CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

MEMOIR 294

CORNWALLIS AND LITTLE CORNWALLIS ISLANDS

DISTRICT OF FRANKLIN

NORTHWEST TERRITORIES

By

R. Thorsteinsson

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
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PREFACE

The larger part of the Arctic Archipelago comprises two geological regions which are potential sources of fuel. Cornwallis and Little Cornwallis Islands lie within the Innuitian region of folded sedimentary strata and are adjacent to the relatively undisturbed sedimentary strata of the Arctic Lowlands and plateau region.

In the present report the author is concerned chiefly with the Palæozoic succession of events and to a minor extent with Quaternary events. His studies disclose the nature and succession of strata with the contained fossils as well as the lateral change of formations, and establish the relationship between the two main geological regions. Field studies on which the author's conclusions are based were made by him in 1951, 1952 and 1953, and in association with Dr. Y. O. Fortier in 1950.

GEORGE HANSON,
Director, Geological Survey of Canada

OTTAWA, July 11, 1956

Cornwallis and Little Cornwallis Islands, District of Franklin, Northwest Territories

CHAPTER I

INTRODUCTION

This report deals mainly with the stratigraphy of Cornwallis and Little Cornwallis Islands in the Canadian Arctic Archipelago. The general geological account presented here results from four field seasons (1950-53) of reconnaissance survey.

Large faunal collections were made in the course of field studies and wherever possible a concerted effort was made to establish faunal successions. Many faunas are related directly to measured and described sections. For the purpose of this report preliminary identifications have been made on many of the faunas, but no identification has yet been attempted on a few of the less common groups, as for example dendroid graptolites and radiolarians. A series of forthcoming reports by several palæontologists is planned for various of the faunal groups and for these the present report provides a necessary stratigraphic background.

Location and Accessibility

The centre of Cornwallis Island is about latitude 75° 15′ north and longitude 95° 00′ west, which locates it near the geographic centre of the Arctic Archipelago (*see* Figure 1). This island, some 2,850 square miles in area, is approximately 72 miles along its greatest dimension and about 60 miles across at its widest point. Little Cornwallis, an island of some 190 square miles, lies off the northwest coast of Cornwallis and between that island and Bathurst Island.

The R.C.A.F. Station Resolute is situated near Resolute Bay on the south-central coast of Cornwallis Island. The Resolute Ionospheric Station, maintained by the Department of Transport, is also at Resolute Bay. The jointly operated Weather Station of the United States Weather Bureau and the Meteorological Division of the Department of Transport, which was previously a separate establishment at Resolute Bay, is now housed at the R.C.A.F. Station.

Cornwallis Island is accessible by aircraft the year round and by ship for part of the summer.

Inhabitants

Cornwallis Island had no permanent residents until 1953. In the autumn of that year the then Department of Resources and Development and the R.C.M.P. established a settlement of Eskimos at Resolute Bay. Five hunters and twelve women and children were brought to Cornwallis Island from Port Harrison on the east coast of Hudson Bay, and from Pond Inlet, Baffin Island. Personnel of the Department of National

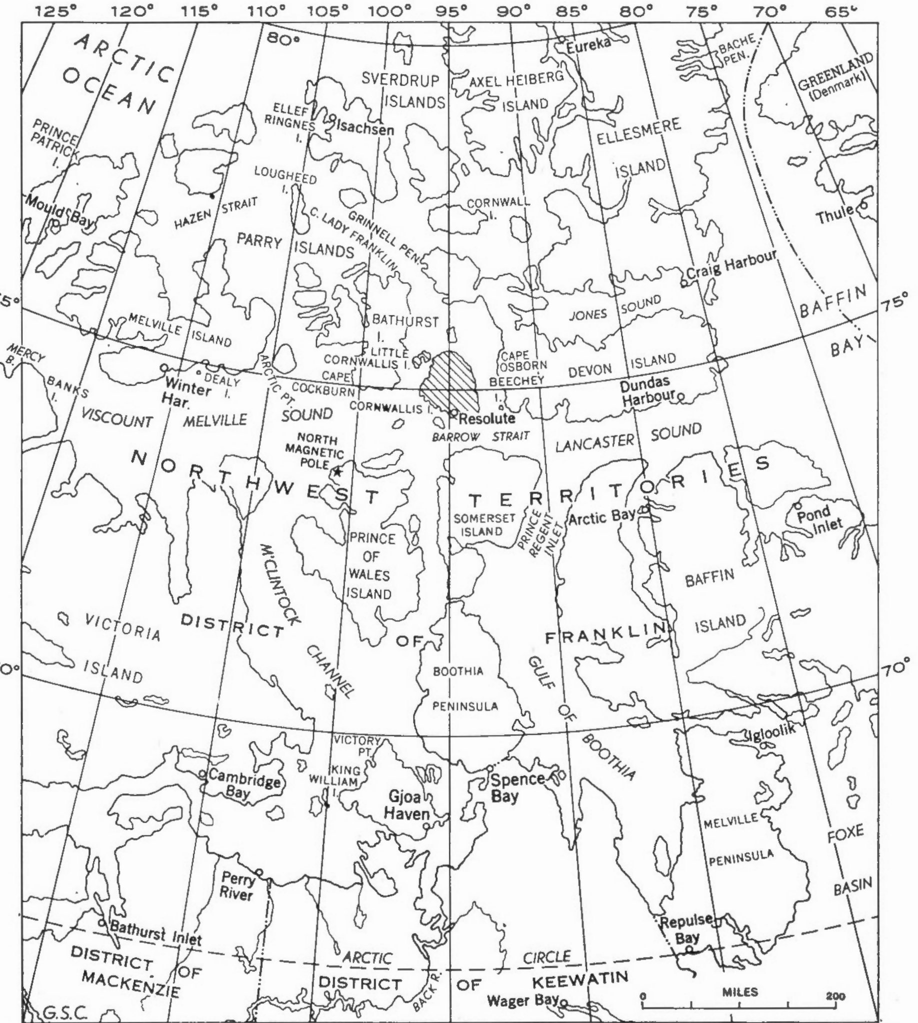

Figure 1. Index map showing location of Cornwallis and Little Cornwallis Islands.

Defence, Department of Mines and Technical Surveys, Department of Transport and the U.S. Weather Bureau have been stationed at Resolute on a temporary basis since 1947.

Fauna

Small herds of musk-oxen (*Ovibos moschatus*), totalling about 30 animals, inhabit Cornwallis Island. They are generally found in the low-lying plains and broad valley floors along the west coast where vegetation is most plentiful. There a herd of musk-oxen will commonly remain within an area of a few acres for several days. Occasionally small bands of these animals will travel into the east half of the island but owing to scarcity of food they seldom remain long in one locality before moving on to an adjacent valley. Herds of musk-oxen on Cornwallis Island generally range from 6 to 14 animals that consist mainly of cows and calves. Invariably one to three adult males accompany each herd. During the summer adult males are commonly observed in pairs or singly. They are prone to wander more than the herds and are not infrequent visitors to eastern regions of the islands. Male musk-oxen unattached to a herd have been observed to travel several miles in a few hours. The largest number of calves seen in one year was three.

No musk-oxen were observed on Little Cornwallis Island but 9 caribou (*Rangifer arcticus pearyi*) were seen there in 1952.

Cornwallis Island supports about the same number of caribou as musk-oxen. These have been observed in the western and northern parts of the Island. In summer adult male caribou are generally separated from cows and calves. Three calves were the largest number observed in one year.

The Arctic wolf (*Canis lupus*) and weasel (*Mustela arctica*) are rare permanent residents on these islands. The Greenland lemming (*Dicrostonyx groenlandicus*) was not observed in 1950 and 1951, two individuals were observed in 1952 and literally thousands in 1953. The Arctic fox (*Alopex lagopus*) was moderately abundant in 1950, very abundant in 1951, their numbers were considerably reduced in 1952, and in 1953 foxes were only rarely observed. The Polar bear (*Thalarctos maritimus*) and Arctic hare (*Lepus arcticus*) are fairly common permanent residents. An average of about 12 animals of these species was observed during each of the four field seasons.

The most abundant sea mammals in the straits and channels around the Cornwallis Islands are the Atlantic walrus (*Odobenus rosmarus*), ringed seal (*Phoca hispida*) and white whale (*Delphinapterus leucas*). The ringed seal is a permanent resident as is the less common bearded seal (*Erignathus barbatus*). Allen Bay is a breeding ground for walrus and an estimated 500 animals inhabit this region each year. A few herds of Harp seal

(*Phoca groenlandica*) were observed each year in Barrow Strait and Wellington Channel. Bones of the Greenland whale (*Balaena mysticetus*) and narwhal (*Monodon monoceros*) were commonly found on the raised beaches and as much as 125 feet above sea-level, but neither of these animals was observed alive.

Bird life is remarkably abundant and varied on the Cornwallis Islands. This is especially true of the gulls whose rookeries are common in the more inaccessible outcrops and cliffs along the coast as well as several miles inland along the canyon walls of major streams. The following information on the status of observed species on Cornwallis Island has been furnished by Robert Jasse. These observations were made during the three summers of 1951-53: red-throated loon (*Gavia stellata*), a very common nesting species; Black guillemot (*Cepphus grylle*), nests around Cape Hotham, but rare elsewhere; Brunnich's murre (*Uria lomvia*), nests commonly near Cape Hotham, but rare elsewhere; dovekie (*Plautus alle*), a rare fall migrant; pomarine jaeger (*Stercorarius pomarinus*), an uncommon nesting species, but common in migration; parasitic jaeger (*Stercorarius parasiticus*), a common nesting species; long-tailed jaeger (*Stercorarius longicaudus*), an uncommon nesting species but a common migrant; ivory gull (*Pagophila eburnea*), a common migrant; Kittiwake (*Rissa tridactyla*), nests abundantly at Advance Bluff; Ross' gull (*Rhodostethia rosea*), a rare spring migrant; glaucous gull (*Larus hyperboreus*), nests very commonly on rock exposures over all of Cornwallis Island; Iceland gull (*Larus leucopterus*), a common spring migrant; Thayer's gull (*Larus argentatus thayeri*), a common nesting species, especially along the east coast; Sabines gull (*Xema sabini*), a very common migrant; Arctic tern (*Sterna paradisaea*), an abundant nesting species; fulmar (*Fulmarus glacialis*), during the nesting season this is an abundant species along the east coast of Cornwallis Island. It is fairly common elsewhere around the island and is believed to breed on western Devon Island; old-squaw (*Clangula hyemalis*), a very common nesting species; northern eider (*Somateria mollissima*), an abundant nesting species; King eider (*Somateria spectabilis*), a common nesting species; greater snow goose (*Chen hyperborea*), an uncommon migrant; light-bellied brant (*Branta bernicla hrota*), a common nesting species; red phalarope (*Phalaropus fulicarius*), a common migrant and rare nesting species; ruddy turnstone (*Arenaria interpres morinella*), a rare spring migrant and possible nesting species; Knot (*Calidris canutus*), a rare migrant and possible nesting species; purple sandpiper (*Erolia maritima*), a very common nesting species; Baird's sandpiper (*Erolia bairdii*), a common nesting species; sanderling (*Crocethia alba*), a common migrant and probable nesting species; rock ptarmigan (*Lagopus mutus*), a common winter and summer resident; white gyrfalcon (*Falco rusticolus*), an uncommon migrant; snowy owl (*Nyctea scandiaca*), a fairly common permanent resident; raven (*Corvus corax*), an uncommon permanent resident; horned lark (*Eremophila alpestris*), a rare migrant and possible nesting species; snow bunting (*Plectrophenax nivalis*), a very common nesting species; Greenland wheatear (*Oenanthe oenanthe*), a rare nesting species.

