
14	Sandstone, with minor shale, at a height of 300 feet in a shale horizon is GSC plant loc 7257 which yields spores as follows: ? *Archaeozonotriletes famenensis* Naumova, cf. *A. purus* Naumova, *Cyclogranisporites* sp., ? *Geminospora* sp., cf. *Hymenozonotriletes argutus* Naumova, *H. deliquescens* Naumova, *Hystricosporites delectabilis* McGregor, *Leiotriletes dissimilis* McGregor, *Lophozonotriletes curvatus* Naumova, *L. proscurrus* Kedo, *Lycospora magnifica* McGregor, *Perotrilites perinatus* Hughes and Playford, *Punctatisporites* sp., *Stenozonotriletes* sp., and *Tholisporites densus* McGregor; This florule was identified by D.C. McGregor and dated as mid to late Frasnian, probably late Frasnian (pers. com., 1971)	700	6315
	Member C		
13	Sandstone, impure, arkosic; pebbly sandstone, moderately resistant	450	5615
	Member B		
12	Sandstone, grey-green, fine grained; siltstone grey-green; shale, dark grey, minor; all intimately interbedded; recessive	950	5165

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Member A		
11	Sandstone, quartzose, blocky	350	4215
	Preserved thickness of Griper Bay Formation	2450	
	Hecla Bay Formation		
	Upper Member		
	contact conformable		
10	Sandstone, quartzose, very pure, recessive, poorly consolidated, reddish hematitic shale interlayers	1100	3865
	Lower Member		
9	Sandstone, quartzose, typical Hecla Bay Formation, rather pure, thick bedded to massive, resistant	750	2765
8	Shale, dark grey, very soft weathering; at a height of 40 ft. contains GSC loc. 67106	150	2015
7	Sandstone, quartzose, salt and pepper sandstone, light tan colour, occasionally greenish tinge, plant fragments are common, abundantly crossbedded; at a height of 300 feet are pyrite concretions; the unit becomes more quartzose upward	675	1865
6	Sandstone, quartzose, fairly pure, rubbly weathering, tan to yellowish	630	1190
5	Siltstone and shale, grey-green, recessive	50	560
4	Sandstone, quartzose, tan coloured, fairly pure; interbeds of greenish shale and red hematitic sandstone	150	510

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Shale, greenish grey, and fine grained sandstone that is shaly; with worm trails, contains GSC loc. 67105	20	360
2	Sandstone, quartzose, fairly impure, blocky, thick bedded, very minor green shale interbeds	140	340
	Total thickness of lower member of formation	2565	
	Total thickness of Hecla Bay Formation	3665	
	Bird Fiord Formation		
	contact conformable		
1	Sandstone, quartzose, calcareous, very shale; with equal amounts of shale interbeds that are greenish grey	200	200
	Observed thickness of Bird Fiord Formation	200	
	Lower limit of Exposure		

Section 6. Erskine Inlet

The following section is a south dipping section that occurs southwest of the southernmost end of Erskine Inlet. It begins at 75°45'N, 101°30'W and continues from there southward. Thicknesses were measured by scale on air photo A-16151-100.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
	Member B		
7	Sandstone, grey-green, fine grained, siltstone grey-green; shale, dark grey, interbedded	1000	8230
	Member A		
6	Sandstone, quartzose, blocky, resistant	530	7230
	Exposed thickness of Griper Bay Formation	1530	
	Hecla Bay Formation		
	contact conformable		
5	Quartz, sandstone, white, weathering white, friable in part, crossbedded (wind driven?), red staining on some surfaces, thick bedded, red shale interlayers	1400	6700
	Lower Member		
4	Sandstone, quartzose, rather pure, thick bedded to massive, resistant	2200	5300
	Total thickness of Hecla Bay Formation	3600	
	Bird Fiord Formation		
	contact conformable		
3	Sandstone, quartzose, calcareous cement, grey green, shaly, alternating with dark green shale intervals, the sandstone is occasionally micaceous; the sandstone forms resistant layers and outcrops sporadically while the alternating shale units are recessive, the shale is dark grey green, fissile; occasional interbeds of light yellow grey, non calcareous quartz sandstone	2300	3100

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Eids Formation</u>		
	contact conformable		
2	Limestone, shaly, thin bedded to fissile, moderately resistant, forming a ridge, upper contact cover	300	800
1	Shale, siltstone, very limy, thin bedded to fissile, crumbly, very recessive generally, and only rubbly with no outcrops, upper contact not exposed, thickness uncertain but a probable minimum of 500 feet	500	500
	Exposed thickness of Eids Formation	800	
	Lower limit of exposure		

Section 8. Southern Byam Martin Island (north flank)

The following section occurs on southern Byam Martin Island on the north flank of a major east-west trending fold. It begins at 75°09'N, 104°10'W and extends from this point northward. Thicknesses were measured by scale on air photo A-16766-122.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
5	Sandstone, quartzose, greenish, non-calcareous, very shaly and silty, fine to medium grained, interbedded with dark green to dark grey noncalcareous shales. The entire unit is recessive	1000	4010
4	Sandstone, quartzose, quite pure, medium grained, very light cream; crossbedding, ripple marking, weathering very light blue grey; bluff forming, massive to thick bedded	30	3010
3	Sandstone, quartzose, light cream, occasionally crossbedded and ripple marked, rare greenish interbeds up to 40 feet thick	780	2980
2	Sandstone, quartzose, greenish	1000	2200
	Examined thickness of Griper Bay Formation		
	Hecla Bay Formation		
	Upper Member		
	contact conformable		
1	Sandstone, quartzose, very pure, cream to very light grey, occasionally rusty weathering, occasionally hematitic interbeds	1200	1200
	Exposed thickness of the Hecla Bay Formation	1200	
	Base of section at lower limit of exposure		

Section 9. Southern Byam Martin Island (south flank)

The following section occurs on southern Byam Martin Island on the south flank of a major east-west trending fold. It begins at 75°09'N, 104°10'W and extends from this point southward. Thicknesses were measured by scale on air photo A-16776-122 and air photo A-16766-115.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
8	Sandstone, quartzose, fine grained, grey green, fairly resistant, minor siltstone and shale	150	3730
7	Sandstone, quartzose, fine grained, grey green, interbedded with much soft quartz siltstone and shale	180	3580
6	Siltstone, quartzose, grey-green, calcareous; sandstone, quartzose, poorly exposed, recessive; coquinoid interbeds, thin silty limestone interbeds. At a height of 20 feet are interbeds of coquinal brown limestone (GSC loc. 65797) that contain the following fossils: Invertebrates (according to D.J. McLaren) Productella sp. Ptychomaletoechia? sp. rhynchonelloid n. gen.? open-coil planispiral gastropod abundant fragmentary gastropods and pelecypods scattered crinoid columnals Lobobactrites? sp. (identified by D.H. Collins) Conodonts (identified by T.T. Uyeno) Palmatolepis perlobata Ulrich and Bassler Pelekysgnathus inclinata Thomas Apatognathus cf. A. varians Branson and Mehl Icriodus costatus Thomas Spores (identified by D.C. McGregor) ?Archaeozonotriletes famenensis, Naumova A. gracilis Kedo ?Geminospora sp. ?Hymenozonotriletes denticulatus Naumova Hystricosporites porcatus (Winslow) Allen		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Lophozonotriletes cristifer (Luber) Kedo L. curvatus Naumova Perotrilites sp. (= Diaphanospora perplexa Balme & Hassel) Retusotriletes simplex Naumova; the fauna has been dated by McLaren as early Famennian (pers. com., 1971), and the flora was dated by McGregor as late Frasnian or early Famennian, probably early Famennian (pers. com., 1971) At a height of 120 feet interbeds of coquinal limestone (GSC loc. 65798) yielded the following fauna Invertebrates (identified by D.J. McLaren) Productella? sp. Ptychomaletoechia? sp. rhynchonelloid n. gen.? Cyrtospirifer spp. (one species with apsacline interarea resembling C. mimetes (Crickmay)) open-coil planispiral gastropod pelecypod and gastropod fragments pectinoid pelecypod Invertebrates (identified by D.H. Collins) Mooreoceras bradfordoides Flower compressed, actinosiphonate oncocerid Lobobactitrites? sp. Conodonts (identified by T.T. Uyeno) Palmatolepis perlobata Ulrich and Bassler Icriodus costatus (Thomas) Apatognathus cf. A. varians Branson & Mehl Herrmannian? sp. (identified by M.J. Copeland) Spores as were identified by D.C. McGregor include Archaeoperisaccus sp. A. ovalis Naumova cf. Archaeozonotriletes micromanifestus Naumova ?A. variabilis Naumova Endosporites macromanifestus Hacquebard ?Faveosporites pertusus Vigran		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	?Hymenozonotriletes denticulatus Naumova Lophotriletes atratus Naumova Lophozonotriletes excisus Naumova L. cristifer (Luber) Kedo Perotrilites sp. (=Diaphanospora perplexa Balme & Hassel) Retusotriletes sp. Stenozonotriletes sp. ?S. ornatus Naumova McLaren has dated the fauna in GSC loc. 75789 as early Famennian (pers. com., 1971) and McGregor dated the associated flora as late Frasnian or early Famennian (pers. com., 1971)	150	3400
5	Sandstone, quartzose, fine grained, medium grey green, medium green; much interbedding of grey green siltstone and dark green shales	600	3250
4	Sandstone, quartzose, light grey to cream	250	2650
3	Sandstone, quartzose, impure, shaly and silty, dark greyish green, weathering medium greyish green, minor hematitic bands	1200	2400
		2350	
	Hecla Bay Formation		
	Upper Member		
	Upper contact conformable		
2	Sandstone, cream to very light grey, weathering blue grey, occasionally rusty and red-purple hematitic beds, massive to thick bedded	50	1200
1	Sandstone, quartzose, very pure, cream to very light grey, occasionally rusty weathering, occasional hematitic interbeds	1150	1150
	Exposed thickness of Hecla Bay Formation	1200	
	Lower limit of exposure		

Section 10. Northern Helena Island

The following section is in an isolated erosional remnant of Belcher Channel Formation on northern Helena Island. It is located on air photo A16151-165, beginning at 100°45'W, 76°44'N and continuing from there northward. It is a continuation upward of Section 12. This section was described by W.W. Nassichuk and was measured by tape.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Belcher Channel Formation		
11	Limestone, dolomitic, silty, coarsely crystalline, thin bedded with colonial coral heads up to 2 feet in diameter and rare gastropods; biostromal limestone unit with corals as at unit 8	70	510
10	Limestone, dolomitic, finely crystalline, silty thin bedded yellow orange weathering	70	440
9	Limestone, dolomitic silty, greenish grey, vuggy, thin bedded few corals as in unit 7	30	370
8	Limestone, dolomitic, biostromal, with abundant colonial corals; GSC loc. 73160 which contains Antiquatonia sp., stenoscismatacean brachiopod indet., "Lithostrotion" kunthi (Stuckenberg), and an indeterminate tabulate coral; these were identified by E.W. Bamber who states (pers. com., 1971) that they have been found elsewhere in the Lower Permian Belcher Channel Formation	60	340
7	Limestone, dolomitic, fine grained, vuggy, chert nodules in part, some beds are biostromal (Part of GSC loc. 73159 came from this unit)	10	280
6	Shaly interbeds, white chert nodules abundant in dolomitic limestone, recessive	10	270
5	Limestone, dolomitic, brownish grey, finely crystalline, vuggy as below, beds 4 inches thick, with colonial corals, beds sometimes more than 1 foot thick containing white irregular chert nodules up to 10 inches in diameter, GSC loc. 73159 which was collected in this unit and unit 8 includes colonial corals identified by E.W. Bamber (pers. com., 1971) as "Lithostrotion" cf. portlocki Milne-Edwards and Haime, ?Stylastraea sp., Roemeripora sp.	45	260

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Limestone, dolomitic, silty as below except solitary corals rare, silicified where present	90	215
3	Limestone, dolomitic, fine grained, yellow green, weathers yellow grey, beds 1 foot thick, vuggy, traces of silicified gastropods, solitary corals	80	125
2	Limestone, dolomitic, fine grained, light grey weathering pale green, thin bedded unit, recessive forming fully, shaly interbeds, unit contains badly weathered solitary corals	25	45
1	Dolomite, finely crystalline, very porous and vuggy, partly silty with some laminae, poorly bedded, blocky	20	20
	Preserved thickness of Belcher Channel Formation	510	

MELVILLE ISLAND GROUP

Griper Bay Formation

Contact regional angular unconformtiy

Sandstone, quartzose, rather pure, very light grey weathering light cream (for rocks beneath this see Section 12)

Section 11. Southwestern Helena Island

The following is a north dipping section that begins on the south coast of Helena Island at latitude 76°36'N, 101°05'W. It is in the valley of a southeast flowing stream whose mouth is 6 miles northeast of the southernmost tip of Helena Island. The section is located on air photo A-16203-208. Thicknesses were measured in part by tape and staff, and in part by scale on the photograph.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Hecla Bay Formation		
	Lower Member		
8	Sandstone, fine grained, medium light brown, tiny orange limonitic specks, tiny muscovite flakes, resistant, thick bedded, weathers slightly rusty brown, covered at the base	200	2590
	Examined thickness of Hecla Bay Formation	200	
	Bird Fiord Formation		
	contact conformable		
7	Sandstone, quartzose, fine grained, slightly calcareous, micaceous, dark green, medium bedded; interbedded with non-calcareous shaly sandstone, grades up by decrease in calcareous cement to younger formation; woody fragments, burrows and tracks; shallow water; in this unit is GSC plant loc. 7019 which contains Ancyrospora ancyrea (Eisenack) Richardson, Asperispora sp., Calyptosporites velatus Richardson, ?Hymenozonotriletes argutus Naumova, Perotrilites sp., Samarisporites sp. (?=Hymenozonotriletes macrotuberculatus Archangelskaya), Stenozonotriletes insessus Allen, and Verrucosisporites sp.; this florule was identified by D.C. McGregor (pers. com., 1971) who stated that the assembly is Eifelian or Givetian, more likely Givetian	250	2390
6	Sandstone, quartzose, fine grained, strongly calcareous, light brown, faintly green, tiny muscovite flecks, medium bedded, resistant alternating with recessive greenish brown siltstone and shale; at a height of 400 feet in GSC plant loc. 7018	700	2140

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
5	Sandstone, very fine grained, quartzose, strongly calcareous, grey green, resistant, medium bedded, alternating with dark greenish shales, recessive; at a height of 275 feet (GSC plant loc. 7016) is Archaeotriletes incompositus Chibrikova, at a height of 500 feet (GSC plant loc. 7017) is Ancyrospora sp., Calyptosporites velatus Richardson, and Grandispora (2 species); these were identified by D.C. McGregor (pers. com., 1971) who considered that GSC plant loc. 7016 suggests a Givetian age and that GSC plant 7017 is Givetian or Eifelian, more likely Givetian	500	1440
	Total thickness of Bird Fiord Formation	1450	
	Blue Fiord Formation		
	contact covered		
4	Covered. Probably Blue Fiord Formation	100	940
3	Limestone, shaly, fine grained, medium grey weathering tan grey, medium bedded	40	840
	Total thickness of Blue Fiord Formation	140	
	Eids Formation		
	contact conformable		
2	Interval is covered but contains rubble of the Eids Formation. It is soft shaly siltstone and silty shale, light tan	600	800
	Total thickness of Eids Formation	600	
	Stuart Bay Formation		
	contact conformable		
1	Shale, silty, dark grey, calcareous, weathers tan, moderately resistant	200	200
	Exposed thickness of Stuart Bay Formation	200	
	Base of section at lower limit of exposure		

Section 12. Central Helena Island

The following is a north dipping section occurring on central Helena Island. The rocks dip north and the section begins above a southerly directed thrust fault. The section begins one mile inland from the south coast at Lat. 76°39'N, Long. 100° 47'W. Thicknesses were measured by scale on air photo A-16151-166.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Belcher Channel Formation		
20	Limestone, dolomitic (see Section 10)		
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
	contact regional angular unconformity		
	Member C		
19	Sandstone, quartzose, rather pure, very light grey, weathering light cream (in places removed by pre-Belcher Channel erosion)	300	11395
18	Sandstone, quartzose, medium grained, very coloured, mainly orange with some brownish and greenish	900	11095
	Total thickness of Member C	1200	
	Member B		
17	Sandstone, greenish grey, impure, quartzose, slightly cherty, coaly bits throughout, shale interbeds, soft, thin bedded, succeeded sharply by quartz sandstone but actual contact covered	800	10195
16	Small amount of section missing through normal faulting	100?	9395
15	Shale, dark grey to dark grey green and medium grained greenish grey, impure, quartzose, sandstone; at base is a coaly shale yielding GSC plant loc. 7014, which contains: Archaeoperisaccus sp., ?Archaeozonotriletes gorodkensis Kedo, ?A. variabilis Naumova, ?Hymenozonotriletes polymorphus Naumova of Ozolin'a 1960 (not H. polymorphus of Naumova 1953, Pl. 22),		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Stenozonotriletes sp., and Tholisporites; these were identified by D.C. McGregor (Kerr, McGregor and McLaren, 1965; also pers. com., 1971), who dates the florule as mid to late Frasnian and favours the late Frasnian	120	9295
	Total thickness of Member B	1020	
	Member A		
14	Sandstone, coarse, pebbly, light greenish grey, impure, quartzose; much angular white and some black chert fragments; at the base conglomeratic, pebbles of rounded white chert and some black chert	500	9175
13	Sandstone, quartzose, impure, medium to coarse grained, angular, much white and some black chert fragments, some fragments of green shale, overall colour medium, light greenish grey, in places abundantly crossbedded, often with plant fragments, also green, silty and shaly interbeds; upper contact sharp and may be a disconformity, GSC plant loc. 7027 contains: Archaeozonotriletes micromanifestus Naumova A. variabilis Naumova Biharisporites sp. ?B. submamillarius McGregor, Chelinospora svalbardiae Allen, cf. Hymenozonotriletes spinuliferus Naumova, Hystricosporites (2 species) ? Lycospora magnifica McGregor, and Stenozonotriletes sp.; this assemblage was identified by D.C. McGregor (pers. com., 1971), who dated it as mid to late Frasnian	375	8675

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
12	Sandstone, quartzose, dark green, fine grained medium bedded, interbedded with shaly siltstone and shale, dark green to black, plant fragments common; ripple marks common, along strike it is partly laterally gradational into the coarser overlying unit; at height of 950 feet GSC plant loc. 7026, which contains Ancyrospora (2 species), Apiculiretusispora sp., Archaeoperisaccus sp., Biharisporites sp., Grandispora sp., Hystricosporites porcatus (Winslow) Allen, Hystricosporites sp., and Retusotriletes laevigatus Guennel; this assemblage was identified by D.C. McGregor (pers. com., 1971), who considered that it is Frasnian, and probably early Frasnian	1800	8300
	Total thickness of Member A	2675	
	Total preserved thickness of Griper Bay Formation	4895	
	Hecla Bay Formation		
	contact probably conformable		
	Upper Member		
11	Sandstone, quartzose, very light cream, weathers light grey to rusty; at 200 feet in the interval common subangular pebbled beds of white chert and some dark grey chert to ½ inch diameter	400	6500

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
10	Cover, rubble is light cream, quartz, sandstone, weathering cream	1300	6100
	Total thickness of Upper Member	1700	
	Lower Member		
9	Sandstone, greenish, recessive, plant bearing; GSC loc. 7025 contains: ?<u>Archaeozonotriletes</u> <u>micromanifestus</u> Naumova <u>Calyptosporites</u> <u>velatus</u> Richardson <u>Grandispora</u> sp. <u>Hystricosporites</u> sp. cf. <u>Hymenozonotriletes</u> <u>spinosus</u> Naumova <u>Perotrilites</u> sp. cf. <u>Diaphanospora</u> <u>riciniata</u> Balme and Hennelly; this assemblage was identified by D.C. McGregor (pers. com., 1971), who stated that it is either late Middle or early Upper Devonian, and favoured a Givetian age	30	4800
8	Sandstone, quartzose, faintly feldspathic and micaceous, very light cream, blocky resistant, weathering cream	1500	4770
7	Sandstone, quartzose, feldspathic, faintly micaceous, fine grained, reddish orange, thick bedded, minor greenish sandy interlayers at base, grades up to cream sandstone	250	3270
6	Sandstone, quartzose, fine grained, tan brown, non-calcareous, blocky, crossbedding; interbeds of slightly limy shaly sandstone, greenish wood fragments and fossils, top of unit grades to overlying red orange sandstone; at the base is GSC plant loc. 7022 which contains: <u>Ancyrospora</u> sp. cf. <u>Archaeozonotriletes</u> <u>arduus</u> Archangelskaya ?<u>Hymenozonotriletes</u> <u>praetervisus</u> Naumova <u>Perotrilites</u> sp. <u>Samarisporites</u> sp. (?=<u>Hymenozonotriletes</u>) <u>macrotuberculatus</u> Archangelskaya <u>Verrucosisporites</u> sp.		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	this florule was identified by D.C. McGregor (pers. com., 1971) who considers that the assemblage is Eifelian or Givetian in age, more likely Givetian; at a height of 200 feet is a 1-13 foot fossiliferous lensing interlayer of tan, limy sandstone, GSC plant loc. 7024 yielding: Ancyrospora sp. Apiculatasporites (2 species) ?Camarozonotriletes obtusus Naumova Camarozonotriletes (2 species) ?Hymenozonotriletes polyacanthus Naumova H. proteus Naumova ?Lophozonotriletes (2 species) Raistrickia aratra Allen Stenozonotriletes sp. Verrucosisporites sp. the above florule was identified by D.C. McGregor, who dated the assemblage as Givetian or Frasnian, with late Givetian suggested as the most reasonable age (pers. com., 1971)	300	3020
5	Sandstone, quartzose, fine grained, brownish, resistant, blocky	300	2720
	Total thickness of Lower Member	2380	
	Total thickness of Hecla Bay Formation	4080	
	Bird Fiord Formation		
	contact covered		
4	Cover; rubble is blocky, non-calcareous; quartz sandstone, probably of Bird Fiord Formation; contact not exposed at top	320	2420
3	Sandstone, quartzose, strongly calcareous, fine grained, greenish grey, resistant, alternates with non-calcareous, green sandy shale and siltstone, recessive	800	2100
	Total thickness of Bird Fiord Formation	1120	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Eids Formation		
	contact conformable		
2	Siltstone, quartzose, very slightly calcareous, tan, weathers light yellow grey, crossbedding common; resistant	300	1300
	Total thickness of Eids Formation	300	
	Bathurst Island Formation		
	contact conformable		
1	Siltstone, dark grey, quartzose, calcareous, thin bedded, weathers slightly brownish grey, in places limestone nodules	1000	1000
	Total exposed thickness of Bathurst Island Formation	1000	
	Lower limit of exposure at a fault		

Section 13. Hosken Islands

The following section is on the southernmost of the two Hosken Islands, north of Bathurst Island proper. The section begins in the centre of the island at Long. 100°05'W, Lat. 76°43'N and continues from this point eastward. The section was measured in part by staff, and in part by scale on air photo A16203-122.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bathurst Island Formation		
9	Siltstone, medium brown, thin to medium bedded, strongly calcareous; GSC loc. 67118	500	2070
	Cape Phillips Formation		
	contact conformable		
8	Shale, fissile, recessive; at base are graptolites, GSC loc. 67117	90	1570
7	Siltstone, thin to medium bedded, fairly resistant, GSC loc. 67116	600	1480
6	Shale, fissile, silty, black, recessive, at top grades to siltier rock that is harder; thin to medium bedded; at top is GSC loc. 67115	230	880
5	Limestone, rubbly, petroliferous; GSC loc. 67114	70	650
4	Shale; at base with biserial graptolites, GSC loc. 67113	30	580
3	Total thickness of Cape Phillips Formation	1020	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	contact conformable		
2	Limestone, micritic, with fossil fragments, light grey, thinly bedded, recessive, alternatives with yellow-grey shaly interlayers, toward top shaly interlayers weather rusty, fossiliferous, with favositid heads common in GSC loc. 67112	150	550
	Total thickness of Irene Bay Formation	150	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Thumb Mountain Formation		
	contact conformable		
1	Dolomite, microcrystalline, petroliferous, sugary, medium dark grey	400	400
	Exposed thickness of Thumb Mountain Formation	400	
	Base of section at lower limit of exposure		

Section 14. Stokes Range

The following is a north dipping section northwest of Dampier Bay, a bay on the west side of May Inlet, northern Bathurst Island. It begins near sea level at a thrust fault at the foot of major bluffs. The base is at 76°17'30"N, 101°05'W. Thicknesses were measured by scale on air photo A-16151-31.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Cape Phillips Formation		
	faulted at the top		
7	Shale, typical of the Cape Phillips Formation	700	2577
6	Limestone, dark grey brown, micritic, petroliferous, weathering light brown	12	1877
	Exposed thickness of formation	712	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	contact conformable		
5	Limestone, micrite, commonly with fossil fragments, thinly bedded, dark grey, much soft greenish shale interlayers weathering green, recessive, fossils lying loose are abundant	180	1855
	Total thickness of Irene Bay Formation	180	
	Thumb Mountain Formation		
	contact conformable		
4	Limestone, dark grey, petroliferous, vuggy, resistant, slightly dolomitic	50	1675
3	Limestone, micrite, thick bedded, light grey, resistant, slightly dolomitic	150	1625
2	Dolomite, shades of grey, finely porous, petroliferous, medium bedded, occasionally laminated, resistant	475	1475

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
1	Cover felsenmeer, probably representing this formation	1000	1000
	Preserved thickness of Thumb Mountain Formation	1675	
	Lower limit of exposure at a thrust fault		

Section 15. Dundee Bight, West

The following is a north dipping section beginning at Long 100°25'W; 76°01'N, three miles west of Dundee Bight in a very short north-northwesterly flowing stream. Thicknesses were measured by scale on air photo A-16151-180.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
8	Sandstone, calcareous cement; siltstone; shale	300	2941
	Eids Formation		
	contact conformable		
7	Shale and siltstone, limy, dark grey, fine grained, very recessive, thin bedded to fissile	1500	
	Total thickness of Eids Formation (approximate)	1500	
	Stuart Bay Formation		
	contact sharp but conformable		
6	Sandstone, quartzose, fine grained, light grey brown, bluff forming, grades sharply to the overlying Eids Formation	80	1141
5	Siltstone, quartzose, shaly, calcareous, dark grey, weathers yellow grey, gradational at top	450	1061
4	Limestone, silty, nodular	1	611
3	Shale and siltstone	4	610
2	Limestone, crinoidal, brown	6	606
	Total thickness of Stuart Bay Formation	541	
	Bathurst Island Formation		
	contact probably conformable		
1	Shale and siltstone, calcareous, dark grey to dark grey brown	600	600
	Observed thickness of Bathurst Island Formation	600	

Section 16. Dundee Bight, central

The following section is on the western shore of May Inlet in coastal cliffs. It begins at Lat. 76°02'N, Long. 100°15'W and continues southward on the south flank of a main anticline. Thicknesses were measured in part by staff and in part by scale on air photo A-16151-180.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Eids Formation		
8	Siltstone and shale, limy (approximate thickness)	1500	5285
	Stuart Bay Formation		
	contact probably conformable		
7	Siltstone and fine grained sandstone, medium chocolate brown to medium grey, calcareous, laminated to thin bedded, weathers yellow grey, upper contact with the Eids Formation is covered; contains much flagstone; plant fragments common; at about 370 feet is GSC loc. 67077	840	3785
6	Sandstone, pebbly, pebbles of chert to $\frac{1}{4}$" diameter maximum, dark grey, black, red; limestones, sandy variables thicknesses of pebbly, beds and limestone beds in a siltstone succession	30	2945
	Total thickness of Stuart Bay Formation	870	
	Bathurst Island Formation		
	contact probably disconformable		
5	Siltstone, quartzose, calcareous, dark chocolate brown, weathers yellow grey, thin to medium bedded, in lower part alternates with minor dark green, non-calcareous fissile shale, weathering medium grey; through the unit are occasional interbeds of thick bedded, medium brown limy, quartz siltstone, weathering orange; at a height of 1200 feet is GSC loc. 67073; at height of a little less than 1800 feet is GSC loc. 67-74; at a height of 1800 feet is GSC loc. 67075; at a height of 1810 feet is GSC loc. 67076, which contains Tentaculitids	1900	2915

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Siltstone, and shale, dark chocolate brown, slightly calcareous, thin bedded, weathers yellow grey; at the base are loose fossils GSC loc. 67069; at 40 feet is GSC loc. 67070; at 70 feet is GSC loc. 67071; at 135 feet is GSC loc. 67072	145	1015
	Total thickness of Bathurst Island Formation	2045	
	Cape Phillips Formation		
	contact conformable		
3	Shale, dark grey, recessive, non-calcareous, fissile, weathers dark grey to medium grey, occasionally rusty, in the upper 100 feet becomes calcareous, weathers yellow grey, grades up to calcareous chocolate brown, rock of the overlying formation; at height of 110 feet is GSC loc. 67063; at 195 feet is GSC loc. 67064; at 265 feet is GSC loc. 67065; at 265 to 267 feet is a 3 foot thick band of orange weathering slightly calcareous siltstone; at 330 feet is GSC loc. 67066; at 385 feet is GSC loc. 67067	490	870
2	Shale, dark grey, much interbedded calcareous siltstone in beds and lenses, medium grey weathering yellow grey	55	380
1	Shale and lesser siltstone, dark grey, non-calcareous, weathers tan grey, thinly bedded at top becomes much medium grey calcareous very silty rock; at the base loose is GSC loc. 67061 with graptolites; at a height of 125 feet is cf. *M. riccartonensis* 10 inches long; at a height of 230 feet is GSC loc. 67062	325	325
	Exposed thickness of Cape Phillips Formation	870	