Mode of Travel

The Geological Survey parties used a 22-foot freighter canoe with 5- and 10-H.P. outboard motors in travelling along the coast. The advantage of a light craft for such work is the ease with which it can be pulled onto the shore out of shifting fields of pan ice. Several overland, back-packing journeys were made using light field equipment. The clay mantled uplands of these islands are virtual quagmires during the spring thaw and walking is exceedingly difficult. After the initial spring run-off, however, and with the onset of drying conditions the country provides excellent footing.

History of Exploration

Cornwallis Island was discovered by Lieut. (later Admiral Sir) W. E. Parry (1821)[1] on August 22, 1819, as he sailed westward through Lancaster Sound in his search for a Northwest Passage. On this remarkable journey, which carried him as far west as Melville Island, Parry discovered and named all the larger islands, channels, and straits on his route west from Lancaster Sound. After finding his westward progress blocked by ice, Parry wintered his two vessels, the *Hecla* and *Griper*, in Winter Harbour, Melville Island. The following summer he retraced his course to England. Parry named Cornwallis Island to honour Sir William Cornwallis at that time an Admiral of the Royal Navy.

The ill-fated expedition of Sir John Franklin was next to visit the region of Cornwallis Island. Franklin left England in 1845 sailing in the *Erebus* and *Terror*. He too sought a passage from the Atlantic to the Pacific.

Although it is certain that Franklin must have made numerous discoveries around Cornwallis Island and mapped the remaining coast-line, no record of his work was ever found, and after having sailed out of Baffin Bay no member of his party was seen again by civilized man. The only written document left by his expedition was a note found in a cairn at Victory Point, near the northern extremity of King William Island, by Lieutenant W. R. Hobson in 1859. Hobson was second-in-command of the expedition in the *Fox* (1857-59), under the command of Captain (later Admiral Sir) F. L. M'Clintock. This note (M'Clintock, 1859, pp. 283-84) contained the important information that, before wintering at Beechey Island in 1845-46, Franklin had "ascended Wellington Channel (in 1846) to lat. 77° and returned by the west side of Cornwallis Island", that the

[1] Dates in parentheses are those of references cited in the Bibliography at the end of this report.

ships had been beset in the ice since September 1846 and that they were abandoned in April of 1848. It further contained the tragic news that Franklin had died in 1847, that the loss of life up till 1848 had been 9 officers and 15 men, and that the remaining 105 officers and men were about to commence a journey (in April 1848) to the Back River on the mainland in an attempt to reach civilization.

This was the first information obtained proving that Cornwallis was actually a separate island and not joined to Bathurst Island. It is still unknown which of the two possible straits between Bathurst, Little Cornwallis, and Cornwallis Islands was negotiated by the *Erebus* and *Terror*.

In late August of 1850, two British squadrons in search of Sir John Franklin's expedition entered Barrow Strait. One of these was commanded by Captain Horatio T. Austin (British P. P. 1852) and consisted of the sailing vessels *Assistance* and *Resolute*, together with the steam tenders *Intrepid* and *Pioneer*. Austin's ships wintered about 2 miles off Griffiths Island and between that island and Cape Martyr on Cornwallis. The second squadron under the command of whaling Captain William Penny (Sutherland, 1852; also British P.P. 1852) comprised the *Lady Franklin* and *Sophia*. These squadrons were accompanied by a privately financed expedition led by Sir John Ross in the *Felix*. Penny and Ross wintered in Assistance Bay on the south coast of Cornwallis Island. An American squadron under Lieutenant E. J. DeHaven (Kane, 1854), made up of the *Advance* and *Rescue*, also accompanied the above vessels as far west as Griffith Island. Upon proceeding homeward in the fall of 1850 DeHaven's ships became beset by ice in Wellington Channel where they passed part of the following winter before extricating themselves and returning home.

The official record of Sir John Ross' expedition, dated August 12, 1851, was found by the writer in a cairn on Prospect Hill at the head of Assistance Bay. The record was taken from the cairn July 18, 1951, and is reproduced on Plate II.

Much of the shoreline of Cornwallis Island was explored and charted by manned sledge parties of these 1850-51 expeditions. Although the entire west and northwest coastal regions were not visited, a narrow isthmus was supposed to connect Cornwallis with Bathurst Island approximately in the position where Little Cornwallis is now shown.

After fruitless searchings, Austin, Penny and Ross returned to England in 1851, and in 1852 the British Admiralty outfitted a second expedition to search for their missing countrymen. Five ships, the *Assistance, Resolute, Pioneer, Intrepid,* and *North Star* sailed under the new command of Sir Edward Belcher (1855; also British P.P. 1855). The ships reached Beechey

Island (a small tied-island off the southwest coast of Devon Island) in August, where Belcher divided his squadron. The *Resolute* and *Intrepid*, under command of Captain Henry Kellett, proceeded to Melville Island where they wintered off Dealy Island. The *North Star* remained at Beechey Island as a depot and retreat vessel in case of disaster to the advancing vessels. Belcher, with the *Assistance* and *Pioneer*, ascended Wellington Channel to Northumberland Sound where he passed the first winter. Travelling parties from these squadrons discovered and explored several hundred miles of new coast-line, including several new islands. Although many sledge parties carrying communications between the advance ships and Beechey Island travelled along the coasts of Cornwallis Island they followed previous routes along the east and south shores and no new coasts were charted.

Attempts by the advance ships to return home in the summer of 1853 failed. Kellett's ships passed the winter of 1853-54 frozen in the ice off Cape Cockburn, near the southwestern tip of Bathurst Island. The *Assistance* and *Intrepid* were also frozen fast in the ice off Cape Osborn, Devon Island in Wellington Channel. Fearful of the contingencies attending another winter in the Arctic, especially with respect to the health of his men, Belcher ordered abandonment of the four advance ships in the summer of 1854. At this time the crew of the *Investigator*, under command of Captain Robert M'Clure, was on board Kellett's ships. M'Clure had entered the Archipelago in 1850 via Bering Strait in search of Franklin. After three winterings, the last two beset in Mercy Bay on the north coast of Banks Island, M'Clure and his men were miraculously discovered and rescued by members of Kellett's ships in 1853. The crews of five abandoned vessels walked over the ice to Beechey Island where they assembled on board the *North Star* and two relief ships, the *Phoenix* and *Talbot*, which had just arrived from England. From Beechey Island the three ships returned to England.

Three expeditions under command of Captain J. E. Bernier visited the Parry Islands in the early part of the present century. These were sent out by the Canadian Government, the first two for the purpose of patrolling the waters of the Arctic regions and annexing islands and territory granted by Great Britain to Canada.

In July and August 1906, Captain Bernier in the Canadian Government Steamship *Arctic* sailed through Lancaster Sound and reached as far west as Arctic Point, Melville Island. While advancing westward, Bernier, on August 24, built cairns and deposited documents at Dobell Point, Griffith Island and at Sheringham Point, Cornwallis Island. Bernier turned back from Melville Island, wintered in Pond Inlet, Baffin Island, and returned to Quebec City in 1907.

On a second expedition 1908-09, Bernier (1910) reached Melville Island where he wintered at Winter Harbour. Although Bernier sailed close to the southern coast of Cornwallis, he apparently landed only on Browne Island and this during his return from Melville Island.

In 1910, the *Arctic* was again fitted and sailed with instructions from the Minister of Marine and Fisheries to patrol Arctic waters and attempt a northwest passage via M'Clure Strait. On August 25, Bernier (1912, p. 24), accompanied by members of his crew, landed at Cape Airy, southwestern Cornwallis Island, where he deposited a document in a cairn and explored the vicinity of Pioneer Bay. Upon reaching Melville Island, the *Arctic* was unable to negotiate M'Clure Strait. Bernier then retraced his course eastward, wintering at Arctic Bay, Baffin Island, and returning home in 1911.

On March 10, 1929, Inspector A. H. Joy, accompanied by Constable McTaggart and an Eskimo companion, left Dundas Harbour, Devon Island, to commence one of the longest and most successful of all R.C.M.P. Arctic patrols. Joy travelled west to Melville Island, thence northeastward by way of Lougheed, Ellef Ringnes and Cornwallis Islands, reaching Bache Peninsula, Ellesmere Island, on May 29, after having travelled some 1,700 miles. Inspector Joy touched briefly on the east and south coasts of Cornwallis Island. At Depot Point Cairn on the east coast, Joy (p. 64) removed a note dated August 8, 1850, which was left in the cairn by Captain William Penny.

In the spring of 1930, Corporal M. M. Timbury (1931), accompanied by Constable R. W. Hamilton (both of the R.C.M.P.) and a native hunter, patrolled a part of the east coast of Cornwallis Island. The patrol left Dundas Harbour, travelled westward to Cornwallis and north to Grinnell Peninsula. From there Timbury returned to Dundas Harbour via the west coast of Devon Island.

Previous to the establishment of the Weather Station at Resolute Bay in 1947, U.S.A.F. photo reconnaissance planes had mapped the remaining uncharted west and northwest coastal area of Cornwallis and at the same time established the insularity of Little Cornwallis Island. The Geological Survey party of 1950 (Harwood, 1951) was second to circumnavigate Cornwallis Island and the writer's party of 1952 was probably the first to set foot on Little Cornwallis Island. Sir John Franklin is known to have sailed round Cornwallis Island and it is possible that he too made a landing on Little Cornwallis.

Previous Geological Investigation

Charles Konig (1824), was the first to describe the geology of this part of the Arctic from observations and rock specimens collected by members of Parry's expedition. His descriptions, which pre-date the classic works of Murchison and Sedgwick, are largely in terms of Wernerian classification. Nevertheless, Konig clearly recognized that limestone formations rest upon "primitive formations" (i.e. Precambrian) near Prince Regent Inlet on northern Baffin Island, and continue westward through Barrow Strait. Moreover, he correctly compared certain of these limestones with those of Gotland.

Describing some of the limestone specimens, Konig (p. ccxlix) says, "Among them a variety of limestone seems to prevail, which is very like the Alpine or mountain limestone. It is compact, of yellowish and greyish colour, and contains among other remains of zoophytes and shells, abundance of the same species of *Terebratula,* which are characteristic of that rock in various alpine tracts in Europe. A greyish-brown fetid variety of limestone, from the north side of Barrow's Strait bears great resemblance to the mountain limestone as it occurs in Derbyshire...". Very probably the "*Terebratula*" referred to represents *Atrypella* which abounds in the Upper Silurian shelly faunas of this and neighbouring regions of the Arctic Archipelago.

With reference to crinoidal limestone which Konig states is prevalent in various parts of the north coast of Barrow Strait, he says (p. ccl), "There is little doubt that this zoophyte is related to some of those encrinites of which parts of the stem and branches so frequently occur in the transition limestone of Gothland".

Konig (p. ccli), also described, but did not figure, a new species of chain coral, *Catenipora parrii* from Prince Regent Inlet.

Until recently Cornwallis Island was shown on maps as underlain by strata of Silurian age. This was based on several collections of fossils made along the southern and eastern coastal areas of that island by members of Austin's and Penny's squadrons in 1850-51. Although never visited, and up till 1947 considered a peninsula off northwestern Cornwallis, Little Cornwallis Island was shown as underlain by Carboniferous rocks. Evidently this erroneous interpretation resulted from an extrapolation of presumed geological conditions on Bathurst Island.

Some of the fossils collected on Cornwallis Island are described in an appendix to Sutherland's narrative of 1852 by J. W. Salter of the Geological Survey of Great Britain. Another small collection was studied by Samuel Haughton (1857). The following list includes fossils from Cornwallis and smaller islands in the immediate vicinity, described by Salter (no correction of the original nomenclature is here attempted): *Columnaria sutherlandi* Salter; *Favistella franklini* Salter; *Favosites gothlandica* Linnaeus; *Favosites polymorpha* Goldfuss; *Halysites catenulatus* Linnaeus; *Strephodes? austini* Salter; *Strephodes pickthorni* Salter; *Chonetes* sp., *Orthis* sp., *Pentamerus* *conchidium* Dalman; *Spirifer crispus* Linnaeus?; *Rhynconella* n. sp., *Rhynconella phoca* Salter (the now well-known Arctic brachiopod *Atrypella phoca*); *Rhynconella sublepida* De Vern; *Strophomena* sp., *Strophomena donnetti* Salter; *Bellerophon nautarum* Salter; *Orthoceras ommanneyi* Salter; *Orthoceras* sp. 1 and 2; *Encrinurus* (*Cryptonymus*) *laevis* Anselm?; *Proetus* sp.; and *Cytherina baltica* Hisinger.

Other fossils described and figured in this report from neighbouring regions of Devon and Somerset Islands are: *Arachnophyllum richardsonii* Salter; *Calophyllum phragmoceras* Salter; *Clisiophyllum* sp.; *Favistella reticulata* Salter; *Fenestella* sp.; *Atrypa reticularis* Linnaeus and *Rhynconella mansonii* Salter.

In his summary of the geology of this region Salter (p. ccxxxiii), states that "The great formation which occupies the Arctic lands, or at least skirts their icy shores, is a limestone, which from all that can be gathered from the fossils, is of Upper Silurian Age".

It is apparent that many of the fossils described in Salter's paper were collected from the Allen Bay and Read Bay formations of the present report.

In two subsequent papers (1853 and 1855) Salter reviewed his studies of this area. In these very little new is added to his work of 1852 except for his assertion (1855, p. 212), that "there need be no hesitation in referring the whole of the limestones, in a general way, to the Wenlock group".

Haughton described and figured the following: *Syringopora geniculata; Cardiola salteri* Haughton; *Orthoceras griffithi* Haughton, and *Cromus arcticus* Haughton. The latter had been described previously by Salter 1852, as *Encrinurus (Cryptonymus) laevis* Anselm. Very probably many of the fossils brought back by the Franklin search parties were not collected in situ.

It is of interest to note that one member of Austin's expedition of 1850-51 observed that strata in various parts of Cornwallis and neighbouring regions were deformed from their original horizontal position. This was noted by an anonymous member among the officers and seamen of the expedition in their narrative "Arctic Miscellanies" (1852, p. 180).

McMillan (1910), geologist on the Canadian Government Expedition of 1908-09, apparently made no landings on Cornwallis Island. However, he visited Browne Island (p. 416), and made observations from on board ship on the attitude of strata on Griffith Island and at Cape Hotham, Cornwallis Island. Griffith and Browne Islands are two small islands lying off the south coast of Cornwallis. On Browne Island, McMillan described two types of limestone which he distinguished on bases of colour. He noted that a darker, rusty weathering limestone "when broken emits a fetid odour resembling that of crude petroleum". He stated that the limestone on this island strikes north-south and dips eastward up to 30 degrees and listed *Favosites gotlandica* Linnaeus, as occurring there. McMillan (pp. 438-39) noted the dip of bedrock on Griffiths Island as 10 to 30 degrees in an east-northeasterly direction and that at Cape Hotham the dip is 30 to 40 degrees northeast.

The parties of the Geological Survey headed by Fortier and the writer in 1950 and by the writer during the three succeeding years were the first to undertake a systematic geological study of the Cornwallis Islands. Preliminary results of the first three field seasons' work have already been published by Thorsteinsson and Fortier (1954).

Physiography and Drainage

Cornwallis Island can be divided into two dissimilar physiographic divisions of different relief and stage in the erosion cycle. One of these represents a plateau remnant resulting from advanced peneplanation effected at some early time. This plateau is situated approximately in the southeastern quarter of the Island where it borders about 20 miles of the south and the east coasts that face Barrow Strait and Wellington Channel respectively (*see* Plate III). The plateau reaches an average elevation of about 1,000 feet. A height of 1,350 feet, measured by aneroid about 7 miles southwest of Read Bay, represents, in all likelihood, the highest point on the plateau and Cornwallis Island. The surface of the plateau is undulating and truncates several major structures. It is crossed by several streams, steep in gradient and characterized by stream canyons with numerous waterfalls, but large intervening areas are apparently devoid of drainage lines. At present these streams are actively down-cutting and extending headwards. The remainder of Cornwallis Island is physiographically of more mature aspect (*see* Plate IV). West and northwest from the southeastern plateau, elevation above sea-level decreases, stream systems are more integrated, and a generally more rugged terrain prevails. Increased dissection coupled with incomplete emergence of the Island has resulted in much of the west and southwest coasts having features characteristic of drowned topography. Many parts of the west and northwest coastal regions are low-lying plains that slope gently seaward and on which major streams flow through generally well-graded stream channels, commonly several miles in length, before reaching the sea. The largest streams on Cornwallis Island are outside the southeastern plateau.

The east coast of Cornwallis Island presents certain physiographic features that are difficult to explain. This coast is remarkably straight over long distances, especially where it follows the strike of bedrock and, unlike much of the remaining coast-line, moderate elevations are reached within a very short distance of the sea. Heights up to about 800 feet above sea-level bound the east coast as far north as Separation Point and yet vertical cliffs are absent as strata dipping 35 to 45 degrees form a dip slope coast-line. To the north of Separation Point, the coastal elevation of Cornwallis Island decreases and levels out at about 400 feet above sea-level beyond Read Bay, an elevation which is maintained to the north end of the Island. Westward and inland from the east coast, the land rises gradually up to the Island's divide that trends in a north-northwesterly direction from the plateau remnant. Another comparatively straight segment of coast-line extends from Decision Point to Cape Phillips. Along this the coast also approximately parallels the strike of bedrock. Possibly these unusually linear segments of the coast-lines are, in fact, fault line scarps. Well-developed sea-cliffs of notable extent occur in the vicinity of Advance Bluff on the east coast of Cornwallis where flat-lying strata along the axis of the Advance Bluff syncline are truncated by the coast.

Study of air photographs and other sources of information suggest that Devon Island, east of and adjacent to Cornwallis, comprises a youthfully dissected plateau tilted gently westward throughout much of its length of some 240 miles. Elevations of approximately 5,000 feet characterize eastern regions of Devon Island which are capped by plateau glaciers. Along the west coast of Devon, opposite Cornwallis Island, prevailing elevations approximate or slightly exceed those of the east coast of Cornwallis. It would appear, therefore, that Cornwallis Island may be interpreted as a continuation (across Wellington Channel) of the tilted plateau of Devon Island. This interpretation must be considered along with relative resistance of formations to erosion in attempting to account for the physiographic characteristics of Cornwallis described above.

The maximum elevation of Little Cornwallis is about 525 feet. The physical features of this island are comparable to those of adjacent regions of Cornwallis Island.

Vegetation

For the most part, Cornwallis Island is barren of vegetation and this barrenness together with the comparatively low relief of the Island has produced a generally desolate landscape. Uplands in excess of about 300 feet in elevation have little or no plant cover except for small patches commonly found on hill summits. However, plants in considerable variety are more plentiful in other areas, particularly in broad valley floors (*see* Plate IV) and in low-level areas below about 300 feet that occur mainly in the vicinity of the coast. On Cornwallis Island plant-covered areas are most common along the fringe of the west and northwest coasts where moderately large areas lie close to sea-level, but even there vegetation can seldom be described as more than sparse.

In the northwestern coastal region of Cornwallis Island, particularly in an area centred round latitude 75° 33′ and longitude 95° 59′, a noteworthy exception to the otherwise general barrenness of the Island is found. Here an estimated 15 square miles of almost level, lake- and pond-covered lowlands lie within 50 feet of sea-level. This area is virtually covered with vegetation, predominantly grasses. The general aspect of this region is that of an oasis in an otherwise Arctic desert. Small bands of caribou and musk-oxen are commonly seen grazing in these meadows.

Little Cornwallis has about half the elevation of its sister island and much of its terrain lies well within 300 feet of sea-level. In marked contrast to Cornwallis, Little Cornwallis Island is characterized by considerable plant cover, the total area of which probably equals that of the much larger Cornwallis Island.

Plant cover in this region of the Arctic appears to be related in main to three factors; elevation above sea-level, effectiveness of solifluction, and type of bedrock. It is, however, difficult to evaluate the relative effect of each of these factors.

The effect of elevation on plant cover is implicit from the foregoing discussion of the Cornwallis Islands. However, the causes of this relationship are less apparent and are doubtlessly in part related to solifluction. Presumably during the growing season the sea exerts an ameliorating influence upon local climate and, with other factors being favourable, renders the low-lying coastal regions more conducive to plant growth. Moreover, uplands, unlike the more sheltered valleys, are exposed to the generally cool summer winds blowing over ice-filled channels. Even in winter much snow is blown into the deeper recesses of valleys, leaving parts of the uplands subject to the erosive effects of blowing snow and rock particles.

Solifluction is active on slopes as low as approximately 5 degrees and dominates mass wastage processes throughout much if not all permafrost regions. Solifluction is especially active in regions of high latitude like the Cornwallis Islands where the active layer is comparatively thin (about 3 feet), and relief is sufficient to permit movement. In terrain of active solifluction stable soil conditions necessary for plant establishment and growth are seldom attained. This is especially true where the moving mantle is derived from bedrock unconducive to early soil development.

Calcareous shale, argillaceous limestone, shale (Cape Phillips formation), and clay (Intrepid Bay formation) seem to form soil suitable for plant growth on these islands, whereas relatively pure limestone and dolomite formations (Read Bay and Allen Bay formations) do not. This correlation of rock type and plant cover appears to hold true, in part, irrespective of relief and solifluction. Relatively pure carbonate rocks are, however, the most resistant to erosion and hence dominate the areas of greatest relief where, in turn, solifluction is generally most active.

On Cornwallis Island two relatively restricted areas are underlain by strata of the Intrepid Bay formation that have been preserved in down-faulted blocks and left surrounded by older formations (*see* Plate V). These areas of Intrepid Bay outcrops clearly illustrate how rock types affect plant cover. The Intrepid Bay formation consists chiefly of sand, clay, and coal seams and is everywhere carpeted by vegetation, mainly cryptogamic plants, causing this formation to stand out in marked contrast to the surrounding completely barren terrain of limestone and dolomite.

Another noteworthy example of bedrock affecting plant cover occurs in northeastern Cornwallis Island. At elevations around 450 feet, the northwesterly trending contact of the mainly impure limestone and shale of Cape Phillips formation and relatively pure carbonate sediments of Cornwallis formation can virtually be mapped by noting the very sparse but perceptible plant cover on the former and its absence on the latter. There, as in the case of the Intrepid Bay formation, vegetation is mainly in the form of lichens and mosses and the terrain in places possesses considerable local relief.