Section 19. Young Inlet, south

The following is a northwesterly dipping section, that begins at the northwest tip of a small lake, located at 99°W, 76°20'N, and about four miles south-southeast of the head of the western arm of Young Inlet and continues to the northwest. It is located on air photo A-16761-168, from which thicknesses were measured by scale.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
28	Sandstone, quartzose, light grey green to light grey, very faintly limy	150	4005
27	Sandstone, quartzose, limy, shaly, grey green, weathers slightly greenish grey, recessive, interbeds 10 or so feet thick of sandy limestone which is resistant, the limestone decreasing upward	300	3855
26	Shale, green, non-calcareous, calcareous veining fragments about, soft and very recessive	30	3555
25	Covered, probably limy sandstone	85	3525
24	Limestone, very quartz sandy, light grey, slightly greenish	5	3440
23	Covered	30	3435
22	Limestone, quartz sandy	5	3405
21	Covered, probably limy sandstones	28	3400
20	Limestone, quartz sandy, bluff forming	5	3372
19	Sandstone, very limy, and limestone, sandy, grey green, minor grey and cream sandstone, weathers yellow grey, largely rubble interval, recessive	80	3367
18	Sandstone, quartzose, slightly calcareous, with muscovite grains, medium light grey, powdery limonite specks, weathers orange	50	3287
17	Sandstone, quartzose, calcareous, muscovite flakes; thin to medium bedded, dark grey , weathers greenish grey	95	3237
	Observed thickness of Bird Fiord Formation		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Blue Fiord Formation		
	contact conformable		
16	Limestone, medium bedded, brown, sandy and shaly; much shale in discrete beds up to 3 feet thickness, non-calcareous.	110	3142
15	Limestone, thick bedded, brown, minor shale	55	3032
14	Cover, rubble of limestone	90	2977
13	Limestone	2	2887
12	Cover, rubble of limestone	25	2885
11	Limestone, micritic, fragmental, medium brown, weathers light yellow brown, very shaly, shaly interlayers in part, wavy surfaces on bedding, ledge forming	70	2860
10	Cover	60	2790
	Total thickness of Blue Fiord Formation	412	
	Eids Formation		
	contact conformable		
9	Siltstone and mudstone, strongly siliceous & dolomitic, quartzose, calcareous; dark grey to dark chocolate brown, weathers tan yellow, resistant, grades to overlying rock	200	2730
8	Siltstone and mudstone, calcareous, quartzose, slightly siliceous generally, in places highly siliceous, thinly bedded, medium dark grey, fairly resistant, weathers tan yellow, occasional rusty weathering interlayers	850	2530
	Total thickness of Eids Formation	1050	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Stuart Bay Formation		
7	Siltstone, quartzose, calcareous, chocolate brown, minor dolomite interbeds and minor chert pebble conglomerates, weathers yellow tan, 30 to 38 feet from the top is an 8 foot interval of coarse boulder conglomerate with boulders up to 2 feet diameter, rounded, black fragmental crinoidal, shaly limestone; overlain by black shaly limestone which shows intra-formational slumping, dying out upward and grading into shaly limestone and limy shale of the overlying formation; boulders at the top of the unit contain crinoid fragments (GSC loc. 67737)	1000	1680
6	Dolomite, sugary, fine-grained, light to light grey, weathering light grey, medium bedded, bluff former	150	680
5	Covered, the rubble is a thinly bedded siltstone	120	530
4	Siltstone, quartzose, very limy, minor chert pebble conglomerate, chocolate brown, fairly resistant	45	410
3	Shale, limy, dark grey recessive	50	365
2	Limestone, very shaly, very petroliferous, well rounded chert pebbles up to 1 inch diameter, thin bedded, weathers medium light grey, contains fossils (GSC loc. 67736)	15	315
	Total thickness of Stuart Bay Formation	1380	
	Bathurst Island Formation		
	contact disconformable		
1	Siltstone	300	300

Section 20. Young Inlet, east

The following section begins at Long. 98°37'W, Lat. 76°28'N, about 5 miles east-northeast of the head of the eastern branch of Young Inlet, and dips to the northwest. Thicknesses were measured by scale on air photo A-16761-195; GSC plant loc. 8341 to 8412 collected by D.C. McGregor, and GSC locs. 83292 to 83332 collected by T.T. Uyeno, are included in the description of this section.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Hecla Bay Formation		
	Lower Member		
13	Sandstone, quartzose, medium to coarse grained yellow orange, weathering yellow orange, limonitic spots; this unit contains GSC plant locs. 8409 to 8412, and GSC locs. 83331 and 83332	146	8668
	Preserved thickness of Hecla Bay Formation		
	Bird Fiord Formation		
	contact conformable		
12	Sandstone, quartzose, usually calcareous, medium grained, yellow oranged, weathers yellowish orange, crossbedded and ripple marked; this unit contains GSC plant Locs. 8403 to 8408 and GSC Locs. 83327 to 83330	506	8522
11	Sandstone, quartzose, medium grained, calcareous, generally light grey, slightly greenish, chert fragments, weathers greenish, alternates with much dark greenish grey sandy shale, abundant trails on surfaces, largely covered, sand ledges protrude; the unit contains GSC plant locs. 8397 to 8402 and GSC locs. 83332 to 83326	560	8016
10	Shale, greenish, non-calcareous, recessive; this unit contains GSC plant locs. 8395 and 8396	38	7456
	Total thickness of Bird Fiord Formation	1104	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Blue Fiord Formation		
	contact conformable		
9	Limestone, variable, largely covered, medium light grey to dark grey, shaly, fossils occur in big blocks; uppermost 30 feet is an outcropping limestone bluff, micritic, fragmental, medium light brown, weathers yellowish brown, slightly greenish, greenish shale partings; the unit contains GSC plant locs. 8390 to 8394 and GSC ocs. 83317 to 83321	558	7418
8	Limestone, crinoidal in places, shaly, medium brown, medium bedded, weathers very light brown; this unit contains GSC plant locs. 8388 to 8390 and GSC locs. 83311 to 83316. At the base (GSC loc. 67018) Klapper identified <u>Icriodus</u> cf. <u>corniger</u>	347	6860
	From conodonts and spores McGregor & Uyeno regard the formation as Eifelian (pers. com., 1971).		
	Total thickness of Blue Fiord Formation	905	
	Eids Formation		
	contact conformable		
7	Mudstone, calcareous, siliceous, dark chocolate brown, dolomitic, weathers light brownish grey, thin to medium bedded, conchoidal fracture, upper 100 feet is covered, becoming more limy upward;	845	6513

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
6	Limestone, very siliceous, dolomitic, shaly, common chert nodules, dark grey, weathers very light, brownish grey, thin bedded to fissile, weathering shows laminae, sharp clinkery sound on striking, toward top it becomes dark chocolate brown, grading into the overlying unit, Tentaculites and organic trails occur; this unit contains GSC plant locs. 8385 and 8386 and GSC loc. 83310. X-ray analysis showed the following composition: Specimen 8385; height 85 feet - calcite 66%, quartz 28%, dolomite 3%, illite 2%, kaolinite 1%; Specimen 8386 - calcite 80%, quartz 17%, dolomite 3%	1000	5668
	From spores and conodonts McGregor and Uyeno regarded the formation as late Emsian and Eifelian (pers. com., 1971)		
	Total thickness of Eids Formation	1845	
	Stuart Bay Formation		
	contact gradational		
5	Limestone, very shaly, siliceous, dark grey to black, medium bedded, weathers light grey, partly replaced by black chert nodules; interbedded in equal amounts with faintly limy siliceous dark grey to black shale, weathering light grey; upward the shale becomes more predominant and grading to overlying rock, plants occur at the base in GSC loc. 67016; this unit contains GSC plant locs. 8383 and 8384, and GSC locs. 83307 to 83309	292	4668
4	Sandstone, very fine grained calcareous, yellow brown to chocolate brown, weathers light yellow tan, thin bedded; minor siltstone, chocolate brown, grades to dark grey shaly limestone at the top; this unit contains GSC plant locs. 8379 to 8382	345	4376

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Sandstone, very fine grained, quartzose, yellow brown to chocolate brown, medium bedded; minor siltstones; this unit contains GSC plant locs. 8376 to 8378, and GSC locs. 83305 and 83306. GSC loc. 83306 at a height of 353 feet in this unit contains Monograptus cf. M. yukonensis, Jackson and Lenz, 1963, that was identified by R. Thorsteinsson and dated as late Siegenian to early Emsian	403	4031
2	Sandstone, very fine grained, quartzose, calcareous, chocolate brown, weathers tan, lesser amounts of siltstone, occasional sandy crinoidal limestone; chert pebble conglomerate at the base; at a height of 200 feet is GSC loc. 67014; at the top is GSC loc. 67015 (graptolites). This unit contains GSC plant locs. 8371 to 8375, and GSC locs. 83299 to 83304	280	3628
	From spores and conodonts McGregor and Uyeno regarded the formation Emsian, with possibly some Siegenian at the base (pers. com., 1971)		
	Total thickness of Stuart Bay Formation	1320	
	Bathurst Island Formation		
	contact concordant (probably a regional unconformity)		
1	Sandstone, quartzose, very fine grained, calcareous, thin to medium bedded, medium dark grey to chocolate brown; very much calcareous, quartz siltstone, which is thin bedded, chocolate brown, weathers tan; at the top are graptolites GSC locs. 67012. D.C. McGregor collected the following samples in this formation, GSC plant locs. 8343 to 8370, and T.T. Uyeno collected GSC locs. 83292 to 83298. According to McGregor and Uyeno (in press) GSC loc. 83298 which occurred 30 feet below the top of the formation contains Nowakia sp. and Styliolina sp. (identified by A.W. Norris), plant megafossils including Rebuchia n. sp., Drepanophycus spinaeformis Goeppert, Sawdonia ornata (Dawson) Hueber, and a new genus of zosterophylloid line (identified by F.M. Hueber), and Monograptus sp. cf. M. thomasi Jaeger (1966) (identified by R. Thorsteinsson and dated as probably Siegenian or Emsian). On the basis of these fossils McGregor and Uyeno (pers. com., 1971), regard the formation as probably Siegenian	3348	3348
	Exposed thickness of Bathurst Island Formation	3348	
	Base of section at lower limit of exposure		

Section 21. Young Inlet, southeast

The following section begins at Lat. 76°21'N, Long. 98°35'W. This point lies about 6 miles south-southeast of the southern end of the east branch of Young Inlet. Thicknesses were measured by scale from air photo A-16761-193.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
21	Sandstone, calcareous; limestone, arenaceous, dark greenish to light greenish	300	6645
	Observed thickness of Bird Fiord Formation	300	
	Blue Fiord Formation		
	contact conformable		
20	Limestone, dark grey, medium bedded, shaly, with shaly interlayers; weathering colour yellow brown; limestone, sandy, weathering yellow brown, grades abruptly to overlying formation	870	6345
	Total thickness of Blue Fiord Formation	870	
	Eids Formation		
	contact conformable		
19	Shale and mudstone, very siliceous, calcareous, dolomitic, fetid, thin bedded, dark grey to black, weathers medium light grey to light tan, interbedded with dark limy fissile shale, Tentaculites abundant, at the top unit becomes dark very shaly limestone and limy shale and grades to overlying formation; the formation here is resistant and the so-called clinkery facies of the Eids	850	5475
	Total thickness of Eids Formation	850	
	Stuart Bay Formation		
	contact conformable		
18	Limestone, fragmental, constituting patch reefs, grading laterally to sandy limestones, very petroliferous, thickness varies, the width is a minimum of 50 feet; GSC loc. 67735	15	4625
17	Limestone, fragmental, sandy	40	4610

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
16	Limestone, massive, constituting a patch reef, grading to sandy limestone and limy sandstone laterally	20	4570
15	Limestone, fragmental, medium bedded	10	4550
14	Limestone, boulders up to 4 feet diameter of poorly rounded to rounded medium light grey fragmental limestone and pellet limestone with some white subrounded chert fragments; GSC loc. 67734	20	4540
13	Limestone, fragmental, medium grey, weathers medium grey, thick-bedded, ledge-forming	35	4520
12	Sandstone, quartzose, dark grey, dolomitic, fine grained, weathers tan brown, a typical flagstone, thin bedded, interbedded with about 30% of medium brown sugary dolomite	300	4485
11	Dolomite, sugary, medium dark grey, contains irregular black chert nodules, blocky, sharp contact at the base of this unit	40	4185
10	Sandstone, quartzose, shaly, the base is marked by pebble conglomerate, grading up to sandstone and some mudstone; chocolate brown; non-calcareous, at a height of 500 feet is GSC loc. 67028	650	4145
9	Sandstone, quartzose, fine grained shaly, shaly siltstone, mudstone; all are calcareous, dark chocolate brown, weathering tan; Tentaculites observed in places, grading to entirely mudstone at the top	340	3495
8	Conglomerate, fine, pebbles maximum diameter 2 inches are of tan, white, grey-green, orange, dark grey, and red chert, and of limestone; pebbles are angular to sub-rounded; also sandy limestone interbeds; in upper 20 feet is GSC loc. 67733 containing intact brachiopods that are probably indigenous and broken corals that possibly are not	105	3155
7	Limestone, quartz sandy, fine grained; sandstone limy medium light grey, weathering tan; graptolites at a height of 80 feet in GSC loc. 67732	190	3050

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
6	Siltstone, limy, dark grey to chocolate brown, weathers tan, thin bedded, minor fine grained sandstones; Tentaculites	125	2860
5	Covered, sandy limestone and limy sandstone, probably as below	75	2735
4	Limestone, quartz sandy; quartz sandstone, limy; medium light grey, tan weathering, occasiona, conglomeratic interbeds, recessive	100	2660
3	Conglomerate, fine grained, thick bedded to massive, pebbles of limestone and chert, resistant ledge	45	2560
2	Conglomerate, coarse pebbles of medium grey limestone up to four inches in diameter, and of white grey, black, cream, or red chert that are up to 2 inches diameter; thick bedded to massive; a sandy limestone constituting a resistant ledge contains GSC loc. 67731; this unit is in three cycles which are coarse to fine upward	15	2515
	Total thickness of Bathurst Island Formation	2125	
	Bathurst Island Formation		
	contact unconformable		
1	Siltstone, shaly, calcareous, dark grey brown, sandstone, fine grained, medium grey green, common fish fragments	2500	2500
	Exposed thickness of Bathurst Island Formation	2500	
	Base of section at lower limit of exposure		

Section 22. Green River

This section begins at 76°26'N, 98°10'W. It is a north dipping section which begins at the headwaters of Green River in the core of a faulted anticline. Thicknesses were measured by scale from air photo A-16202-26.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
13	Sandstone, quartzose, calcareous, medium to light grey green; alternating with dark grey-green shale intervals	800	8605
	Blue Fiord Formation		
	contact conformable		
12	Limestone, brown, shaly, thin to medium bedded; GSC loc. 67104	600	7805
11	Limestone, micrite rather pure, cream, medium bedded; GSC loc. 67103	900	7205
	Total thickness of Blue Fiord Formation	1500	
	Disappointment Bay Formation		
	contact conformable		
10	Dolomite, generally porous, more finely porous upward, creamed coloured, at base vuggy	1300	6305
	Stuart Bay Formation		
	contact conformable		
9	Siltstone, sandstone, minor limestone	1300	5005
	Bathurst Island Formation		
	contact disconformable?		
8	Siltstone, quartzose, brown, medium bedded, and some thinly bedded, weathering light greenish grey to yellow tan, largely covered during this interval	2200	3705
	Total thickness of Bathurst Island Formation	2200	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Cape Phillips Formation		
	contact conformable		
7	Siltstone, shaly, brown, slightly calcareous, weathers slightly greenish grey to yellow tan thinly bedded, grades to overlying formation by increase in siltiness, also becomes thicker bedded and more calcareous	200	1505
6	Covered interval, dark grey fissile shale, grades to brownish, slightly calcareous siltstone, at a height of 50 feet in unit cf. Monograptus bohemicus lies loose but abundant and probably is closely derived	500	1305
5	Limestone, medium light grey, thinly bedded; GSC loc. 67102	85	805
4	Shale; at height of 65 feet is GSC loc. 67100; at a height of 145 feet is GSC loc. 67101	365	720
3	Shale, medium bedded, silty, dolomitic, light chocolate brown, weathers slightly rusty brown, resistant; GSC loc. 67099	30	355
2	Shale, fissile to thin bedded; loose at a height of 100 feet is GSC loc. 67098	200	325
	Total thickness of Cape Phillips Formation	1380	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	contact conformable		
1	Limestone, thin bedded, micrite, greenish shale interlayers, weathers green, slightly rusty, rusty weathering tinge	125	125
	Observed thickness of Irene Bay Formation	125	
	Lower limit of exposure at a fault		

Section 23. Cape Kitson

This section begins in the centre of an anticline, at Long. 97°40'W, Lat. 76°29'N, one mile southwest of Cape Kitson on northeastern Bathurst Island, and continues to the southwest. Thicknesses were measured in part by staff and in part by scale from air photo A-16202-127.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Stuart Bay Formation		
	Upper contact covered		
9	Siltstone, quartzose, very calcareous, thinly bedded; interbeds of medium bedded brownish shaly crinoidal limestone; this unit is mainly covered except for the limestone outcrops with a few interbedded reefs; limestone interbeds in the lower part (GSC loc. 67121) contains Levenea sp., Gypidula? sp., Leptaena sp., indet., rhynchonellid with color markings, Atrypa "reticularis", and an an indeterminate coral; this faunule was identified by Johnson and Boucot, who regard it as Early or Middle Devonian age	250	
	Cape Phillips Formation		
8	(Gap in observations, with unknown thickness covered)	?	
7	Limestone, shaly, nodular, shale interbeds, medium light brown, weathers yellow tan, very sporadically exposed; at a height of approximately 425 feet is GSC loc. 67120	800	1413
6	Shale, fissile, papery, biserial graptolites, grades up to slightly shaly limestone	20	613
5	Limestone, shaly, brown, coquina of straight cephalopods	3	593
4	Shale, fissile, papery, black	20	590
	Exposed thickness of Cape Phillips Formation		
	CORNWALLIS GROUP		
	Irene Bay Formation (assumed)		
3	Gap in outcrop equivalent to 130 feet of rock	130	570

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Thumb Mountain Formation		
	contact conformable (?)		
2	Dolomite, light tan crystalline with cherty nodules, fossils of the "Arctic Ordovician fauna" (GSC loc. 67119) upper contact covered	340	440
1	Dolomite, dark brown, markedly cherty, vuggy, petroliferous, shattered, rubble only is exposed in this interval	100	100
	Exposed thickness of Thumb Mountain Formation	440	
	Base of section at lower limit of exposure		

Section 25. Twilight Creek

This section is at Long. 99° 10'W, Lat. 76° 11'N,beginning at the mouth of Twilight Creek and continuing upstream to the northwest (Pl. III). Lithologic descriptions are taken from McLaren(1963b) The description has been supplemented with revised faunal identifications and datings. It is republished here because it is a key section, containing the type sections of the Bathurst Island and Stuart Bay Formations.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Eids Formation</u>		
	(This formation continues upward and is mainly mudstone and shale, calcareous, grey, with some beds of argillaceous limestone, soft weathering)		
10	Calcareous shale, black, interbedded in nearly equal amounts of medium bedded highly variable limestone; the basal unit yielded fragmentary fauna, (GSC loc. 25837): indet dalmanellid <u>Leptaena</u>? sp. indet. stropheodontids <u>Phragmostrophia</u> sp. large indet. rhynchonellids <u>Atrypa</u> "<u>reticularis</u>" smooth reticulariids (not <u>Ambocoelia</u>) Boucot, Johnson and Harper identified the fauna and state that on the basis of <u>Phragmostrophia</u> the collection is Emsian in age At the base is GSC loc. 83702 and at a height of 20 feet is GSC loc. 83703. These were collected by Uyeno, who identified the following fossils in both collections; <u>Polygnathus foveolatus</u> Philip and Jackson, <u>Spathognathodus</u> n.sp., <u>Ozarkodina</u> n.sp. Uyeno (pers. com., 1971) dated these collections as Emsian.	90	6235

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Stuart Bay Formation (type section)		
	contact conformable		
9	Sandstones, quartzose, argillaceous and calcareous, brownish grey, uniformly fine grained, thin bedded and laminated; interbedded near the top and bottom with black sandy mudstone and siltstone; homogeneous, weathers to yellowish brown flagstone fragments, 1 to 2 inches thick	565	6145
8	Mudstone, silty, calcareous, thin bedded, dark grey, soft weathering and shaly; single beds of fine-grained greyish brown limestone occurring at irregular intervals, commonly are less than a foot thick, they may increase in short distance along strike to small biohermal masses, several feet thick; some intervals of crinoïdal and shell fragments. At a height of 135 feet in this unit is GSC loc. 25835, containing Schizophoria sp. A. Parachonetes aff. macrostriatus (brac. valve) "Leiorhynchus" sp. A. Atrypa "reticularis" Carinatina? sp. (brachial valves) Elythyna? sp. reticulariid (smooth) 2-hole crinoid ossicles Boucot, Johnson and Harper identified this fauna and dated it as Emsian (pers. com., 1971)	220	5580
7	Sandstone, quartzose, thin bedded, fine grained laminated, argillaceous with interbedded calcareous sandstone	415	5360
6	Mudstone, calcareous, sandy, and argillaceous sandstone; contains three pebble beds varying in thickness along strike from about 9 inches to 2 feet, of well rounded pebbles of grey chert and brown aphanitic limestone in a calcareous sandy matrix; along strike these pebbles grade into irregular beds of pale brown fine-grained limestone; limestone pockets in the basal pebble beds (GSC loc. 25834) include the following fauna:		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Parachonetes aff. macrostriatus (ped. valve) Atrypa "reticularis" Carinatina? sp. (brachial valve) pauciplicate spirifer (brac. valve) This fauna is regarded as Emsian by Boucot, Johnson, and Harper (pers. com., 1971).	20	4945
	Total thickness of Stuart Bay Formation	1220	

Bathurst Island Formation (type section)

disconformity?

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
5	The formation consists largely of fairly fine-grained quartzose sandstones, variably argillaceous and calcareous, and calcareous sandy mudstones. In fresh surface the formation is monotonous well-bedded flagstones, that weather yellowish brown to pale brown; there are varying amounts of mudstone or sandstone, but the formation is strikingly homogeneous; calcareous and argillaceous, quartzose sandstones alternate with calcareous, sandy, and silty thin bedded mudstones. The formation contains graptolites identified by Thorsteinsson at various heights above the base. at 3,310 feet (GSC loc. 25831) Monograptus yukonesis Jackson and Lenz 1963 at 3,230 feet (GSC loc. 25832) Monograptus yukonensis Jackson and Lenz 1963 at 3,150 feet (GSC loc. 25833) Tentaculites, Monograptus yukonensis Jackson and Lenz 1963 at 3,000 feet (GSC loc. 25829) Tentaculites Monograptus n. sp. aff. M. hercynicus Perner at 2,490 feet (GSC loc. 25837) Monograptus yukonensis Jackson and Lenz 1963		

ıit	Lithology	Thickness (feet)	Height Above Base (feet)
	Monograptus yukonensis Jackson and Lenz 1963 had earlier been called Monograptus n. sp. A by Thorsteinsson (Berdan et al. 1969). Following Klapper (1969) this species is dated as lower Devonian, and more specifically as Siegenian or early Emsian (Thorsteinsson, pers. com., 1971).	3410	4925
	Total thickness of Bathurst Island Formation	3410	
	Cape Phillips Formation		
	contact transitional		
4	Shale and mudstone, black, largely non-calcareous, but dolomitic in the lower parts, some bands of dark grey argillaceous dolomite, some of these bands are irregular in thickness and others are nodular and discontinuous; the dolomite bands weather prominent orange yellow; many of the black mudstones and shales are strongly petroliferous; in the upper 200 feet of the formation the shales are interbedded with equal amounts of dark grey, argillaceous and calcareous siltstone which is thin bedded and laminated and weather into pale reddish-brown fragments. Graptolites of the Cape Phillips Formation were identified and dated by R. Thorsteinsson (pers. com., 1971), and shelly faunas were identified and dated by G.W. Sinclair. Faunas and their heights above the base of this unit are as follows: at 945 feet (GSC loc. 25824) Ceratiocaris sp. indet. Monograptus n. sp. B aff. M. angustidens Pribyl age: uppermost Pridolian at 935 feet (GSC loc. 25824) Monograptus cf. M. uniformis Pribyl age: Gedinnian (M. uniformis represents the basal zone of lowermost Devonian, or Geninnian)		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	at 735 feet (GSC loc. 25822) Orbiculoid brachiopods *Ceratiocaris* aff. *C. acuminatus* Hall at 405 feet (GSC loc. 25820) *Monograptus transgradiens praecipuus* age: late Pridolian at 295 to 375 feet (GSC locs. 25818 and 25821) *Monograptus* sp. indet. at 205 feet (GSC loc. 25817) *Monograptus* sp. indet. at 195 feet (GSC loc. 25815) *Plectograptus macilentus* (Tornquist) *Monograptus bohemicus* (Barrande) *Monograptus nilssoni* (Barrande) *Monograptus* cf. *M. crinitus* Wood *Monograptus* spp. indet. age: lower Ludlovian	950	1515
3	Mudstone and shale, calcareous, black; with thin beds of argillaceous limestone in the basal 20 feet; banded and laminated mudstones with varying amounts of pyrite, especially in the lower part; weathered surfaces are pale yellowish brown to orange-brown in colour; faunas and their heights above the base of the unit are at 245 to 355 feet (GSC loc. 25814) *Paraplectograptus eiseli* (Manck) *Plectograptus textor* Bouček and Munch *Monograptus* cf. *M. flemingii* (Salter) *Monograptus* cf. *M. vomerinus* (Nicholson) *Cyrtograptus trilleri* (Eisel) age: uppermost Wenlockian		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	at 120 to 245 feet (GSC loc. 25813)		
	Paraplectograptus eiseli (Manck		
	Plectograptus textor Bouček and Munch		
	Monograptus flemingii (Salter)		
	Monograptus cf. M. latus M'Coy		
	Monograptus cf. M. vomerinus (Nicholson)		
	Cyrtograptus lundgreni Tullberg		
	age: upper Wenlockian		
	at 70 to 120 feet (GSC loc. 25812)		
	Monograptus cf. M. priodon (Bronn)		
	Cyrtograptus sp. indet		
	age: probably lower part of Wenlockian series		
	at 30 to 70 feet (GSC loc. 25811) is the following:		
	Stomatograptus robustus Bouček		
	Monograptus convolutus coppingeri Etheridge		
	Monograptus priodon (Bronn)		
	Monograptus cf. M. personatus Tullberg		
	Monograptus spp. indet.		
	Cyrtograptus n. sp. aff. C. centrifugus Bouček		
	age: uppermost Llandovery		
	at 0 to 30 feet (GSC loc. 25810)		
	Stomatograptus grandis (Suess)		
	Stomatograptus robustus (Bouček)		
	Monograptus spiralis spiralis (Geinitz)		
	Monograptus cf. M. priodon (Bronn)		
	Monograptus n. sp. aff. M. vomerinus (Nicholson)		
	Cyrtograptus lapworthi Tullberg		
	Cyrtograptus n. sp. aff. C. centrifugus Bouček		
	age: late Llandovery (penultimate and ultimate zones)	360	565
2.	Shale, calcareous, black, with varying amounts of interbedded argillaceous limestone, which is fine grained and laminated, weathering into thin flagstones; faunas and their heights above the base of this unit are as follows:		
	at 65 to 115 feet (GSC loc. 25809)		
	Monograptus cf. M. priodon (Bronn)		
	Monograptus sp. aff. M. vomerinus (Nicholson)		
	age: upper Llandoverian or lower Wenlockian		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	at 40 to 60 feet (GSC loc. 25808)		
	Monograptus turriculatus turriculatus (Barrande)		
	Monograptus turriculatus minor Bouček		
	Monograptus cf. *M. jaculum* (Lapworth)		
	Monograptus cf. *M. conspectus* (Přibyl)		
	age: upper Llandoverian		
	at 35 feet (GSC loc. 25807)		
	Climacograptus cf. *C. scalaris* Linnarsson		
	Petalograptus cf. *P. palmeus* (Barrande)		
	Monograptus millepeda M'Coy		
	Monograptus cf. *M. regularis solidus* Přibyl		
	Monograptus sp. indet.		
	age: lower Llandoverian		
	at a height of 15 feet (GSC loc. 25806)		
	Climacograptus sp. indet.		
	Monograptus sp. indet.		
	Rastrites sp. indet.		
	age: Llandoverian	130	205
1	Limestone, fine grained, variably argillaceous, black and grey, with interbeds of black calcareous mudstone and shale; some of the limestone beds are strongly petroliferous and others are nodular, mottled, and aphanitic; faunas and their heights above the lowest exposures are:		
	at 60 feet (GSC loc. 25805)		
	Streptelasma sp.		
	Foerstephyllum? sp.		
	Straight cephalopod		
	Illaenus sp.		
	Sinclair considered the age to be Middle or Late Ordovician		
	at 15 to 25 feet (GSC locs. 25802 and 25804)		
	Orthograptus n sp. which Thorsteinsson regards as Late Ordovician in age		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Near the base (GSC loc. 25803) Lophospira cf. L. milleri (Hall) Straparollina n. sp. "Orthoceras" spp. abundant asaphid trilobites (two genera) Leperditella? sp.	75	75
	Exposed thickness of Cape Phillips Formation	1515	
	Base of section at lower limit of exposure		