A general view of the Arctic Archipelago bears out more fully the important influence of rock type on plant cover. Large areas of neighbouring Devon, northeast Baffin, Somerset, and Prince of Wales Islands are known to be underlain predominantly by lower Palæozoic carbonate rocks. Study of air photographs reflects the same barrenness in these regions that characterizes Cornwallis Island. Moreover land mammals, such as musk-oxen and caribou, whose populations must necessarily be closely related to amount of plant food, are known to be generally scarce in these islands. To the west of Cornwallis, Bathurst and Melville Islands stand out in marked contrast. Almost all who have visited these islands have remarked on the abundance of caribou and musk-oxen. Although the geology is not very well known, vast areas of Melville are probably underlain by impure Devonian sandstone and siltstone, and Ordovician and Silurian graptolitic facies (Tozer, 1956). Structurally, Bathurst and Melville Islands appear to belong to one and the same geological province and early explorers of the former have reported widespread sandstone occurrences.

The contrast in plant cover of Bathurst as compared with Devon Island was recognized long ago and aptly related to bedrock by Captain Sherard Osborn (1855, p. 228), who accompanied Belcher in 1852-54 when the latter wintered off Grinnell Peninsula, Devon Island. Moreover Osborn was especially familiar with the prevailing rock types and relative barrenness of Cornwallis Island, having wintered there in 1850-51 while serving in Austin's squadron. In 1853 Osborn was returning from a journey that had taken him westward to Melville Island and back along the north coast of Bathurst. As Osborn approached Cape Lady Franklin, the northeastern extremity of Bathurst and the only locality on the Island where limestone was noted, he wrote in his diary, "The land was fast increasing in barrenness as we approached the Queen's Channel, and that horrid limestone, of which we have such a dislike, increases in quantity at every mile we advance".

Glaciation

There is sufficient evidence to prove that Cornwallis Island was glaciated at least once. Bedrock striated consistently along the same direction over large areas was observed in the vicinity of Resolute Bay and Read Bay, and indicates that ice moved outward from a central location on the plateau. It thus appears that the detected period of glaciation was a local one. This would give support to the opinion of many, and lately of Jenness (1952), that if the Arctic Islands north of Barrow Strait and Viscount Melville Sound were glaciated, they were so covered as the result of local ice accumulation. This, however, leaves unexplained rock fragments, exotic to the bedrock on which they lie, that are found in areas exhibiting no evidence of submergence.

Striated boulders and cobbles of rock indigenous to the Island occur widely scattered on both islands. Morainal hills up to 250 feet high occur near the head of Read Bay and Marshall Peninsula. Terminal moraines several tens of feet in thickness have contributed to the formation of a series of paternoster lakes north of Assistance Bay and to the smaller Laura Lakes behind Snowblind Bay. The greater part of the surface of Cornwallis Island is covered with a mantle of clay admixed with frost-shattered debris from bedrock or of frost-shattered debris (felsenmeer) only. The mixture is either till or regolith, but it is difficult to differentiate between the two everywhere because the original characteristics have been obliterated in many places by widespread solifluction. Much of the present mantle of these islands can only be described as resulting from this subsequent process, the origin of this material being in doubt.

The east coast of Cornwallis Island is broken by numerous fiords and U-shaped valleys in which major streams, flowing at grade for shorter or longer distances, run into Wellington Channel. Sophia, Eleanor, the largest of the Laura Lakes, and several other unnamed finger lakes occupy segments of such valleys and apparently owe their origin to local excavation of the floors of pre-existing stream channels by seaward advancing ice tongues. Traced inland for varying distances, all U-shaped valleys end abruptly to give way to V-shaped valleys. This junction is commonly marked by increased stream gradients characterized by waterfalls. Such prominent coastal indentations, as for example Barlow Inlet (*see* Plate III) and Helen Haven, can only be described as fiords, although the term may seem inappropriate because of the non-mountainous terrain in which they are formed. Soundings of Barlow Inlet revealed the presence of a topographic high across the mouth, which may be a terminal moraine. Numerous cirques and nivation hollows, grading imperceptibly into one another, occur along the brim of the sea-coast and plateau facing Wellington Channel and constitute striking glacial phenomena (*see* Plate III). Many of the larger of these amphitheatre-like depressions house cirque or rock-basin lakes. Minor, second-cycle streams flow from the cirques and nivation hollows in V-shaped valleys, and, in their early stages of erosion, reach the sea through multiple cascades.

Approximately 12 miles directly west of Read Bay and to the west of a prominent north-trending range of hills, is a group of perhaps as many as 100 linear rock-basin lakes. The lakes vary from a few feet to a mile in length. They trend northerly along the strike of bedrock and occupy depressions between *roches moutonnées*. A south-to-north direction of ice flowage is indicated at this locality.

Erratics are common at all elevations on the island and especially upon the raised beaches, where there is apparently an inverse ratio between their incidence and their height above sea-level. On the raised beaches a great variety of rock types are found in which metamorphic rocks predominate. Above the recognizable limit of recent submergence, on the uplands, the following rock types have been found, in approximate order of their decreasing abundance; red quartzite, quartz sericite schist, granite-gneiss. No boulders exceeding 10 inches in diameter have been observed, the average erratic being apparently cobble-size above the upper limit of recent marine submergence. Erratics weighing over a ton are however common on the raised beaches. As the raised beaches are at least post-glacial for the most part, there can be little doubt that the boulders on them are not true glacial erratics but have been ice-rafted to their present position. The origin of the erratics exotic to the island, on the uplands, is not clear. Probably they indicate an earlier and more profound submergence than that indicated by raised strand lines. Another possibility is that they represent the transported debris of glaciers originating on the mainland. In any case their origin is masked by more recent events.

Emerged Strand Lines and Other Features of Emergence

Emerged strand lines are striking topographic features of the Cornwallis Islands, and indeed of many other coasts of the Arctic. These are best developed and best preserved where the land slopes gently to the sea (*see* Plate IV). On such coasts a series of raised beach ridges and intervening swales rise successively higher above sea-level and, except for local irregularities, parallel the present coast-line. They may be observed sweeping up the major stream valleys, bays and fiords, and around headlands and points. Their development and emergence clearly post-dates the development of major streams, the general configuration of the islands, and the period of glaciation. Second-cycle streams, which without exception have smaller valleys than first-cycle streams, have cut at right angles across the strand lines; a few have eroded gorges as deep as 100 feet through strand lines and into bedrock, along which they commonly flow through a series of waterfalls and cascades.

The raised beaches are composed of rounded to angular limestone and dolomite pebbles and cobbles. The numerous fossils present indicate that this material originated entirely from local rock formations. Many of the pebbles and cobbles on the surface are solution-faceted, whereas those below the surface are rounded to subangular (Nichols, 1953, p. 275). Numerous lakes, presumably occupying initial irregularities on the old shores, and swale ponds exist on the emerged beaches. The thickness of the beach deposits varies from very thin with bedrock projecting through, to deposits 30 feet thick as observed along stream-cuts. The raised beaches are cut by numerous frost cracks generally disposed in characteristic tetragonal patterns. These are underlain by ice-wedges in the permafrost that vary from less than an inch to over a foot in thickness.

No well-defined strand line was observed above an elevation of 275 feet, but the extent of maximum submergence recognized, probably of the same cycle as the beach deposits, is believed by other criteria to be 425 feet.

Four complete walrus skeletons were seen at elevations from 225 to 300 feet above sea-level[1], 3 on Cornwallis Island and 1 on Little Cornwallis Island. It is difficult to explain the occurrences of walrus skeletons all several miles from the present shore except as being deposited when these parts were submerged. Broad, comparatively level areas are common on the uplands adjacent to the coasts, at elevations considerably below that of the plateau remnant. These may represent wave-cut benches. One noteworthy example, having elevation of approximately 400 feet, is between Cape Phillips and Disappointment Bay. Numerous marine shells were observed on its surface. Marine shells, similar to forms existing today in the Arctic Sea, have been collected on Cornwallis Island at elevations up to 425 feet. Miss F. J. E. Wagner, Geological Survey of Canada, has

[1] Exact location shown on Map 1054A in pocket.

identified the following forms from a collection made at an elevation of 120 feet near Barlow Inlet:

Pelecypods

Macoma calcarea (Gmelin)
Mya truncata var. *uddevalensis* (Forbes)
Hiatella arctica (Linné)

Cirripedes

Balanus sp.

The general and recent sequence of events by which the present configuration of the Cornwallis Islands has evolved may be briefly outlined as follows:

1. Advanced peneplanation.
2. Uplift and development of first-cycle streams. At this time the approximate present configuration and a relief somewhat greater than at present probably were attained.
3. Glaciation. Growth of an ice-cap, probably accompanying but possibly preceding, submergence.
4. Emergence, probably closely following deglaciation. The formation of successively lower strand lines and the development of second-cycle streams.

Cape Hotham Landslide

Cape Hotham with its impressive landslide is an off-cited landmark in Arctic literature and forms the southeastern extremity of Cornwallis Island (*see* Plate I). This region of Cornwallis was Captain W. E. Parry's first view of new land as he sailed into Barrow Strait on his voyage of discovery. Parry (1821) made no mention of a landslide at this locality, nor is there indication of such in his engraving of Cape Hotham opposite page 58. For these reasons Goodsir (1852, p. LXVIII) concluded that the landslide occurred between Parry's 1819-20 expedition and 1849.

Cape Hotham has an elevation of 675 feet as measured by aneroid. The landslide extends along Wellington Channel for a distance of some 2,000 feet. It possesses a maximum height of 225 feet and an average width of about 450 feet.

Factors both geological and topographical contributed to the insecurity and finally in the slide and fall of rock at Cape Hotham. The effect of topography is implicit in Plate I and Figure 2 which shows the presumed conformation of the Cape prior to the landslide. Probably most important of the geological features are the several joint systems that transect the

Cape. These are shown on the accompanying map (in pocket). Figure 2 also illustrates the structure of the limestone beds that form Cape Hotham and dip at an angle of about 30 degrees towards Wellington Channel. The low sea-cliffs, now covered largely in the fallen debris, truncate the downward extension of the slip plane that is also a bedding plane. Two of the prominent joint systems and the slip plane (covered for the most part by talus) are shown in Plate I, figure 2. Percolating waters and frost action along joint and bedding planes, or an earthquake, probably provided the necessary "trigger" effect. As both sliding and falling motions were involved the Cape Hotham landslide is a compound rockslide—rock fall (*see* Sharpe, 1938, p. 77).

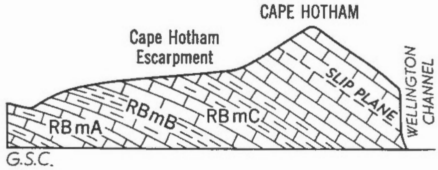

Figure 2. West to east cross-section of Cape Hotham showing geology and conformation prior to the landslide. *Modified from* figure 1, Plate I. (RBmA = member A of Read Bay formation; RBmB = member B; RBmC = member C; for lithologic symbols *see* Figure 3.)

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The difficulties attending identification of generally unfamiliar and numerous faunas (and one flora) necessitated assistance of diverse authorities on various fossil groups. Special thanks is accorded A. E. Wilson of the Geological Survey who identified most of the shelly faunas—a task that has involved several months of research. Acknowledgment is also made to the following persons who assisted in fossil identifications and in supplying information on ages and correlations: G. Arthur Cooper and J. Brookes Knight, U.S. National Museum; Helen Duncan, U.S. Geological Survey; T. E. Bolton, D. J. McLaren, G. Winston Sinclair and F. J. E. Wagner of the Geological Survey of Canada; A. K. Miller, Department of Geology, State University of Iowa; Norman W. Radforth, Department of Geology, McMaster University; and Walter C. Sweet, Department of Geology, Ohio State University.