Section 27. Half Moon Bay, west

This is a composite section in the Half Moon Bay Structure on the east side of May Inlet at Long. 99°55'W, Lat. 76°02'30"N. Up to the Eids Formation the section was measured on the south flank; the Eids and younger formations are from the north flank. Thicknesses were measured by scale on air photos A-16203-45 and 146. This section is shown on Fig. 4 and Pl. XVI.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
	Upper limit of exposure		
13	Sandstone, quartzose, very limy, micaceous, sandy limestone; sandy shale; limy shale; dark grey green, dark green, brownish green, limy sandstone and sandy limestone, resistant alternating with shales which are dark green	2300	8031
	Exposed thickness of Bird Fiord Formation	2300	
	Blue Fiord Formation		
	contact conformable		
12	Limestone, micritic, thin to medium bedded; shaly interlayers give irregular wavy surfaces to bedding planes; biostromal; contains GSC loc. 67026 and GSC loc. 67027	45	5731
	Total thickness of Blue Fiord Formation	45	
	Eids Formation		
	contact conformable		
11	Siltstone and mudstone, quartzose, very limy, medium grey to tan, soft, crumbly, recessive, limestone interbeds near top but grading sharply to the overlying unit, cross laminae occur most commonly at the base, gradational with lower unit, thickness uncertain because of a possibility of deformation	1400	5686
	Total thickness of Eids Formation (approximate)	1400	
	Stuart Bay Formation		
	contact conformable		
10	Siltstone, thin to medium bedded, slightly calcareous; interbedded mudstone and shale, orange weathering; at base is soft sediment deformation	1400	4286

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
9	Pebble conglomerate, siltstone matrix, pebbles of white chert and crinoidal fragments, GSC loc. 67092	60	2886
	Total thickness of Stuart Bay Formation	1460	
	<u>Bathurst Island Formation</u>		
	Contact angular unconformity		
8	Siltstone, thin bedded to fissile, fine grained; sandstone, very fine grained; shale, rarely calcareous; dark brown to dark grey; weathers tan brown; at the base are GSC loc. 67024 and GSC loc. 67091 with graptolites and fish fragments	1150	2826
	Total thickness of Bathurst Island Formation	1150	
	<u>Cape Phillips Formation</u>		
	contact conformable		
7	Shale, dark grey, slightly calcareous, thin bedded to fissile; siltstone; minor limestone, grading sharply upward to the overlying formation	650	1676
6	Limestone, argillaceous, dark grey to dark chocolate brown, thin bedded; much dark grey calcareous shale and some dark grey calcareous siltstone; grapolites common; gradational very gradually to overlying shale unit	650	1026
5	Limestone, fine grained, medium brown	34	376
4	Shale, black, calcareous, silty, some siltstone, very soft; biserial graptolites	40	342
3	Limestone and dolomite, mottled, the limestone is dark grey, the dolomite is grey brown, medium bedded	37	302
	Total thickness of Cape Phillips Formation	1411	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	CORNWALLIS GROUP		
	Irene Bay Formation		
	contact conformable		
2	Shale, calcareous, green interbedded with thin bedded, micritic limestone, with fossil fragments, recessive, minor black shale, calcareous	65	265
	Total thickness of Irene Bay Formation	65	
	Thumb Mountain Formation		
	contact conformable		
1	Limestone, micritic, medium grey to grey brown, shaly interlayers present and weathers greenish or rusty yellow, medium bedded	200	200
	Exposed thickness of Thumb Mountain Formation	200	
	Base of section at lower limit of exposure		

Section 28. Half Moon Bay, east

This section is on the east side of a dome in the Half Moon Bay structure, beginning at Long. 99°55'W, Lat. 76°02'30"N and continues first east and then south through a major stream cut. Thicknesses were measured by scale on air photo A-16203-146. This section is shown on Fig. 4, and Pl. XVI.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Eids Formation		
	upper limit of outcrop		
9	Siltstone and mudstone, very limy, medium grey to tan, soft crumbly; lower part very recessive, upper part moderately resistant; specimen K1-63-69c from a height of 1000 feet showed the following x-ray analysis; calcite 49%, quartz 34%, dolomite 6%, illite 5%, feldspar 3%, kaolinite 2%, pyrite 1%, and a trace of chlorite.	1100	6565
	Stuart Bay Formation		
	contact conformable		
8	Siltstone, medium bedded, weathering orange, slightly calcareous, mudstone interbeds and fissile black calcareous shale; at a height of 20 feet is GSC loc. 67088; at a height of 675 feet is GSC loc. 67089; at a height of 1175 feet is GSC loc. 67090	1380	5465
7	Siltstone, thin to medium bedded, often flaggy, hard, yellow orange weathering, at base thin crinoid beds; at a height of 10 feet is GSC loc. 67086; at a height of 155 feet is GSC loc. 67087	170	4085
	Total thickness of Stuart Bay Formation	1550	
	Bathurst Island Formation		
	contact conformable		
6	Siltstone, thin bedded, fine grained at a height of 15 feet is GSC loc. 67082; at a height of 30 feet is GSC loc. 67083; at a height of 175 feet is GSC loc. 67084; at a height of 300 feet is GSC loc. 67085	305	3915

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
5	Siltstone, thin bedded to fissile, recessive, slump structures common with movement toward the south; at a height of 575 feet is a one foot limestone interbed; between 755 and 785 feet limestone interbeds are common, and comprise 25% of the rock; at a height of 770 feet is GSC loc. 67081	785	3610
4	Siltstone, coarse, very fine grained sandstone, thin to medium bedded, intraformational slumping to the south, very minor black shale interbeds; at a height of 200 feet is GSC loc. 67080	225	2825
3	Siltstones, dark brown to dark grey, calcareous, flaggy, interbedded with about equal amounts of shale, fissile, calcareous, at 100 feet from the top is flagstone with tarry bituminous liquid, at the top it is fissile and graptolite bearing with GSC loc. 67079	1800	2600
2	Siltstone, medium brown, limy, yellow tan weathering, flagstones to fissile	500	800
	Total thickness of Bathurst Island Formation	3615	
	Cape Phillips Formation		
	contact conformable		
1	Shale, limestone	300	
	Observed thickness of Cape Phillips Formation	300	300

Section 29. Reindeer Bay

The following is an east dipping section of the Melville Island Group that occurs above an angular unconformity. It begins about 1 1/2 miles inland from the east coast of Bathurst Island, in the course of a northeasterly flowing stream that enters the sea at a delta lying 5 miles south of Reindeer Bay. The section which begins at Long. 97°40'W, Lat. 76°14'30"N, is visible on air photo A-16202-48. Thicknesses were measured by staff.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation		
	Member B		
11	Sandstone, quartzose, fine grained, weathers dark grey green	40	1305
10	Shale	35	1265
9	Sandstone, quartzose, fine grained, medium light grey green, non-calcareous, impure, small scale cross-laminae, at about 30 feet in this unit in a shale interbed (GSC loc. 59041) are the following spores: Acanthotriletes hirsutus Chibrikova cf. A. uncatus Naumova cf. Archaeozonotriletes famenensis Naumova ?A. micromanifestus var. famenensis Naumova Biharisporites sp. Calamospora atava (Naumova) McGregor Cyclogranisporites (2 species) Hymenozonotriletes deliquescens Naumova var. cinctus Chibrikova H. parvimammatus (Naumova) Kedo Hystricosporites sp. Lophozonotriletes cristifer (Luber) Kedo L. tylophorus Naumova Perotrilites (2 species) Pustulatisporites gibberosus (Hacquebard) Playford Retusotriletes cf. R. subgibberosus Naumova ?Stenozonotriletes definitus Naumova Stenozonotriletes (2 species) The foregoing spores were identified by D.C. McGregor and dated as probably early Famennian (McGregor, pers. com., 1966)	140	1230

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
8	Shale, at 60 feet (GSC plant loc. 7256) are the following spores: cf. Ancyrospora simplex Guennel ?Archaeotriletes membranus Kedo ?Archaeozonotriletes famenensis Naumova Calamospora sp. cf. Cornispora sp. (?=Anisozonotriletes bicornis Nazarenko) Cymbosporites sp. (Same as in 7254) Hymenozonotriletes parvimammatus Naumova Hystricosporites sp. Lophozonotriletes cristifer (Luber) Kedo L. excisus Naumova L. grandis Naumova Petrotrilites perinatus Hughes & Playford; The foregoing spores were identified by D.C. McGregor, who states that the most likely age is early Famennian	125	1090
7	Sandstone, fine grained, quartzose, impure, interbeds of siltstone that are similar, light grey green, minor shale interbeds; the sand is ripple-marked, cross-bedded and surface marked; top marked by 3 foot limestone interbed	175	965
6	Shale, dark grey green, fissile, interbedded with medium grey green siltstone beds up to 3 inches thick, very occasional olive grey to brown limestone beds, top is marked by a 5 foot brown limestone interbed; at a height of 5 feet (GSC plant loc. 7254) are the following spores: Biharisporites sp. cf. Cornispora (?=Anisozonotriletes bicornis Nazarenko) ?Cymbosporites (2 species) Hymenozonotriletes parvimammatus (Naumova) Kedo Hystricosporites (2 species) Lophozonotriletes cristifer (Luber) Kedo L. excisus Naumova Perotrilites perinatus Hughes & Playford ?Stenozonotriletes simplex Naumova The foregoing spores were identified by D.C. McGregor		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	who states that the age is probably early Famennian, but that the possibility of a latest Frasnian could not be definitely eliminated.		
	At 80 feet (GSC plant loc. 7255) are the following spores: ?Archaeozonotriletes famenensis Naumova ?A. foveolatus Naumova cf. A. polymorphus Naumova Calamospora sp. cf. Cornispora (?=Anisozonotriletes bicornis Nazarenko) Cymbosporites sp. ?Dibolisporites sp. (Same as in 65800) ?Hymenozonotriletes denticulatus Naumova H. parvimammatus Naumova ?H. spinulosus Naumova Hystricosporites sp. Lophozonotriletes grandis Naumova L. cristifer (Luber) Kedo L. curvatus Naumova Perotrilites sp. Phyllothecotriletes sp. ?Stenozonotriletes simplex Naumova Triangulatisporites rootsii Chaloner The foregoing spores were identified by D.C. McGregor, who dated them as late Frasnian or early Famennian, probably early Famennian	90	790
5	Sandstone, quartzose, fine grained, impure medium greenish grey weathers greenish grey, grades sharply upward to shale and siltstone after a three-foot brown limestone interbed	50	700
4	Cover (possibly minor faulting)	100	650
3	Sandstone, quartzose, fine grained, impure, medium greenish grey, weathers greenish grey, lowermost 50 feet is gradational with the Lower Member which is orthoquartzite	150	550
	Preserved thickness of Member B	905	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Member A		
	contact conformable		
2	Sandstone, quartzose, very pure, light cream on fresh surfaces with faint rusty bands, weathers to faintly rusty tan, thick bedded, medium grained, subrounded	200	400
	Total thickness of Member A	200	
	Preserved thickness of Griper Bay Formation	1105	
	Hecla Bay Formation		
	angular unconformity		
	Lower Member		
1	Sandstone, quartzose, light grey to white, weathering slightly rusty light grey	200	200
	Observed thickness of Hecla Bay Formation	200	

In the next major stream four miles south of Section 29 and about three miles inland from the coast, a collection (GSC loc. 59040) was made in Member B, at about 1,300 feet above the base of the formation and higher than anything in Section 29 (see Kerr, McGregor and McLaren, 1965). GSC loc. 59040 contains both shelly fauna and spores. The shelly fauna inclues:

Acanthatia? sp.
Basilicorhynchus sp.
Ptychomaletoechia? sp.
rhynchonelloid indet.
Cyrtospirifer cf. *C*. *animasensis* (Girty)
Cyrtospirifer sp.
orthocone nautiloid fragments
These were identified by D.J. McLaren and
dated as early Famennian (pers. com., 1971)

Unit	Lithology	Thickness (feet)	Height Above Base (feet)

The spores from GSC Loc. 59040 include:

cf. Acanthotriletes gratus Kedo,
A. famenensis Naumova,
cf. Archaeozonotriletes famenensis Naumova,
? A. notatus Naumova,
cf. A. semilucensis Naumova,
Cyclogranisporites (2 species),
Endoculeospora sp. (? Archaeozonotriletes subnotatus Chibrikova),
Hymenozonotriletes inaequus McGregor,
H. parvimammatus (Naumova) Kedo,
H. versabilis Kedo,
?Lophozonotriletes crassus Naumova,
L. cristifer (Luber) Kedo,
L. dentatus Hughes and Playford,
cf. L. macrogrumosus Kedo,
cf. L. rarituberculatus (Luber) Kedo,
Perotrilites sp.,
Pustulatisporites sp. (cf. Acanthotriletes pullus (Naumova),
Reticulatisporites sp.,
Retusotriletes cf. R. pychovii Naumova,
Stenozonotriletes cf. S. clarus Ishchenko, and
Verrucosisporites cf. V. rufus Butterworth and Williams,

The above spores were identified by D.C. McGregor, who considered them to be of Famennian age, probably early Famennian.