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Geological observations by Y. O. Fortier, with whom the writer was jointly associated during the initial field season on Cornwallis Island, are embodied in the accompanying map.

CHAPTER II

CLIMATE OF CORNWALLIS ISLAND

by M. Hagglund[1]

Continuous weather records have been kept at Resolute Bay, on the south coast of Cornwallis Island, since October, 1947. Like most Arctic weather outposts, Resolute is a coastal station and its climate shows moderating maritime influence of the sea, even at this high latitude where ocean channels are ice-covered a large part of the year. Slight variations in the climatic elements as recorded at Resolute may be expected in the interior of the Island. However, from the standpoint of large-scale climatic controls, such as mean air pressure and physiography, the comparatively minor areal extent and low relief of Cornwallis Island would tend to militate against marked contrast in coastal and inland climates. Therefore, with minor exceptions, that will be mentioned where considered significant, the climate in the vicinity of Resolute Bay may be assumed to be fairly representative of the whole of Cornwallis Island.

Before discussing some of the details of the climatological statistics recorded to date, the influence of the major climatic controls and the roles they play in determining the existing climatic regime will be briefly considered. The first and most obvious influencing factor is the high latitude of 75 degrees north, which places the area under consideration some 8 degrees north of the Arctic Circle. Latitude determines the lengths of the winter dark period when no solar radiation is received, and the corresponding period in summer when the sun never sets. At Resolute the sun never rises from November 4 to February 5 and does not set from April 30 to August 15. The amount of solar radiation reaching the ground during the latter period is, of course, dependent on cloud cover. Another effect of the high latitude is the limitation imposed on the maximum altitude attained by the sun. The resulting obliquity of the sun's rays causes a lessening of the heat received at the earth's surface due to absorption in the greater thickness of atmosphere traversed. Thus, in early spring particularly, the Arctic sun is frequently referred to as a 'heatless' sun.

The distribution of land, ice, and water is an important factor in the determination of climatic extremes. The waters surrounding Cornwallis Island are normally frozen over completely from mid-October until early July, or about eight to nine months out of twelve. There have, however, been exceptions, for instance the winter of 1952-53 when Barrow Strait

[1] Meteorologist in charge of the Arctic Section, Basic Weather Services Meteorological Division H.Q., Toronto, and Officer-in-charge of the Resolute Weather Station 1952-53.

to the south of the Island remained ice-free. The presence of the comparatively wide channels surrounding the Island, whether frozen over or open, has a moderating influence on the temperature regime. Ice thickness averages 5 to 7 feet in the area after one season's growth, but even with this thickness, there is sufficient heat transported upward from the water below the ice to exert the moderating effect mentioned and to keep temperatures from falling to the extremes that have been observed at many continental stations in much lower latitudes. Similarly in summer, the icy water provides a thermostatic control that prevents the temperature from rising to levels it otherwise would. Moreover the open water provides moisture that results in extensive low cloud and fog. This in turn restricts the amount of solar radiation reaching the ground.

Lastly, and perhaps most significant, is the control exercised by mean air pressure patterns and mean storm tracks and the influence on both of these by the large scale topography of landmasses, both neighbouring and distant, with regard to Cornwallis Island. From the southeast round to the north lie the low-lying islands of the Archipelago that are characterized mainly by plains topography. In marked contrast, to the north round to the southeast lies the major topographic barrier of the north-south Ellesmere Island-Baffin Island mountains and beyond it, the Greenland ice-cap. Both of the latter act as mechanical barriers preventing the free transport of air in the lower levels of the troposphere from one side to the other and profoundly influencing the mean tracks followed by Arctic storms. A part of almost every migrating mid-latitude low-pressure centre that tracks near, or anywhere north of the southern tip of Greenland, is deflected northward into Baffin Bay, and eventually affects the Cornwallis Island area. Thus mean-pressure maps for all seasons of the year normally show lower pressures over Baffin Bay than elsewhere in the Arctic, with higher pressure to the west and northwest of Cornwallis Island. The mean gradient resulting is such as to produce prevailing northwesterly surface winds over Cornwallis Island, most pronounced in winter and spring and weakest in June and July. During the latter period prevailing winds are actually southeasterly. There are also many storm centres that approach the Arctic Archipelago from the west and southwest, and which affect Cornwallis Island as they pass easterly into Baffin Bay along the path of least resistance offered by Lancaster Sound or Jones Sound which breach the Ellesmere-Baffin mountain barrier, or west of Resolute and then northward under the deflecting influence of the Axel Heiberg-Ellesmere topographic barrier. Storm centres following these tracks may be expected in any season, but are most frequent in the period June through August. Their effect on the Cornwallis area is to produce a high percentage of winds from the southeast in this three-month summer period and to bring most of the rainfall recorded at Resolute.

Average wind speed at Resolute is lowest in December at 8·8 m.p.h. In summer it is 11·5 m.p.h. and it reaches a maximum of 12·3 m.p.h. in October, the stormiest month of the year. During storms, the strongest average winds occurring are normally 40 m.p.h. or less, although winds in the 40-50 m.p.h. range have occurred, again with the highest frequency in October.

Temperature data for Resolute are listed in Table I, which includes observations to the end of February, 1954.

An inspection of Table I reveals the fact that although mean temperatures in winter are lower than in sub-Arctic continental areas, the extremes recorded are not as great. Large variations in winter temperatures can occur, however, but usually for very brief intervals. For instance, a temperature of 20° F. has been observed in March, the same month of the year in which the extreme low of −54.6° F. was recorded. Such respites from the continuous sub-zero cold of the winter months are a rare occurrence, and are the result of brief incursions of warm low latitude air brought northward in the lower levels of the atmosphere by an intense storm centre. The normal vertical distribution of temperature over Resolute in winter shows a heavy and persistent surface inversion, which breaks down only in cases of strong pressure gradients when a turbulent transfer of heat occurs, bringing the warmer temperatures observed aloft right down to the earth's surface. Thus, a significant rise in temperature in winter is invariably accompanied by strong winds. On the other hand, the extreme summer maximum recorded, 60° F. in July, 1952, occurred during a period of calm. A wind springing up on a warm day in summer usually results in a rapid drop in temperature due to the cooling effect of the icy waters in nearby ocean channels. The control exercised by these same icy waters is responsible for the lack of any large variations in temperature in July and August, as compared to variations observed in the winter months. Moving into the interior of the Island one might well expect to find extreme maximum temperatures of the order of 5° to 8° F. higher than at the coast in July and August and extreme minimum temperatures lower by the same order of magnitude in the winter months from November through March.

On the average, about 45 per cent of the annual total of 5·35 inches of precipitation (*see* Table II) falls in the form of rain in the period June through September. There is considerable variation, however, since in four years out of seven, annual rainfall actually comprised slightly more than 50 per cent of the total precipitation. Variation in annual totals range from 3·91 inches in 1952 to 6·58 inches in 1950. The highest monthly rainfall occurred in July, 1948, with 1·78 inches, and the highest single monthly snowfall total occurred in May, 1948, when 14·8 inches of snow

Table I

Temperature Data for Resolute from October 1947 to February 1954

—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mean daily max.	−22·2	−24·3	−14·9	1·3	22·3	37·7	45·1	41·4	27·4	11·3	− 2·1	−13·6	9·1
Mean daily min.	−35·5	−37·7	−29·7	−15·9	9·4	29·3	35·0	32·3	19·1	− 0·9	−15·6	−26·9	− 3·1
Mean	−28·8	−31·0	−22·3	− 7·3	15·8	33·5	40·0	36·8	23·2	5·2	− 8·8	−20·2	3·0
Extreme max.	22·3	6·3	20·0	30·1	40·0	56·8	60·0	59·1	42·3	29·9	27·2	17·0	
Extreme min.	−52·6	−53·7	−54·6	−38·1	−19·8	8·4	29·1	16·8	0·2	−23·7	−42·9	−50·6	

Table II

Mean Monthly and Annual Precipitation for Resolute from October 1947 to February 1954

—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mean rainfall (inches)	0·00	0·00	0·00	Trace	Trace	0·44	0·93	0·86	0·21	0·00	0·00	0·00	2·44
Mean snowfall (inches)	0·8	1·1	1·4	1·9	4·6	2·5	0·4	1·8	5·2	5·8	2·5	1·1	29·1
Mean Totals (inches of water)	0·08	0·11	0·14	0·19	0·46	0·69	0·97	1·04	0·73	0·58	0·25	0·11	5·35

fell. Snow may fall in any month of the year, the total for August being higher than that of most of the winter months. Over the seven-year period, the maximum snowfall occurred in September and October, with a secondary maximum in May and June. In comparison, the total that falls in the winter months is very light. This made it easier to obtain the above statistics, as it is only in early autumn and late spring that Arctic snowfall resembles the light, fluffy, mid-latitude variety for which the conversion factor of 10 inches of new snow equals 1 inch of water is fairly accurate. During the rest of the winter the same conversion factor was used, but new snow crystals in this period are more like grains of sand and have a specific gravity of about 0·2. The problem is further complicated as falling snow in winter is almost always accompanied by blowing snow. On these occasions, it is usually impossible to tell whether snow is falling or not, and at the end of a storm, when the whole visible snow landscape has changed owing to erosion in some areas and accumulation in others, any estimate of the amount of newly fallen snow becomes exceedingly difficult. Despite these complications the overall error is probably not very large, mainly due to the low total snowfall in winter as compared to that in the spring and fall. The storms of blowing snow have a profound effect on the areal distribution of the winter's total snowfall. The erosive action of the blowing snow grains and the effect of turbulance near the earth's surface are such that hilltops are swept bare and much of the snow accumulates in low-lying areas, in ravines and gullies, and to windward and leeward of obstacles, such as hills and buildings.

The most spectacular effect is in a camp-area where the drifts are frequently as high as the buildings whereas the immediate surrounding area is almost snow-free. It can be said, however, that approximately two-thirds of the annual total precipitation is evenly distributed mainly due to the amount that falls in late spring, summer and early autumn. The remaining one-third accumulates in low-lying and protected areas as described above.

During a typical year at Resolute the short summer ends about August 31, when the mean daily temperature falls below the freezing point. By the second week of September inland lakes are frozen over and a week later bays and sheltered coastal waters are covered with new ice. Around mid-October the main channels surrounding the Island with the possible exception of Barrow Strait, are also frozen over. Freeze-up of the surrounding waters is frequently delayed as September and October are the stormiest period of the year, as evidenced by the snowfall maximum which occurs in this period.

On November 4, the sun fails to rise above the horizon and sub-zero temperatures become the general rule. They hold sway right through till early May, except for the brief respites mentioned earlier. During this long winter period storms of blowing snow as described above are a common occurrence. There are also frequent occurrences of ice crystal precipitation as relative humidity is high, but the total amount of such precipitation is too light to be measured.

By early May the mean temperature rises above 0° F. and towards the end of the month an occasional thaw may occur. In the second week of June the mean temperature rises above the freezing point and the spring thaw begins in earnest. The spring run-off is quite rapid, so that by July 1, the snow cover over the entire island has usually disappeared except for remnants of deeper drifts or in sheltered gullies. Break-up of sea ice accelerates about the same time, with Barrow Strait and Wellington Channel leading the way. By early August most of the land-fast ice in bays and harbours is floating freely and, under the action of wind and tide, either moves out or disintegrates.

July and August are the two warmest months of the year. They are, however, not as pleasant as they might be because of the increased frequency of migrating cyclonic disturbances and plentiful low cloud and fog, which begin in July and extend through September, coinciding fairly closely with the period of maximum open water. This summer maximum of cloudiness and fog, during which low cloud occurs about 50 per cent of the time, is often considered to be restricted, in the Arctic, to the coast, but for an island as small as Cornwallis and for a locality that has an average wind speed of 11·5 m.p.h. for the period in question, the centre is probably as much affected by low cloud as the coast.

On August 15 the sun once more dips below the northern horizon ending the period of continuous sunshine, and thereafter frosts are normal at night. By the end of August the mean temperature is once more below the freezing point, and the typical yearly cycle is complete.

CHAPTER III

STRATIGRAPHY

General Statement

The preponderance of bedrock exposed in the traversed region of Cornwallis Island comprises a thick, conformable sequence of marine formations, moderately folded and ranging in age from about Middle Ordovician to Late Silurian or Early Devonian. Carbonate sediments constitute the principal rock type. Isolated and small patches of two and probably three younger formations rest with structural unconformity on these older rocks.

The Eleanor River formation is the oldest exposed in the region and consists of limestone. Outcrops of this formation are restricted mainly to the central part of Cornwallis Island, but a small outcrop area occurs near the northern extremity. No fossils have been discovered in this formation which is, however, tentatively regarded as of Ordovician age.

The Cornwallis formation overlies Eleanor River strata and comprises mainly carbonate, with lesser clastic and gypsum sediments. This formation is widely distributed over central and northwestern Cornwallis. It also occurs on Little Cornwallis where it constitutes the oldest exposures. It is Middle Ordovician[1] in age.

Although the two oldest formations seem to extend throughout the islands without noticeable lateral variation, regional facies changes occur in the strata that rest conformably on the Cornwallis formation. The zone of facies separation trends somewhat south of west across the approximate centre of Cornwallis Island roughly from Stanley Head on the west-central coast to Snowblind Bay on the east-central coast. Throughout the report this will be referred to as the Stanley Head-Snowblind Bay line of facies change. A graptolitic facies represented by the Cape Phillips formation occurs to the north of this line on Cornwallis and Little Cornwallis Islands. This formation ranges in age from Upper Ordovician to Late Silurian and comprises a highly varied assemblage of rock types, the most important of which are calcareous shale, argillaceous limestone, shale, cherty argillaceous limestone, and limestone. The upper contact of Cape Phillips formation has not been observed.

South of the Stanley Head-Snowblind Bay line of facies change are two formations that together correspond to much of the Cape Phillips formation. Both formations bear shelly faunas and are of purer carbonate

[1] The terms Middle and Upper Ordovician and the tripartition of the Silurian and Devonian used in this report, unless otherwise stated, are taken from the European standards of stages of these systems as follows: Llandvirn, Llandeilo, Caradoc = Middle Ordovician; Ashgill = Upper Ordovician; Llandovery = Lower Silurian; Wenlock = Middle Silurian; Ludlow = Upper Silurian; Gedinnian, Coblenzian = Lower Devonian; Couvinian, Givetian = Middle Devonian; Frasnian, Famennian = Upper Devonian.

composition than Cape Phillips strata and hence are more resistant to erosion. The older of these is the Allen Bay dolomite which ranges from Upper Ordovician to Middle Silurian in age. The Read Bay formation, composed mainly of limestone and argillaceous limestone, overlies the Allen Bay dolomite and ranges in age from Middle to Late Silurian.

The Snowblind Bay formation rests with conformable and seemingly gradational contact on Read Bay beds. Outcrops of this formation consist mainly of coarse limestone breccia and conglomerate with lesser amounts of sandstone and siltstone, and are restricted to one locality between Read Bay and Snowblind Bay on the east coast of Cornwallis Island. An Early Devonian age is suggested for this formation on the basis of its vertebrate fauna. However in view of the suggested correlation of the Disappointment Bay formation the age limit of the Snowblind Bay formation has been extended (*see* discussion below). Snowblind Bay beds are folded conformably with the underlying Read Bay formation.

The Disappointment Bay formation comprises beds of dolomite, sandstone, and a basal limestone and chert conglomerate. This formation is represented by two small outcrop areas near the northern extremity of Cornwallis Island where it rests with angular unconformity on the Cape Phillips formation. On the basis of a marine invertebrate fauna, the Disappointment Bay formation has been correlated with Upper Silurian rocks of the Appalachian region.

The structural relationship of the Disappointment Bay formation indicates that this formation post-dates the deformation of the older and conformable series of lower Palæozoic formations that include Snowblind Bay beds. In view of the apparent incompatible age determinations of the Snowblind Bay and Disappointment Bay formations both are, for the present, dated as Late Silurian or Early Devonian. Presumably the coarse clastic nature of the Snowblind Bay formation reflects the onset of tectonism that affected the Cornwallis Islands in Late Silurian or Early Devonian time.

Upper, and probably Middle, Devonian fossils have been collected over several acres of an upland on Marshall Peninsula, northwestern Cornwallis Island. Many of these were collected in drift or regolith, but it was not possible to determine whether the source of others was large boulders or small outcrops. The restricted nature of this occurrence and abundance of fossils suggest that the fossils are derived from bedrock remnants. However, as neither the thickness of such presumed remnants nor their structural relationship to other strata could be determined, no formational name is proposed for these rocks.

Unconsolidated and partly consolidated clastic sediments and coal seams of the Intrepid Bay formation make up the youngest observed bedrock of the Cornwallis Islands. The Intrepid Bay formation occurs at two moderately restricted and separate localities, and on the basis of plant spores is dated Middle Pennsylvanian.

As presently known, the stratigraphic column of the Cornwallis Islands comprises an aggregate thickness of approximately 22,500 feet of both marine and continental strata. Moreover, structural data indicate that still older beds may yet be discovered in the remaining unexplored interior of Cornwallis Island. The rocks are unaltered by metamorphism and there is no evidence of vulcanism.

The lower Palæozoic formations of Cornwallis Island, which include about 20,000 feet of beds, have been gently to moderately folded. Yet today no part of this region possesses mountainous terrain that generally characterizes deformed post-Precambrian geosynclinal sequences. Instead these islands comprise typical plains topography marked by subdued hills, ridges and generally broad valleys that have developed on a former surface of erosion, an extensive remnant of which remains today in the southeastern region of Cornwallis Island. Because of the nearly uniform carbonate nature of the lower Palæozoic folded sequence and prevailing shallow dips, the influence of bedrock on topography is not especially noticeable.

The bedrock of Cornwallis Island is dominated by four formations: the Cornwallis and Cape Phillips formations in the north half of the Island, and Cornwallis, and the Allen Bay and Read Bay in the south half. The latter two are purer in carbonate sediments than their facies equivalent, the Cape Phillips formation, and therefore more resistant to erosion. It appears, therefore, that this facies division on Cornwallis Island is at least in part responsible for the contrasting physiography in which the greatest relief and most of the plateau remnant are found in the southern part of the island, whereas lower more maturely dissected terrain occurs in the northern parts.

Folded Cornwallis and Cape Phillips strata are exposed in the explored regions of Little Cornwallis Island. In general, the coast itself provides the finest exposures. Bedrock is generally well exposed in small canyons and deeper stream valleys and especially where these reach the environs of the coast. On the other hand, outcrops are generally scarce towards the interior of the islands and this is especially true of the plateau remnants in the southeastern region of Cornwallis Island which is markedly lacking in drainage lines. There, in many places, it is possible to walk for several miles between streams without observing an exposure, although ubiquitous frost-shattered debris (felsenmeer) of bedrock generally permits the tracing of formational contacts. In general, outcrop prevalence may be likened to most non-glaciated, temperate climate regions of comparable relief.

TABLE III

Formations of Cornwallis Island south of the Stanley Head-Snowblind Bay line of facies change

Era	Period	Epoch	Formation and thickness in feet	Lithology
Cenozoic	Quaternary			Till, regolith, and marine beach deposits
Disconformity				
Palæozoic	Pennsylvanian		Intrepid Bay 2,000	Sand, sandstone, clay, coal (nonmarine)
	Angular unconformity			
	Silurian or Devonian	Ludlovian or Downtonian or Dittonian	Snowblind Bay 800	Limestone breccia, limestone conglomerate, sandstone, siltstone, (marine and/or nonmarine)
	Silurian	Ludlovian Wenlockian	Read Bay 8,500	Limestone, argillaceous limestone, calcareous shale, shale, dolomite; minor sandstone and siltstone (marine)
	Ordovician and Silurian	Wenlockian Llandoverian Ashgillian	Allen Bay 5,500	Dolomite; minor limestone, dolomitic limestone; very minor argillaceous limestone and calcareous shale (marine)
	Ordovician	Caradocian	Cornwallis 5,000	Limestone, argillaceous limestone, dolomitic limestone, dolomite, siltstone, shale, gypsum, gypsiferous shale (marine)
	? Ordovician	?	Eleanor River 500	Limestone (marine)

TABLE IV

Formations of Little Cornwallis Island and Cornwallis Island north of the Stanley Head-Snowblind Bay line of facies change

Era	Period	Epoch	Formation and thickness in feet	Lithology
Cenozoic	Quaternary			Till, regolith, and marine beach deposits
Disconformity				
Palæozoic	Pennsylvanian	Middle	Intrepid Bay 2,000	Sand, sandstone clay, coal (nonmarine)
	Disconformity			
	Silurian or Devonian	Keyseran	Disappointment Bay 280	Dolomite, sandstone, limestone, and chert conglomerate (marine)
	Angular unconformity			
	Ordovician and Silurian	Ludlovian Wenlockian Llandoverian Ashgillian	Cape Phillips 8,500	Calcareous shale, argillaceous limestone, shale, limestone, dolomite, cherty argillaceous limestone, cherty limestone, calcareous shale, dolomitic limestone (marine)
	Ordovician	Caradocian	Cornwallis 5,000	Limestone, argillaceous limestone, dolomitic limestone, dolomite, siltstone, shale, gypsum, gypsiferous shale (marine)
	? Ordovician	?	Eleanor River 500	Limestone (marine)

Description of Formations

? ORDOVICIAN

ELEANOR RIVER FORMATION

Definition. The oldest formation delineated up to the present in the Cornwallis Island area is named Eleanor River and, so far as known, is composed of limestone only. The name is taken from the river that drains a large area in the interior of Cornwallis Island and empties into Eleanor Lake in the northeastern coastal region. Near the headwaters of an unnamed tributary of the Eleanor River (approx. lat. 75° 13′, long. 94° 42′) an estimated 200 feet of this formation is well exposed in locally developed cliffs along that stream. These cliffs expose the upper strata of Eleanor River formation, probably within a very few feet of the upper contact, and are chosen for the type section. The upper and lower contacts of this formation have not been seen.

Distribution and Thickness. The type section occurs along the southeastern flank of the Centre anticline, a broad gently dipping domelike structure situated in the approximate centre of Cornwallis Island. From available information, this anticline appears to have its structural high in strata of this formation. An aggregate of 500 feet of discontinuously exposed Eleanor River strata is estimated to be exposed in the traversed region of the Centre anticline.