Section 30. Moses Robinson River

This is a west northwest dipping section that begins at Long. 97°45'W, Lat. 76°04'N, in the valley of Moses Robinson River. It begins at a fault three miles inland from the mouth of that river, and extends upstream (see Fig. 13). Thicknesses were measured in part by staff, and in part by scale on air photo A-16202-52.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
10	Sandstone, quartzose, limy cement, micaceous, grey green, dark green and medium grey, often limonitic specks, thin to medium bedded weathers grey brown and grey green; sandy limestone; dark greenish sandy shale; the sandstone beds are resistant, and the shaly beds recessive at a height of 50 feet is GSC loc. 67008; at a height of 175 is GSC loc. 67009; at a height of 225 is GSC loc. 67010	450	5965
	Preserved thickness of the Bird Fiord Formation	450	
	Blue Fiord Formation		
	contact conformable		
9	Limestone, micritic, very light grey to light cream, weathering very light grey; thick bedded and micritic at base becoming medium bedded and slightly fragmental to top, upper and lower contacts gradational; at about 300 feet corals were collected in GSC loc. 67007	600	5515
	Total thickness of the Blue Fiord Formation	600	
	Disappointment Bay Formation		
	contact conformable		
8	Dolomite, very light grey to cream, weathering light yellowish cream, sugary, medium to thick bedded; minor vuggy dolomite, grades upward to limestone of the overlying formation (the lower part of this unit in a creek 2 miles to the southwest was designated as the upper or B member of the Sherard Osborne Formation by Thorsteinsson and Glenister (1963, p. 591). We suggest abandonment of the Sherard Osborne Formation).	600	4915

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
7	Sandstone, quartz and chert grains grading upward to dolomite. In the stream valley 2 miles to the southwest this unit thickens to 100 feet of conglomerate consisting of chert and quartz pebbles in a sandy dolomitic matrix. There the unit was assigned by Thorsteinsson and Glenister (1963, p. 591) to the upper part of Member A of the now abandoned Sherard Osborne Formation	10	4315
	Total thickness of Disappointment Bay Formation	610	
	Stuart Bay Formation		
	contact angular unconformity		
6	Limestone, shaly, bioclastic, light grey, slightly brownish to dark grey brown, weathering tan to yellow grey, thin to medium bedded, much calcareous shaly siltstone interbeds. At the base is GSC loc. 67004, which yielded Leptaenopyxis cf. bouei Barr., and an indeterminate spirifer (Johnson pers. com., 1971), as well as Icriodus pesavis (Uyeno, pers. com., 1971), and has been dated by those workers as Siegenian. At a height of 240 feet two faunules were collected: GSC loc. 67005, which yielded Dalejina sp., indeterminate dalmanellids, Atrypa "recticularis", Favosites, and Icriodus pesavis; and GSC loc. 67006, which yielded Schizophoria sp., an indeterminate orthotetacean, Mesodouvillina? sp., Atrypa "reticularis", and an indeterminate atrypoid. Johnson and Boucot identified these faunules, dating GSC loc. 67005 as Early Devonian, and GSC loc. 67006 as Early or Middle Devonian. GSC locs. 67004, 67005, and 67006 also yielded graptolites that are presently under study	550	4305
	Total thickness of the Stuart Bay Formation	550	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Bathurst Island Formation</u>		
	regional angular unconformity		
5	Siltstone, quartzose, limy, chocolate brown, thin bedded; silty limestone, argillaceous limestone, quartzose limestone quartzose limestone, graptolites collected in the unit one mile to the south along strike include GSC oc 67002 and GSC oc. 67003; [this unit and the overlying formation are on strike with and probably equivalent to the lower or carbonate part of Member A of the type section of the Sherard Osborne Formation (Thorsteinsson and Glenister 1963, p. 591); the present writers suggest in this report that the name Sherard Osborne Formation be dropped from use]	525	3755
	Total thickness of Bathurst Island Formation	525	
	<u>Cape Phillips Formation</u>		
	contact conformable		
4	Shale, dark grey, very limy and containing limestone interbeds at base, becoming non calcareous upward, at top grades sharply to younger formation by appearance of calcareous component and colour change to moderate brown	800	3230
3	Limestone, thin bedded, very shaly, medium to dark brownish grey, weathers light tan brown, interbedded with much calcareous dark brownish grey shale and siltstone, which is graptolitic, becoming shalier upwards gradationally, fairly recessive	500	2430
	Covered	100	1930
	Total thickness of Cape Phillips Formation	1400	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	CORNWALLIS GROUP		
	<u>Irene Bay Formation</u>		
	contact conformable		
2	Shale, greenish, calcareous, recessive, interbeds of thin limestone, micritic with fossil fragments	30	1830
	Total thickness of Irene Bay Formation	30	
	<u>Thumb Mountain Formation</u>		
	contact conformable		
1	Limestone, micritic, light grey, yellowish grey, thick bedded, hard, dense, weathers yellowish grey, in places with rusty staining; dolomite minor; at top greenish shaly interbed	1800	1800
	Exposed thickness of Thumb Mountain Formation	1800	
	Lower limit of exposure at a normal fault		

Section 31. Driftwood Bay (composite)

The following section is a composite of four segments whose locations are shown on Map 000A and occur within a radius of 2 miles of Long. 97°50'W, Lat. 75°57'N in the vicinity of Ptarmigan Creek. Thicknesses were measured in part by staff, and in part by scale on air photo A16202-16.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	MELVILLE ISLAND GROUP		
	Griper Bay Formation(?)		
	Member A (Lower)		
14	Quartz sandstone, cream, very light grey, yellow-orange on fresh surfaces; weathering colours range from yellow orange to rusty orange; thick bedded to massive, medium to coarse grained, very rarely with limy cement; this is the youngest formation in the area, it occurs only in one long belt that is largely downfaulted, and rests unconformably on rocks ranging from the Thumb Mountain Formation to the Bird Fiord Formation; the type section of the Driftwood Bay Formation of Thorsteinsson and Glenister (1963, Fig. 50, loc. G) is a part of this unit but that formation has been abandoned herein	1500	8640
	Exposed thickness of Griper Bay Formation	1500	
	Hecla Bay Formation		
	contact angular unconformity		
13	Sandstone, quartzose, very pure yellow orange, weathers yellow orange, soft weathering	400	7140
12	Sandstone, quartzose, very light grey, clean, friable, weathering very light grey, much limonitic quartz sandstone weathering rusty red	300	6740
	Exposed thickness of Hecla Bay Formation	700	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
	contact conformable		
11	Sandstone, quartzose, very limy, micaceous, thin bedded, grey green, dark green; brownish green interbeds of sandy limestone and micaceous quartzose shale; poorly exposed, the upper two thirds of this unit being nearly covered by rubble; occasional wood fragments; at 10 feet above the base occurs GSC loc. 26440, and at 200 feet above the base occurs GSC loc. 26443, both being collected by Thorsteinsson and Glenister (1963) and identified as Middle Devonian in age	600	6440
	Total thickness of the Bird Fiord Formation	600	
	Blue Fiord Formation		
	contact conformable		
10	Limestone, micritic, cream coloured, very light grey, minor medium brown, coquinal at top and base; thick bedded	900	5840
	Total thickness of Blue Fiord Formation	900	
	Disappointment Bay Formation		
	contact conformable		
9	Dolomite, very slightly limy, sugary, very light grey to cream, minor vugs, weathers light yellowish cream, resistant	1000	4940
8	Sandstone, quartzose, dolomite cement, cream to very light brown, weathers light yellow brown, resistant, thick bedded, quartz grains weather as laminae; small scale cross laminae	300	3940
7	Conglomerate, pebbles of angular to rounded chert that is white, dark grey, yellow or orange; (in places this lower unit is absent altogether and younger units of this formation rest		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	on rocks that range from the Bathurst Island Formation to the Thumb Mountain Formation)	250	3640
	Total thickness of Disappointment Bay Formation	1550	
	<u>Bathurst Island Formation</u>		
	contact angular unconformity		
6	Covered, rubble composed of siltstone, quartzose, limy, chocolate brown	250	3390
	Total thickness of Bathurst Island Formation	250	
	<u>Cape Phillips Formation</u>		
	contact conformable		
5	Shale, dark grey, very limy and containing limestone interbeds at base, becoming non-calcareous upward, at top grades sharply to younger formation by appearance of calcareous components and colour change to moderate brown. At locality D Thorsteinsson and Glenister (1963, p. 590) made collections in ascending stratigraphic order (GSC loc. 26433) that range from a suggested Wenlockian age to the middle part of the lower Ludlovian subseries	800	3140
4	Limestone, thin bedded, very shaly, often cherty, medium to dark brownish grey, weathers light tan brown; interbedded with much calcareous dark brownish grey shale and siltstone which is graptolitic, becoming shalier upwards gradationally, fairly recessive; at the base in a thin black fissile shale (GSC loc. 67001) were collected <u>Pseudogygites</u> <u>latimarginatus</u> and biserial graptolites; Thorsteinsson and Glenister (1963, p. 589) refer to collections made in ascending stratigraphic order in this unit at their Locality C (GSC loc. 26434) ranging in age from Uppermost Ashgillian to hignest Llandoverian	550	2340

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Dolomite, sugary, mottled, dark grey and grey brown, petroliferous, basal and upper contacts sharp; this the lowermost is part of Member A of the formation; it contains GSC loc. 67000	50	1790
	Total thickness of Cape Phillips Formation	1400	
	CORNWALLIS GROUP		
	<u>Irene Bay Formation</u>		
	contact conformable		
2	Limestone, thin bedded, medium grey, shaly, greenish shaly interlayers, microcrystalline with fossil fragments, recessive	40	1740
	Total thickness of Irene Bay Formation	40	
	<u>Thumb Mountain Formation</u>		
	contact conformable		
1	Dolomite, light grey, sugary, vuggy, minor limestone, medium bedded, becoming more limy towards the top, resistant; Thorsteinsson and Glenister (1963, p. 588) collected Middle Ordovician faunules in this unit; GSC loc. 26432, containing <u>Rafinesquina</u> cf. <u>R</u>. <u>lenta</u> Troedsson, "<u>Orthoeeras</u>" sp., <u>Plectorthis</u> sp., and <u>Brachyaspis</u>? sp; and GSC loc. 26437, containing <u>Paleocystites</u> sp., <u>Rhinidictyia</u> cf. <u>R</u>. <u>minor</u> Ulrich, <u>Resserella</u> sp., <u>Rafinesquina</u> sp., <u>Rafinesquina</u> cf. <u>R</u>. <u>deltoidea</u> (Conrad), <u>Isotelus</u> sp. <u>Goniurus</u> sp., <u>Flexioalymene</u> cf. <u>F</u>. <u>whittakeri</u> Foerste, and <u>Leperditella</u> sp.	1700	1700
	Exposed thickness of Thumb Mountain Formation	1700	
	Lower limit of exposure at a fault		

Section 32. Head of Bracebridge Inlet, north side

The section begins at Long. 98°45'W, Lat. 75°43'30"N, and continues towards the west into a main creek valley and from there north. Thicknesses were measured in part by staff and in part by scale on air photo A-16203-19. The section is the upper part of a composite section shown on figure 5, and is illustrated in Pl. XVIII.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
12	Sandstone, quartzose, calcareous, light grey weathering greenish grey interbedded with dark green limy shales	230	4520
	Observed thickness of Bird Fiord Formation	230	
	Blue Fiord Formation		
	contact conformable		
11	Limestone, micrite, fossil fragments, brown, weathers tan, medium bedded, irregular bedding, sandy interlayers, some layers highly fossiliferous	235	4290
	Total thickness of Blue Fiord Formation	235	
	Eids Formation		
	contact conformable		
10	Siltstone and mudstone, siliceous, dolomitic, slightly to medium bedded, petroliferous, weathers medium light grey, alternates with shaly limestones, dark grey medium bedded, the former type increases and becomes predominant upward, it is a hard clinkery rock; at a height of 50 feet is GSC loc. 59038; at a height of 250 feet is GSC loc. 59039	2000	4055
	Total thickness of Eids Formation	2000	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Stuart Bay Formation		
	contact conformable		
9	Dolomite, silty, light tan, very fine grained to sugary medium bedded, laminated, interbedded with dolomitic siltstones, dark grey, weathering tan; minor limestone, poor rubbly exposure; grades to limestone of younger formation at top	550	2055
8	Covered	150	1505
7	Dolomite, fine grained light olive grey to medium grey, shaly, medium bedded to thick bedded, minor coquina, alternates with dark chocolate brown silty dolomite in layers about 10 feet thick on the average, weathers light tan, minor chert pebbly interlayers; at a height of 475 feet is GSC loc. 59037, a silicified faunule containing: Schizophoria sp., Dalejina sp., Cortezorthis sp. (large,w/radial septa), Gypidula sp., Leptaena sp., indet. orthotetacean Megastrophia? sp. Phragmostrophia sp., Stropheodonta? sp. (fine ribs) Strophonella? sp. Atrypa "reticularis", Atrypa? sp. (coarse ribbed), Elythyna? sp. Cyrtina sp. indet. brach., and indet. corals. This fauna was identified by Johnson and Boucot who considered it to be of Emsian age (pers. com., 1971)	800	1355

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
6	Conglomerate, dolomite matrix, light olive grey, chert boulders up to 8 inches in diameter, black or dark grey brown; dolomite boulders; minor black chert interbeds	45	555
5	Dolomite, dense, hard fine grained, light olive grey, weathers light orange, coquinoid with silicified brachs; at 25 feet below the top is GSC loc. 59036, a silicified faunule containing _Skenidium_ sp. _Cortezorthis_ sp. (small form) _Muriferella_ sp. _Schizophoria_ sp. (small form) _Dalejina_ sp. _Gypidula_ sp. (ribbed) _Leptaena_ sp. indet. orthotetacean indet. stropheodontid _Phragmostrophia_ sp. _Strophonella_? sp. indet. ribbed rhynchonellid "_Atrypa_" sp. (fine ribs, non-frilly) _Atrypa_ "_reticularis_" _Spinatrypa_ sp. _Carinatina_? sp. _Nucleospira_ sp. rostrospiroid reticulariid, ambocoeliid, and _Cyrtina_ sp.; This fauna was identified by Johnson and Boucot who considered it to be of probable early Emsian age (pers. com., 1971)	25	510

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Limestone, silty, medium grey brown, weathers light tan; much limy quartzose siltstone, medium brown weathering tan, minor silty dolomite toward top; all are sporadic outcrops	340	485
3	Covered	45	145
2	Siltstone, quartzose, calcareous, thin bedded dark grey to dark grey brown, alternating with thin interlayers of calcareous fine grained sandstone, light grey brown; at height of 25 feet in the unit is GSC loc. 59035; containing *Cortezorthis* sp. indet. rhynchonellid *Atrypa* "*reticularis*", *Favosites* sp.; This collection was identified by Johnson and Boucot, and considered to be of Siegenian or Emsian age (pers. com., 1971)	30	100
1	Siltstone, dolomitic, dark grey	70	
	Exposed thickness of Stuart Bay Formation	2055	
	Base of section at lower limit of exposure		

Section 33. Polar Bear Pass

This is a northwesterly dipping section occurring at Long. 98°25'W, Lat. 75°44'30" N occurring north of the central part of Polar Bear Pass. It is on the east side of the main stream flowing to Goodsir Inlet, 3 miles north of the main right angle bend in that stream. Measuring was done by scale on air photo A-16203-66, and by staff. The following section includes observations on the Stuart Bay Formation made by H.P. Trettin and fossil collections made by R. Thorsteinsson. The section is shown on figure 4 and Pl. XVIII.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Disappointment Bay Formation		
6	Dolomite	700	2260
5	Conglomerate, boulders, cobbles and pebbles of chert and quartzite; interbedded dolomite	500	1560
	Observed thickness of Disappointment Bay Formation	1200	
	Stuart Bay Formation		
	contact angular unconformity		
4	Dolomite, evaporitic type, microcrystalline, medium to dark grey, sooty, thinly bedded to very thinly bedded, ripple marks, mud cracks, fetid odour, interbedded with beds of limestone with fossils, and with patch reefs; at a height of 100 feet in unit 4 (GSC loc. 67141) are: Anastrophia? sp. Gypidula aff. pseudogaleata Hall Gypidula aff. problematica (Barr.) indet. brachiopod (pentameroid?) Cymostrophia? sp. "Chonetes" sp. indet. rhynchonellid aff. "Plethorhynchia" diana (Barr.) aff. Astutorhynchia sp. Spinatrypa sp. Atrypa "reticularis" Toquimaella kayi Johnson (figured in Johnson, 1967) indet. reticulariid (faintly ribbed) The foregoing fauna was identified by Johnson and Boucot, who consider that it is Early Devonian, probably early Siegenian, and about Quadrithyris Zone age (pers. com., 1971). In unit 4 there are; at a height of 125 feet GSC loc. 67142 containing graptolites; at a height of 135 feet is GSC loc. 67143 containing graptolites; at a height of 350 feet is GSC loc. 67144 containing graptolites; at a height of 455 feet is GSC loc. 67145 containing:		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Skenidioides</u> sp. <u>Isorthis</u> cf. <u>canalicula</u> (Schnur) <u>Cortezorthis</u> sp. (small & large) <u>Schizophoria</u>? sp. <u>Muriferella</u> sp. <u>Dalejina</u> sp. <u>Gypidula</u> sp. <u>Leptaena</u> sp. "<u>Schuchertella</u>" sp. <u>Strophonella</u> sp. <u>Stropheodonta</u> cf. filicosta Johnson <u>Phragmostrophia</u> sp. <u>Chonetes</u> sp. indet. rhynchonellids, 2 spp. <u>Katunia</u>? sp. <u>Atrypa</u> "<u>reticularis</u>" <u>Spinatrypa</u> sp. <u>Anatrypa</u>? sp. <u>Nucleospira</u> sp. <u>Howellella</u>? sp. <u>Quadrithyris</u>? sp. indet. reticulariid (aseptate) <u>Cyrtina</u> sp. indet brach. <u>Leonaspis</u> sp. <u>Receptaculites</u> sp. indet. corals indet. gastropods The foregoing fauna was identified by Johnson and Boucot, who considered that it is of probable early Emsian age (pers. com., 1971)	540	1060
3	Covered (approximate thickness)	250(?)	520
	Total thickness of Stuart Bay Formation	790	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Bathurst Island Formation</u>		
	contact covered		
2	Covered (approximate thickness)	250(?)	270
1	Dolomite, microcrystalline, calcareous, dark grey, cinoidal; contains GSC loc. 67140	20	20
	Exposed thickness of Bathurst Island Formation	270	
	Base of section at lower limit of exposure		

Section 34. Head of Goodsir Inlet

The following is a northwesterly dipping section that begins at Long. 98°17'W, Lat. 75°44'N and continues towards the northwest. Thicknesses were measured by scale on air photo A-16203-66. The section is shown on figure 4, and Pl. XVIII.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Disappointment Bay Formation		
14	Dolomite, with basal conglomerate containing boulders, cobbles and pebbles of chert and quartzite	400	5050
	Observed thickness of Disappointment Bay Formation	400	
	Stuart Bay Formation		
	contact angular unconformity		
13	Siltstone and dolomite, same as unit 9, recessive	150	4650
12	Dolomite, evaporitic, silty resistant, some limestone interbeds, thinly bedded, outcropping as isolated stacks	60	4500
11	Siltstone and dolomite, same as unit 9, recessive	130	4440
10	Limestone reef (see Pl. IV), brecciated, highly fossiliferous, light grey, micritic massive, fractured, abundant shelly fossils in three collections. These are 67038, which contains: Gypidula aff. kayseri, "Brachyprion" cf. mirabilis, Thliborhynchia sp. (costellate), indet rhynchonellid sp., Atrypa sp. (fine-ribbed), Spirigerina supramarginalis, Dubaria sp., Ogilviella rotunda, Cyrtina sp., Conocardium sp., favositids; 67039, which contains Schizophoria sp., Machaeraria sp., Atrypa sp., Spirigerina supramarginalis, Dubaria sp., Ogilviella rotunda, favositids; and 67040, which contains Atrypa sp. (fine-ribbed), favositids. All were identified by J.G. Johnson who stated (pers. com., 1971) that 67039 and 67040 are of Quadrithyris Zone age (early Siegenian). In places reef is absent and interval is occupied by correspondingly thicker sections of the enclosing units	60	4310
9	Siltstone, calcareous, recessive, dolomitic, chocolate brown weathering tan; siltstone, dolomitic. The base of this unit coincides with an angular unconformity one mile to the north-east, where the entire Bathurst Island Formation is absent due to erosion	100	4250
	Total thickness of Stuart Bay Formation	500	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bathurst Island Formation		
	contact angular unconformity		
8	Siltstone, dolomitic, calcareous, medium chocolate brown, thin bedded, weathering tan; recessive, with occasional interbeds of very light grey crinoidal limestone and micritic limestone that are up to 15 feet thick; at a height of 480 feet is GSC loc. 67037; one mile to the northeast the entire formation is missing due to erosion prior to Stuart Bay deposition	900	4150
	Total thickness of Bathurst Island Formation	900	
	Cape Phillips Formation		
	contact conformable		
7	Siltstone, dolomitic, medium chocolate brown, thin bedded to fissile, weathering rusty brown; interbeds of medium to light brown dolomitic siltstone, medium bedded, weathering rusty; grades by increasing calcareous interbeds to calcareous siltstone of overlying unit; at a height of 230 feet are GSC locs. 67035 and 67036	900	3250
6	Siltstone, dolomitic, slightly calcareous, medium dark brown weathering tan, thinly bedded slightly cherty, poor exposure in this interval; at a height of 285 feet loose fossils were collected at GSC loc. 67034	400	2350
5	Chert, shaly, thin to medium bedded, often nodular, medium chocolate brown, cherty dolomitic siltstone interbeds, resistant, grades upwards by decreasing amounts of chert to cherty dolomitic siltstone	320	1950

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Shale, dolomitic, dark chocolate brown; siltstone, calcareous, dolomitic with tan silty, sugary, dolomite interbeds, occasionally fossiliferous, limestone nodules up to 1 foot in diameter; at a height of 37 feet is GSC loc. 67030	155	1630
	Total thickness of Cape Phillips Formation	1775	
	CORNWALLIS GROUP		
	Irene Bay Formation		
	contact conformable		
3	Dolomite, finely crystalline, thin bedded, medium grey, fine grained, interbedded with greenish weathering shaly layers, recessive	50	1475
	Thumb Mountain Formation		
	contact conformable		
2	Dolomite, sugary, finely porous to vuggy, light to medium chocolate brown, thick bedded to massive; at a height of 840 feet is GSC loc. 67029	1000	1425
1	Dolomite, tan to brown, sugary, finely porous to vuggy, strongly petroliferous	425	425
	Exposed thickness of Thumb Mountain Formation	1425	
	Base of section at lower limit of exposure		

Section 35. Scoresby Hills, west

This is an easterly dipping section in the western part of the Scoresby Hills. The base occurs at Long. 98°40'W; Lat. 75°50'N, and it continues from there to the northeast to Long. 98°22'W; Lat. 75°52'30"N. Thicknesses were measured by scale on air photos A-16203-64 and A-16761-178.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Disappointment Bay Formation		
12	Dolomite, blocky; contact covered, position estimated	400	8892
	Stuart Bay Formation		
	disconformity (?)		
	Upper member (dolomite)		
11	Cover (position of contact estimated)	1350	8492
10	Dolomite, thin bedded, dolomitic siltstone, interbedded quartz sandstone; becoming quartz sandy upward	1450	7142
9	Dolomite, interbedded dolomitic siltstone and limestone; the limestone decreases in proportion upward and grades out	350	5692
	Thickness of upper member	3150	
	Lower Member (siltstone, limestone, conglomerate)		
8	Limestone, medium dark grey, thick bedded; occasional minor chert pebbles; with interbeds of siltstone that are abundant in the lower part and decrease in abundance upward; upper contact drawn where limestone begins to be interbedded with dolomite	200	5342
7	Siltstone, dolomitic, thin to medium bedded, with thin to medium bedded limestone interbeds increasing upward, the upper contact being drawn where limestone is predominant	665	5142
6	Siltstone, with interbeds of conglomerate in bands 2 to 5 feet thick containing chert pebbles	375	4477
5	Siltstone, mudstone, fine-grained sandstone, dolomitic, calcareous, thin to medium bedded; poorly exposed; along strike two miles to the south are numerous conglomerate and pebble interbeds from 2 to 85 feet thick, with clasts of chert, limestone, and dolomite, usually in a limestone matrix; bioclastic limestone interbeds	1050	4102

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
4	Conglomerate, bioclastic, limestone boulders and pebbles, chert pebbles; in a space of 100 feet it grades laterally westward from 12 feet to 0	12	3052
3	Siltstone, sandstone, shale; occasional graded bedding; becomes coarser upward	1400	3040
2	Patch reefs, algal, stromatoporoids, corals; with rounded limestone boulders up to 4 feet in diameter; thickness ranges from 0 to 40 ft.	40	1640
	Thickness of lower member	3742	
	Total thickness of Stuart Bay Formation	6982	
	Bathurst Island Formation		
	contact probably conformable		
1	Siltstone, sandstone, shale; commonly graded beds; at the base of each graded bed is sand-sized quartz and calcareous skeletal debris, grading upward to silt-sized particles of the same material, and finally to dark brown to black calcareous silty shale; in the upper part of the unit there is more limestone; the contact is drawn below a reefal conglomerate of the overlying formation. (At a height of 1,300 feet in this unit is a normal fault presumed to have very minor displacement	1600	1600
	Exposed thickness of Bathurst Island Formation	1600	
	Base of section at a fault		

Section 36. Heart Lake

This is a north dipping section that begins at the eastern end of Heart Lake and continues from there to the northeast. It begins at Long. 100°W, Lat. 75°31'30"N. Thicknesses were measured in part by staff and in part by scale on air photo A-16203-185 and air photo A-16194-17.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
17	Sandstone, quartzose , partly limy, alternating recessive and resistant, greenish grey weathering greenish grey, poorly exposed recessive; at height of 475 feet is GSC loc. 67060	600	5510
16	Sandstone, quartzose, non calcareous, generally light green, non-limy, resistant	30	4910
15	Sandstone, medium grey, quartzose, recessive thinly bedded, poorly exposed, non limy	175	4880
14	Sandstone, quartzose, limy, medium bedded, light to medium grey fossiliferous at base, yielding GSC loc. 67059	20	4705
13	Sandstone, quartzose, limy, light to medium grey, recessive, thin to medium bedded	75	4685
12	Sandstone, quartzose, grey to greenish grey, very limy, alternating with sandy limestone ripple marks, cross-bedded, worm borings, resistant, medium bedded, near top fossils are in a limestone GSC loc. 67058	60	4610
11	Sandstone, quartzose, shaly, grey and greenish with minor limestone and sandstone interbeds, recessive, poorly exposed, alternating with shaly interbeds, thin to medium bedded	120	4550
10	Sandstone, quartzose, limy, resistant; limestone, sandy, some highly fossiliferous beds, worm burrows common; alternating with lesser amounts of recessive dark green shale, medium bedded; at the base is GSC loc. 67057	30	4430
	Total thickness of formation	1,110	

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Eids Formation		
	contact conformable		
9	Limestone, thinly bedded, shaly and silty, shaly interbeds, occasional worm markings, lower contact gradual upper contact abrupt	275	4400
8	Limestone, very shaly, fissile to thin bedded, medium light grey, weathers yellow grey; equal amounts of interbedded shale, medium grey, limy, micaceous, weathers yellow grey, gypsiferous interbeds contorted by inter-bedding slip; in lower part is GSC loc. 67055	275	4125
7	Unexposed, probably soft weathering Eids as above	750	3850
6	Unexposed, probably Eids as below	400	3100
5	Limestone, very shaly, thin bedded to laminated, dark grey weathers yellow grey, occasional Tentaculites observed, interbeds of thinly bedded very shaly limestone moderately resistant; clinkery sound, at top of unit is GSC loc. 67054	200	2700
	Total thickness of Eids Formation	1900	
	Stuart Bay Formation		
	contact conformable		
4	Siltstone dolomitic, thin to medium bedded, slightly calcareous, at the base is a 15 foot thick bed of shaly limestone with minor chert pebbles, petroliferous, dark grey to black, weathering yellow brown, siliceous at a height of 240 feet is a pebble bed 2 feet thick	1550	2500

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bathurst Island Formation		
	contact conformable(?)		
3	Shale, dark grey, fissile and recessive, fossils at base of this unit are GSC loc. 67043	350	950
2	Siltstone, dark grey brown weathering tan brown, calcareous, resistant	200	600
1	Shale, dark grey to black, fissile, slightly calcareous, weathers recessive and tan brown; some interbeds of medium brown calcareous siltstone and fine grained calcareous sandstone, weathers yellow brown; fossils from near top of unit include GSC locs. 67041 and 67042	400	400
	Exposed thickness of Bathurst Island Formation	950	
	Base of section at lower limit of exposure		

Section 38. Bathurst Caledonian R. J-34 Well

The following section is a well drilled at Lat. 75°33'31"N; Long. 98°43'00"W. The following descriptions are of cuttings and core, shown in the completion report (Dominion Explorers Group - Canso et al., 1964), and have been modified slightly by the writer.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bathurst Island Formation		
18	Dolomitic siltstone and shale; at a height of 1150 to 1160 feet is *Tentaculites* sp.	1440	10000
	Preserved thickness of formation	1440	
	Cape Phillips Formation		
	Member C		
17	Shale, limestone and siltstone	325	8560
16	Siliceous shale; at a height of 211 feet to 229 feet in core No. 2 are *Monograptus transgradiens* Perner, and *Linograptus* sp., which R. Thorsteinsson identified and dated as indicating the penultimate graptolite zone of the Pridolian	1000	8235
	Thickness of Member C	1325	
	Member B		
15	Marl, shale and limestone	120	7235
14	Limestone	45	7115
13	Shale, chert and limestone	440	7070
	Thickness of Member B	605	
	Member A		
12	First bituminous shale and limestone	140	6630
11	Cherty dolomite	90	6490
10	Cherty limestone	285	6400

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
9	Second bituminous shale and limestone	205	6115
8	Dolomite	44	5910
	Thickness of Member A	764	
	Total thickness of Cape Phillips Formation	2694	
	CORNWALLIS GROUP		
	Irene Bay Formation		
7	Shale	156	5866
	Thumb Mountain Formation		
6	Limestone	360	5710
5	Dolomite	615	5350
4	Shale	35	4735
3	Dolomite, limestone and shale	1010	4700
	Total thickness of Thumb Mountain Formation	2020	
	Bay Fiord Formation (?)		
2	Shale, anhydrite and dolomite	417	3690
1	Salt, dolomite, siltstone, anhydrite and shale	3273	3273
	Penetrated thickness of Bay Fiord Formation	3690	
	Penetrated thickness of Cornwallis Group	5866	

Section 39. Misty River

This section begins at Long. 98°45'W., Lat. 75°19'N near Misty R., and continues from there t the northwest to Long. 99°20'W, Lat. 75°28'N. Thicknesses were measured by scale on air photos A-16203-94, A-16203-160, and A-16203-158.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Bird Fiord Formation</u>		
15	Sandstone, quartzose, limy	750	4795
	<u>Blue Fiord Formation</u>		
	contact conformable		
14	Limestone, thin to medium bedded, similar to unit below	300	4045
13	Limestone, brown, shaly, medium bedded to thick bedded; at 100 ft. above base (GSC loc. 67129) is <u>Icriodus</u> <u>nodosus</u>; at a height of 200 feet above base is <u>Icriodus</u> <u>corniger</u>; at a height of 280 feet above the base is <u>Icriodus</u> <u>angustus</u>. These were identified by Klapper (Ormiston pers. com., 1970), and with their positions all can be considered as Eifelian in age	560	3745
	Total thickness of Blue Fiord Formation	860	
	<u>Eids Formation</u>		
	contact conformable		
12	Same rock type as below, thin bedded to laminated, grades sharply to overlying formation by becoming medium bedded and more limestone	500	3185
11	Siltstone, dolomitic, dark grey, siliceous, slightly limy, weathering very light brownish grey, rarely thin bedded or fissile, conchoidal fracture, clinkery sounding when struck; GSC loc. 67128	250	2685
	Total thickness of Eids Formation	750	
	<u>Disappointment Bay Formation</u>		
	contact conformable		
10	Dolomite, sandy, interbedded with dolomitic sandstone	550	2435