In the course of a traverse this formation was traced about 14 miles south from the vicinity of the type section to where the upper contact crosses the headwaters of Taylor River (approx. lat. 75° 01′, long. 94° 51′ 30″). The relation of this south-trending structure that brings Eleanor River strata to the surface of the Centre anticline is not understood. Possibly it represents a bifurcating anticlinal limb of the Centre anticline or it may represent a separate dome or anticlinal structure. It is certain that the Eleanor River formation is more widely distributed in the untraversed interior of Cornwallis Island than is shown on the accompanying map.

On Taylor River, alternating gypsiferous shale, limestone (lithologically similar to Eleanor River limestone) and gypsum constitute lowermost strata of the conformable overlying Cornwallis formation and have been observed within 20 feet stratigraphically of Eleanor River strata. The intervening beds are covered. The contact between the two formations is defined at the base of the lowest gypsiferous or shale stratum. Though the actual contact of the Eleanor River and overlying Cornwallis formation has not been observed, the similarity of the limestone in the two formations suggests that it is gradational although the possibility that a disconformity exists between the two cannot be excluded.

No outcrops of Eleanor River formation have been found on Little Cornwallis Island. Except for exposures in the interior of Cornwallis Island, the only other exposures of Eleanor River strata occur near the northern extremity of that Island, not far from Cape Austin. There, on the upthrown side of a normal fault, approximately 125 feet of Eleanor River limestone are exposed along a west-facing fault line scarp.

Lithology. The Eleanor River formation has not been studied in any detail and much remains to be learned about its thickness, distribution, lithological character, and age. Outcrops of this formation that have been studied comprise uniform and monotonous successions of mainly light brownish grey[1] to brownish grey, weathering to yellowish grey, thin- to generally thick-bedded, flaggy to massive, hard, dense, sublithographic limestone. A few beds of light to medium grey limestone have also been observed.

Age. No fossils were collected in Eleanor River strata and except that the rocks are older than Caradocian beds in the lower part of the Cornwallis formation, the age is unknown. The only fossils observed in this formation were "algaloid" structures of various rounded shapes, replaced by chert and weathering to moderate reddish orange. These structures range from 0·5 to 1 foot in diameter and are particularly abundant in the upper few feet of the formation.

ORDOVICIAN

CORNWALLIS FORMATION

Definition. The Cornwallis formation comprises a thick and varied assemblage of sedimentary rocks that rest on Eleanor River strata. Carbonate rocks predominate with lesser clastic and evaporite strata. No complete section was found, but certain general characters concerning the lithologic succession were found to be consistent over extensive areas of discontinuous exposures on both islands. Characteristic basal and uppermost beds separate this formation lithologically and topographically from the underlying and overlying formation. The type locality chosen is the region of sea-cliffs between Disappointment Bay and Cape Austin at the northern extremity of Cornwallis Island.

The contact of Cornwallis strata with the Eleanor River formation is structurally conformable and has already been discussed. On Little Cornwallis Island and the north half of Cornwallis Island, Cornwallis strata are conformably overlain by the Cape Phillips formation (a graptolitic facies). On the other hand, south of the Stanley Head-Snowblind Bay

[1] Colours have been determined by use of the rock-colour chart of the National Research Council (Goddard, E. N., Chairman and others, 1948).

line of facies change, it is overlain by the Allen Bay formation, a shelly facies equivalent of the lower part of the Cape Phillips formation.

Distribution and Thickness. The Cornwallis formation outcrops over much of the eastern part of Little Cornwallis and is widespread on Cornwallis Island. On the main island this formation is exposed over a large tract of country apparently encircling exposures of Eleanor River formation in the Centre anticline. As with the Eleanor River formation, examination of air photographs and extrapolation of geological contacts into untraversed regions indicate that the Cornwallis formation probably outcrops over a considerable part of the unexplored interior of Cornwallis Island. Indeed, the Cornwallis formation may well exceed all other formations in areal extent. As outcrops of Cornwallis strata are exposed more or less continuously along the north and northwestern coastal regions of Cornwallis, it would appear that this formation occupies a continuous belt of exposures from the central part of the island to eastern Little Cornwallis. However, in the east, south and southwestern coastal regions, outcrops of Cornwallis formation are surrounded by younger formations.

It is difficult to estimate the thickness of the Cornwallis formation, as the entire section is not exposed at any one locality. The greatest thickness of continuously exposed rocks is about 3,000 feet, at the type locality. This does not, however, include strata near the lower and upper contacts of the formation and, though both contacts may be located accurately, graphic measurement cannot be employed effectively to determine thickness because the area is structurally complex. Numerous discontinuous outcrops have been observed in the interior of Cornwallis Island but these occur over broad areas characterized by generally low yet varying dips which do not permit accurate graphic measurement of thickness. At a rough estimate the thickness of the Cornwallis formation is 5,000 feet; but it may well be considerably thicker.

Lithology. The principal lithologic types in the Cornwallis formation are: thick- to generally thin-bedded, blocky to generally flaggy, in general hard, dense, finely crystalline to sublithographic limestone, argillaceous limestone, and dolomitic limestone. These strata vary more in colour than do similar rock types of other formations on these islands. The colours are listed in approximate decreasing order of importance as follows: light to medium dark grey, light olive-grey to olive-grey, greyish pink, greyish orange-pink, moderate pink, greyish orange, greyish yellowish orange, greyish red-purple, pale red-purple, light brownish grey, and brownish grey. The weathered rock is generally greyish yellow to yellowish grey. Shale partings are common and contribute to rubbly weathering.

The basal 800 feet or so of the Cornwallis formation comprise pale green to greyish green siltstone and shale alternating with minor strata of limestone (lithologically typical of this formation), gypsum, gypsiferous shale, and moderate red siltstone. Strata of gypsum and gypsiferous shale have been observed at one locality only, near the headwaters of Taylor River (approx. lat. 75° 01′, long. 94° 51′ 30″). There, about 100 feet of interbedded gypsiferous shale, gypsum, and limestone comprise the lowermost beds of the Cornwallis formation and are exposed more or less continuously to within 20 feet stratigraphically of the Eleanor River formation. These beds are followed by approximately 200 feet of relatively pure gypsum, which in turn is overlain by discontinuously exposed greyish green siltstone and shale. Moderate red siltstone was observed in basal Cornwallis strata in the vicinity of the Centre anticline.

Outcrops in the basal 800 feet or so of the Cornwallis formation are generally very scarce. They are less resistant to erosion than harder strata in the same formation and in the underlying Eleanor River formation, and consequently underlie topographic lows and valleys. These basal beds are overlain by about 1,700 feet of alternating limestone, argillaceous limestone, and dolomitic limestone, including two or three interbeds of pale green and greyish green siltstone averaging about 50 feet thick. The carbonate rocks are lithologically typical for the formation and have been described above.

Except for the uppermost shale unit of the Cornwallis formation, which is described in detail below, the approximate upper half comprises limestone, argillaceous limestone, and dolomitic limestone, alternating with thick strata of greyish yellow to yellowish grey (weathering to the same colours), generally thick- to very thick-bedded, blocky to massive, hard, generally porous, medium to coarsely crystalline dolomite.

The dolomite is best developed in the upper 300 to 400 feet where outcrops of these rocks are virtually indistinguishable from those of Allen Bay strata. Plate VI, figure 1, illustrates a characteristic castellated and pock-marked outcrop. The aggregate thickness of dolomite in the Cornwallis formation is estimated to be about 700 feet.

The uppermost unit of the Cornwallis formation is of greyish green shale with minor discontinuous interbeds and concretions of light to medium grey, sublithographic limestone, 28 to 40 feet thick. This stratum and roughly 60 feet of the underlying limestone are the most fossiliferous strata on the Cornwallis Islands. Literally tons of fossils could be collected at a single good exposure. These fossils are of considerable stratigraphic interest as they represent the so-called "Arctic Ordovician" fauna. Another distinguishing feature of the uppermost shale unit is subrounded pyrite nodules showing characteristic pyritohedron crystal faces. They are generally 1 inch to 2 inches in diameter and weather to dark red-purple.

The top of this shale and limestone unit forms a well-marked line separating the Cornwallis formation from the overlying Cape Phillips and Allen Bay formations, north and south of the Stanley Head-Snowblind Bay line of facies change respectively. Even where exposures are poor or absent, the uppermost shale and limestone stratum of the Cornwallis formation (and therefore the upper contact) may be discerned by virtue of its negative topographic expression relative to more resistant overlying and underlying strata, the rich fauna strewn about in regolith and drift, and scattered dark purple-red pyrite concretions lying on the surface. Were it not for the presence of this stratum at the top of the Cornwallis, separation of this formation from the overlying Allen Bay strata would have been virtually impossible.

The following section was made in uppermost strata of Cornwallis formation about 3·25 miles east of the head of Intrepid Bay. Cephalopods have been determined by Walter C. Sweet and A. K. Miller, bryozoans by T. E. Bolton, and corals, brachiopods, and arthropods by A. E. Wilson.

Section of Cornwallis Formation
in the Southwestern Part of Cornwallis Island (Locality 34)

Unit No.		Thickness Feet
	Overlying strata, Allen Bay formation.	
5	Shale and minor limestone; greyish green shale interbedded with minor discontinuous beds and concretions of medium grey, hard, dense sublithographic limestone; concentrations of *Receptaculites arcticus* Etheridge, near base; remainder of fauna weathers loose from shale or occurs in limestone strata and concretions; ?*Streptelasma arcticum* Wilson, *Persicaria* n. sp., *Lyopora* sp. A aff. *L. franklini* (Salter), *Calapoecia arctica* Troedsson, *C. anticostiensis* Billings, *C. canadensis* Billings, *Palaeophyllum* sp. A, *Halysites* sp. cf. *H. delicatulus* Wilson, *Halysites agglomeratiformis* Whitfield, *Glyptorthis insculpta* (Hall) *Dinorthis* sp., *Herbertella* sp. A, *H.* sp. B, *Öpikina* sp., *Rafinesquina lata* Whiteaves, *Strophomena* sp., (near *S. extensa* Wilson), *Rhynchotrema* n. sp.? *R.* cf. *R. capax* (Conrad), *Trochonema coxi* Wilson, *Maclurites septentrionalis* Wilson, *Hormotoma* sp. (= *H.* n. sp. Troedsson, 1928, Pl. 4, fig. 5), *Loxonema* sp., *Charactocerina thorsteinssoni* Sweet and Miller, *Cyrtogomphoceras baffinense* Foerste, ? *Whitfieldoceras* sp., *Illaenus americanus* Billings, *I. groenlandicus* Troedsson, *I.* sp., ? *Homotelus* n. sp., *Bumastus* sp. A, *B.* sp. B. *Leperditia* sp., *Glyptograptus*[1] n. sp. A................	28
4	Limestone; greyish red, weathering greyish yellow, very thin-bedded, flaggy, hard, dense, sublithographic................................	3
3	Limestone; light grey to olive-grey, weathering similar, thin-bedded, flaggy, hard, dense, sublithographic; bedding planes irregular and composed of shale partings up to 0·25 inch; *Streptelasma* sp. B cf. *S. breve* Winchell and Schuchert, *Nyctopora* sp. A, *Calapoecia canadensis* Billings, *Halysites* n.	

[1] Identification of graptolites and chordates in this report are by the writer.