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
9	Dolomite, very light tan, fine grained; in the upper part of this quartz sandy; this dolomite constitutes 80% of the interval; remainder of the interval is primarily sandstone, fine grained quartzose, dolomitic light yellow orange, slightly calcareous; both rock types are blocky	650	1885
	Total thickness of Disappointment Bay Formation	1200	
	Stuart Bay Formation		
	contact unconformable(?)		
8	Limestone, siliceous, dark grey to black, thinly bedded, some calcareous siltstone and calcareous very fine grained sandstone	500	1235
7	Dolomite, fine grained, thick bedded, hard, light grey to cream. This unit is just an interbed	50	735
6	Limestone, quartz sandy, often bioclastic, alternating with limy siltstone which is thinly bedded, usually the former is resistant and the latter is recessive; at base is a clastic limestone GSC loc. 67125	140	685
5	Cover; the rubble constitutes brown non calcareous sandstone, and dark grey limestone, shaly, and silty	200	545
	Total thickness of Stuart Bay Formation	890	
	Bathurst Island Formation		
	contact angular unconformity		
4	Limestone, dark grey, fissile to thin bedded, siliceous and shaly, weathers medium grey, the top is poorly exposed	175	345

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Sandstone, quartzose, limy, light brown to tan, up to 20% of the interval is composed of bioclastic sandy limestone yielding GSC loc. 67124; interval also contains a hard clinkery dark grey limy siltstone	50	170
2	Sandstone, calcareous, medium bedded, light brown to tans, very uniform lithology throughout	50	120
1	Limestone, thinly bedded, dark grey, very shaly and silty, weathers medium light grey, rubble only; GSC loc. 67123	70	70
	Exposed thickness of Bathurst Island Formation	345	
	Base of section at lower limit of exposure		

Section 40. Head of Freemans Cove

The following is a gently north dipping section occurring at lat. 75°14'N., long. 98°03'W. It is one-quarter mile northeast of the head of Freeman's Cove, eastern Bathurst Island, on air photo A-16203-7. The section incorporates observations made by P.G. Temple and by L.V. Hills. Measurements were made by staff.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Eureka Sound Formation		
8	Sandstone and sand, quartzose, tan	5 - 10 feet	32.5+
7	Coal, black; contains sample #3 of Hills (GSC loc. C-7605)	6 inches	27.5+
6	Clay, yellow	a few inches	27+
5	Andesite	10 - 20	27+
4	Shale, micaceous, organic, dark grey to black; possibly faulted; contains channel samples #1 and #2 of Hills (GSC locs. C-7603 and C-7604)	15	17+
3	Sandstone, quartzose, slightly feldspathic, tan containing leaves and stems of fossil plants (GSC loc. C-4323) including <u>Metasequoia occidentalis</u> (Newberry) Chaney, <u>Taxodium dubium</u> (Sternbert) Heer, <u>Cercidophyllum arcticum</u> (Heer) Brown, and <u>Corylus</u>? sp.; this florule by itself indicates a Late Cretaceous or Early Tertiary age; however, because of the datings of overlying microfloras it is regarded as Late Cretaceous (Dorf and Hickey, pers. com. 1970)	2	2+
2	Sand, quartzose, uncemented, white, medium to fine grained; with stringers of brown lignitic shale	?	
1	Coal, with tree trunks	a few feet	
	Total preserved thickness of Eureka Sound Formation	approx. 50 feet	
	Base of section at lower limit of exposure		

According to Hills (pers. com., 1965 and 1971), all three samples contain the same microfloral assemblage, and these are listed below, along with their ages and Hills' conclusions:

Spores

Aequitriridites spinulosus (Cookson and Dettman) Cookson and Dettman	Cret.
Appendicisporites sp. Weyland and Krieger	
Arcellites sp. (Miner) Ellis and Tschudy Indet.	
Cicatricosisporites Patonie and Gelletich	
Gleichenidites senonicus Ross	Jur. Cret.
Laevigatosporites gracilis Wilson and Webster	Cret. Tertiary
Laevigatosporites ovatus Wilson and Webster	Cret. Tertiary
Laevigatosporites Ibrahim	
Lygodiumsporites? (Pot., Thoms., & Thierg) Potonie	
Osmundacidites elongatus Rouse	U. Cret.
Pilosisporites verus Delcourt and Sprumont	L. Cret.?
Polypodisporites? Potonie	
Cupressus pallens Bolkovitina	Cenomanian Turonian
Schizosporis reticulatus Cookson and Dettman	Cret.
Cingutriletes clavus (Balme) Dettmann	Jur. Cret.
Stereisporites cf. antiquasporites (Wilson and Webster) Dettmann	Cret.
Cingulatisporites sp. Brenner pl. 14, fig. 3	Cret.
Verrucosisporites sp. (probably new)	
Matonisporites cf. M. excavatus Brenner	Cret.?
Taurocusporites? Stover	
Rugulatisporites sp. Pflug	

Gymnospermae

Vitreisporites pallidus (Reissinger) Nilsson	Jur. Cret.
Cycadopites Wodehouse	U. Cret. Tertiary
Bennetiteaepollenites minimus Singh	Cret.
Alisporites (Daugherty) rest. Potonie and Kremp	
Parvisaccites Couper	

Phyllocladites Cookson	
Podocarpidites multesimus (Bolkovitina) Pocock	Jur. Cret.
Podocarpidites naumovai Singh	Albian to Cenomanian
Podocarpidites Cookson	
Piceapollenites Potonie	
Pityosporites (Seward) Manum 1960	
Metasequoia type papillate grain	U. Cret. Tert.

Angiospermae

Alnus (Alnipollenites) 6 pored	U. Cret. Tert.
" " 5 pored	U. Cret. Tert.
Aquilapollenites trialatus Rouse	Maestrichtian
A. quadrilobus Rouse	Maestrichtian
A. amplus Stanley	Maestrichtian
Betula sp. type very similar to form described from the U. Cret. by Bolkovitina	U. Cret. Rec.
Corylus type	U. Cret. Rec.
Ericipites Wodehouse	U. Cret. Rec.
Proteacidites marginatus Rouse	U. Cret.
Wodehousia spinnata Stanley	Maestrichtian

Acritarchs, Hystrichospheres and Dinoflagellates

Deflandrea cf. D. rectangularis Cookson and Eisenack	U. Turonian M. Senonian
D. tripartita Cookson and Eisenach	U. Turonian M. Senonian

D. micracantha Cookson and Eisenack	U. Turonian M. Senonian
D. cf. *D. echinoidea* Cookson and Eisenack	U. Turonian M. Senonian
Paleostomocystis fragilis Cookson and Eisenack	Albian to Cenomanian
Hystrichospaeridium tubiferum (Ehrenberg) Deflandre	Cret.
H. stellatum Maier sensu Cookson and Eisenack	Albian to Cenomanian
cf. *H. ferox* Deflandre	Albian-Senonian
Veryhachium reductum Deunff	Ord. Cenomanian
Veryhachium sp. 5 spined	
Diplotesta luna Cookson and Eisenack	?U. Albian Cenomanian
Hystrichosphaera furcata	Cret.
Baltisphaeridium multispinosum Singh	Albian
Baltisphaeridium Eisenack	
Odontochitina striatoperforata Cookson and Eisenack	Albian-Cenomanian
Gonyaulax margaritifera Cookson and Eisenack	Senonian (Campanian Santonian)
Diconodinium glabrum Cookson and Eisenack	Albian to Cenomanian
Microdinium ornatum Cookson and Eisenack	Albian - L.Turonian
Spinidinium styloniferum Cookson and Eisenack	Albian?
Micrhistridium sp.	

Observations and Conclusions

(1) All three samples appear to contain a similar microfloral assemblage. However, acritarchs, hystrichospheres and dinoflagellates are more common in sample 1.

(2) All acritarchs, hystrichospheres and dinoflagellates identified in this report have been described from marine sediments.

in Australia (foram control). Therefore, it can be inferred that the beds on Bathurst Island are marine. However, their decrease in number and variety in samples 2 and 3 suggests a change to more continental conditions.

(3) The strata are undoubtedly of Upper Cretaceous age. The listed stratigraphic ranges of plant microfossils seem to suggest that sediments of two ages are involved and that the small fault is significant. The late Cenomanian or early Turonian age is suggested by such fossils as <u>Odontochitina striatoperforata</u>, <u>Veryhachium reductum</u> and <u>Paleostomocystis</u>, whereas species of <u>Wodehousea</u> and <u>Aquilapollenites</u> for example suggest a Maestrichtian age.

Two factors lead me to believe that the beds are Maestrichtian in age. Firstly microfossils indicative of the Cenomanian age are rare, and secondly they occur with fossils representative of the younger age.

Section 41. Truro Island

This section occurs on central eastern Truro Island in the valley of a main southeast flowing stream. It begins on the east shore at the mouth of the stream, Lat. 75°18'30"N., Long. 97°08'W. Thicknesses were measured by staff and by scale on air photo A-16202-2.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	<u>Blue Fiord Formation</u>		
15	Limestone		
	<u>Disappointment Bay Formation</u>		
14	Dolomite, slightly limy, tan brown, sugary, resistant	675	1305
	<u>Cape Phillips Formation</u>		
	contact angular unconformity		
13	Siltstone, quartzose, dolomitic, loose graptolites abundant, limy, fine grained, chocolate brown, thinly bedded, weathering yellow grey, dolomite crystals in rosette arrangements up to 1" diameter; at height of 230 ft. is GSC loc. 67139 yielding <u>Monograptus</u> <u>testis</u>	260	630
12	Siltstone, quartzose, dolomitic, slightly calcareous, thinly bedded, cherty	20	370
11	Siltstone, quartzose, dolomitic, slightly calcareous, cherty, rubbly interval of no outcrop	40	350
10	Chert, (GSC loc. 67137) black, shaly, thin to medium bedded, wavy bedding comprising 75% of the interval; interbeds and nodules of petroliferous, brown dolomite, up to 1 1/2 feet in diameter (GSC loc. 67138); non calcareous black shale interbeds	65	310
9	Shale, dark grey to black fissile	25	245
8	Dolomite, petroliferous, limy, brown, resistant	20	220
7	Siltstone, quartzose, dolomitic, fine grained, medium chocolate brown, weathering rusty yellow, grading up to the overlying dolomite, recessive	54	200
6	Shale, black, non calcareous, fissile to thin bedded, recessive, very minor dolomitic interbeds at base; at top is GSC loc. 67136 yielding graptolites	6	146

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
5	Dolomite, petroliferous, limy grained, occasionally vuggy, minor shale interbeds, resistant	45	140
4	Shale, black with limestone nodules and dolomite interbeds, biserial graptolites throughout; GSC loc. 67134 and 67135	23	95
3	Shale, black, becoming calcareous at the top by gradation to the overlying unit, recessive; at base is <u>Pseudogy ites latimargina us</u> and biserial graptolites in GSC loc. 67133	37	72
2	Limestone, medium brown, very shaly, weathering greenish grey, grades to the shales above; GSC loc 67132	15	35
	Total thickness of Cape Phillips Formation	610	
	CORNWALLIS GROUP		
	<u>Irene Bay Formation</u>		
	contact conformable		
1	Limestone, micritic, tiny fossil fragments common, medium brown, medium bedded, weathering light brownish grey, interbedded with greenish weathering shaly particles	20	20
	Exposed thickness of Irene Bay Formation	20	
	Base of section at lower limit of exposure		

Section 42. Dyke Ackland Bay

The following section begins at Long. 98°45'W., Lat. 75°04'N and continues from this point in a northwesterly direction to Long. 99°17'W, Lat. 75°09'W. It begins about 2 miles east of the head of Dyke Ackland Bay between two small circular lakes. Thicknesses were measured by scale on air photos A16203-176, A16194-7 and A16203-166.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Bird Fiord Formation		
11	Shale, dark grey green, limy, with limestone interbeds; very recessive	140	5640
	Observed thickness of Bird Fiord Formation	140	
	Blue Fiord Formation		
	contact conformable		
10	Limestone, micrite composing almost the entire section of this formation; the lower half is light grey to light brown, thick bedded, resistant, blocky weathering, fossils at the base are (GSC loc. 67107); the upper half of the section is mainly light brown, with many white calcite blebs; the upper contact is covered but it appears to be gradational with the overlying unit; at a height of 400 feet in this unit is a 15-foot thick brown crinoidal shaly limestone unit which contains fossils (GSC loc. 67108)	900	5500
	Disappointment Bay Formation		
9	Dolomite, dense, very fine grained, rarely sugary, sooty grey, weathers tan; at base light cream; at top gets yellow silty interbeds before grading to limestone of overlying unit	2,000	4600
	Total thickness of Disappointment Bay Formation	2,000	
	Stuart Bay Formation		
	contact probably disconformity		
8	Dolomite, sugary, finely porous, weathers darker than the overlying and underlying units, it grades in its upper few feet to light cream limestone for a few feet	700	2600

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
7	Dolomite, petroliferous, medium brown, weathering medium dark brown, slightly rusty, friable, sugary to vuggy, crinoidal, medium to thick bedded, minor crinoidal interlayers, grades up to light cream and grey dolomite, weathering medium light grey faintly purplish	150	1900
6	Dolomite, very light cream, finely crystalline, often friable, sugary to vuggy, thin to medium bedded, weathering slightly rusty cream	200	1750
5	Dolomite, thinly bedded, light cream to tan weathering light cream interbedded with minor medium light grey dolomite; silty and sandy at the base	575	1550
4	Sandstone, quartzose, thin to medium bedded, friable, generally light grey to cream, fine grained, rusty veined, grades to dolomitic siltstone in upper part	125	975
3	Sandstone, quartzose, olive grey to medium light grey brown, medium to thick bedded, cross-bedded with source direction from the southeast, worm markings, dolomitic	100	850
	Total thickness of Stuart Bay Formation	1,850	
	Bathurst Island Formation		
	contact angular unconformity		
2	Dolomite, very slightly quartz sandy at base grading up to dolomite, light coloured	250	750
1	Sandstone, quartzose, dolomitic, medium to thick bedded, resistant, slightly rusty tan, weathering rusty tan, clear quartz sand grains, in places quite vuggy; grades up to dolomite, slightly sandy	500	500
	Exposed thickness of Bathurst Island Formation	750	
	Base of section at lower limit of exposure		