Section of Cornwallis Formation
in the Southwestern Part of Cornwallis Island (Locality 34)—Concluded

Unit No.		Thickness Feet
	sp., *Batostoma* sp., *Chasmatopora* sp. A, *C.* sp. B, *Glyptorthis insculpta* (Hall), *Dinorthis* sp., *Strophomena fluctuosa* Billings, *Öpikina* sp., ? *Resserella* sp., *Sowerbyella* sp., *Rhynchotrema* sp. cf. *R. capax* (Conrad), *R.* sp., ? *Liospira* sp., *Bumastus* sp. C, *Ceraurus horridus* Troedsson, *C.* sp., *Ceraurinus daedalus* Cox, *Basslerites* sp., ostracods, unident.	10
2	Limestone; greyish red, weathering greyish yellow, thin-bedded, flaggy, hard, dense, sublithographic	6
1	Limestone; light grey to olive-grey, weathering similar, thin-bedded, flaggy, hard, dense, sublithographic; bedding planes irregular, with shale partings; *Streptelasma* sp. A, *Calapoecia canadensis ungava* Cox, *C. anticostiensis arcticus* Cox, *Batostomella* sp., *Leptaena* sp., *Endoceras* sp. cf. *E. magniventrum* Hall, trilobite fragments, ostracods—a few generalized forms	20
	Total thickness	67
	Underlying strata, covered interval in Cornwallis formation.	

Limestone Breccia in Cornwallis Formation. Near the geographic centre of Cornwallis Island (approx. lat. 75° 14′, long. 94° 37′) limestone breccia and conglomerate boulders occur over approximately 5 square miles of upland surface. Almost all are large, steep-sided, blocklike masses ranging up to 50 feet in height. Certain boulders are so steep-sided as to render scaling difficult or impossible, but a few have weathered to masses of rubble. About 80 of these blocks are present and they impart a striking aspect to the landscape.

The boulders consist of coarse, unsorted limestone breccia and conglomerate, with angular and subrounded limestone fragments ranging to boulder dimensions. Some are over 5 feet across. The fragments are composed mainly of sublithographic to finely crystalline limestone and dolomitic limestone. They exhibit a variety of pastel colour shades and resemble closely the carbonate rocks that characterize the greater part of the Cornwallis formation. No fossils have been seen in the fragments, which are welded into a hard compact mass by carbonate cement. The material is completely devoid of bedding.

The area over which these boulders occurs is crescent-shaped, concave towards the exposures of the Eleanor River formation. It thus assumes the pattern expected of a lenticular stratum with a maximum thickness of about 50 feet, lying stratigraphically above siltstone strata placed in the lowermost part of the Cornwallis formation. However, the boulders of breccia merely project above the clay mantle and no contact with underlying rocks has been seen. Normal sediments of the Cornwallis or any other Palæozoic formation have not been seen overlying the brecciated material, nor has breccia been seen in this stratigraphic position in the Cornwallis formation at other localities. Near the headwaters of Taylor River, this interval in the Cornwallis formation comprises gypsum, gypsiferous shale, and siltstone (p. 32).

In considering the origin of this brecciated material, three facts seem to be of particular importance: (i) the brecciated material forms a lenticular body of restricted areal distribution, (ii) it occupies a stratigraphic position elsewhere occupied by gypsiferous deposits, and (iii) it is evidently derived from rocks similar to the major part of the Cornwallis formation that overlies the gypsiferous deposits. The most satisfactory hypothesis to account for these conditions is that the coarse fragmental material represents a collapse breccia filling a cavern which has resulted from removal by solution of evaporite beds in the basal part of the Cornwallis formation. The breccia on Cornwallis Island seems to resemble closely the Mackinac breccia of northern Michigan, which incorporates blocks from the local Upper Silurian and Lower and Middle Devonian formations. This breccia has been described in detail by Landes (1945), who concluded that it represents fill from overlying formations which has collapsed into caverns formed by the removal of salt from the Salina (Upper Silurian) formation. The Cornwallis Island breccia was probably formed in a similar manner. The absence of fossils in the Cornwallis Island breccia, and the nonexistence of younger beds overlying its erosional remnants make precise dating of the brecciation impossible. However, as all the blocks in the breccia resemble rock types found in the Cornwallis formation, it seems likely that the solution and brecciation took place soon after the deposition of the Cornwallis formations. As the outcrop pattern of the breccia conforms with the regional structure, it seems reasonable to conclude that brecciation took place before the folding of the lower Palæozoic rocks of the Island.

Faunas and Correlation. No fossils were collected in the type section. Except for the upper 500 feet or so, the greater thickness of the Cornwallis formation is generally unfossiliferous. Only one collection was made from the lower beds and at a level which could only be estimated as near the middle of the formation. This collection was made at Locality 16, about 11 miles inland and east of Marshall Peninsula, northwest coast of Cornwallis Island. The fauna is as follows:

Cornwallis Fossils from Northwestern Cornwallis Island

Rhinidictya sp.
Öpikina sp. cf. *Ö. platys* Wilson
Ö. sp.
Rafinesquina sp.
R. semicircularis minor Wilson?
Strophomena sp.

Cornwallis Fossils from Northwestern Cornwallis Island—Concluded

Trigrammaria sp.
Plectorthis sp. (probably new but close to *P. plicatella laurentia* Wilson)
P. sp. (similar to Troedsson's *P. plicatella trentonensis* Foerste, from Cape Calhoun but a little larger)
Bucania sp.
Lophospira sp.
Bathyurus sp. A
B. sp. B

T. E. Bolton identified *Rhinidictya* sp.; Miss A. E. Wilson identified the remainder of the fossils and states that they indicate a Black River-Trenton age. *Bathyurus,* according to her, occurs low in the Black River series, but other forms suggest higher levels.

All other faunas from Cornwallis strata were collected in the upper 500 feet or so of the formation. Most of this interval is characterized by the sporadic occurrence of *Maclurites, Receptaculites,* halysitid corals and a few other forms, and near the top of the formation by the prolific occurrences of fossils.

At Locality 43, near the southeastern extremity of Little Cornwallis Island, the fossils recorded below (Zone B) were collected within the upper 500 feet of the Cornwallis formation (but below the uppermost highly fossiliferous beds); stratigraphically below this fauna but from the same locality are those listed in Zone A.

Cornwallis Fossils from Southeastern Little Cornwallis Island

Zone B.
Receptaculites sp.
Batostoma sp. aff. *B. winchelli* (Ulrich)
Strophomena—type of brachiopod fragment
Maclurites sp.
Metaspyroceras sp.
Spyroceras ? sp.

Zone A.
Rhinidictya sp.
Plectorthis sp.
Resserella sp. cf. *R. sillimani* (Roy)
? *Hesperorthis* sp.
Sowerbyella sp.
Parastrophinella sp. cf. *P. hemiplicata minor* (Roy)
? *Cyclospira* sp.
Calliops sp. cf. *C. narrawayi* Okulitch

T. E. Bolton identified the bryozoans and Miss Wilson the remainder of the faunas. Miss Wilson considers both faunas from Locality 43 indicative of a Trentonian age.

A full list of the fossils from the uppermost 67 feet of Cornwallis beds at Locality 34 is given in the described section (pp. 36-37).

Two small collections of fossils were made elsewhere from fossiliferous strata a few feet stratigraphically below the uppermost shale and limestone unit of Cornwallis formation. Much larger and varied collections could have been made at these localities had circumstances permitted. However, collections had already been made from this interval at Locality 34.

At Locality 56, some 13 miles west of Advance Bluff on the east-central coast of Cornwallis Island, the following were collected (identifications are by A. E. Wilson): *Calapoecia canadensis* Billings, *C. canadensis ungava* Cox.

From Locality 48, about 8 miles southeast of the head of Read Bay on the central-east coast of Cornwallis Island, Miss Wilson has distinguished *Halysites* n. sp. and an undetermined bryozoan, and Sweet and Miller have identified *Spyroceras* sp.

The faunas collected below the upper 67 feet or more of the Cornwallis formation indicate a very rough correlation with the Black River and Trenton series of northeastern North America. On the other hand, the faunas in the uppermost strata of this formation clearly represent an assemblage commonly referred to as the "Arctic Ordovician" fauna. These are terms applied broadly to American Ordovician faunas considered of boreal origin and especially typified by the faunas of the Red River formation of Manitoba, Cape Calhoun formation of northwest Greenland, and Bighorn formation of Wyoming. Other well-known occurrences of these faunas include the several assemblages from Baffin Island, Akpatok Island, Melville Peninsula and nearby Igloolik Island, the Nelson River and Shamattawa formations on the west side of Hudson Bay, Fremont formation of Colorado, and Stewartville formation of Iowa and Minnesota. Faunas of these formations, including the one in the upper part of the Cornwallis formation, comprise mainly corals, bryozoans, brachiopods, gastropods, cephalopods, and ostracods. Two characteristic features render these faunas distinct: large size attained by many of its elements, particularly among the corals, gastropods and cephalopods; and the general extraordinary abundance of fossils.

"Arctic Ordovician" faunas have been variously interpreted as Mohawkian or Cincinnatian in age. The basis of such divergent views rests, firstly, on the fact that nowhere have these faunas been found associated or interbedded with faunas related indisputably to the type sections of the Ordovician series in North America, and secondly, the apparent inclusion in these faunas of forms of both Trenton and Richmond aspect. Probably most writers who have dealt with the difficult age problem of these faunas have considered that all typical occurrences represent one general fauna and age (Miller, Youngquist and Collinson, 1954, p. 44). Others (Teichert, 1937, pp. 43-44) have considered that two or more faunas are represented and that these differ considerably in age, comprising both Middle and Upper Ordovician in terms of the North American succession.

Sweet and Miller, who identified certain cephalopods in the uppermost, "Arctic Ordovician" faunas of the Cornwallis formation, favour an early Cincinnatian (Edenian or Maysvillian, or both) age for these forms. A. E. Wilson, who identified most of the other fossils from these beds, also favours a Cincinnatian age.

The "Arctic Ordovician" fauna in the upper part of the Cornwallis formation is here tentatively considered of Caradocian age in terms of European chronology and of Edenian and/or Maysvillian ages in terms of North American terminology. The formations that rest conformably on the Cornwallis formation are most readily referred to European chronological terms, and it is mainly in the interest of uniformity that the writer also refers the Cornwallis formation to the European Caradocian series. No direct faunal evidence supports such an assignment and correlation is indirectly through the North American type section of the Ordovician in which the Mohawkian, Edenian and probably also the Maysvillian stages are referred to the Caradocian of Great Britain (Whittington, 1954, p. 261). The problem of the age of "Arctic Ordovician" faunas is discussed further under the heading of Cape Phillips formation (p. 87).

Though general aspect and common genera permit approximate correlation of the fauna in uppermost Cornwallis strata with most if not all of the above-mentioned occurrence of "Arctic Ordovician" faunas, comparison of species in common permits correlation of the upper Cornwallis fauna with only three of these occurrences. It has the following identical or closely comparable forms in common with the Silliman's Mount fauna in southwestern Baffin Island (Miller, *et al.*, 1954):

Fossils Common to Cornwallis Beds and the Silliman's Mount Fauna of Baffin Island

Receptaculites arcticus Etheridge
Calapoecia anticostiensis Billings
C. canadensis Billings
Halysites agglomeratiformis Whitfield
Rhynchotrema capax (Conrad)
Cyrtogomphoceras baffinense Foerste
Illaenus groenlandicus Troedsson
Ceraurus horridus Troedsson

The upper Cornwallis fauna has the following identical or closely comparable forms in common with the fauna of the Cape Calhoun formation of northwestern Greenland (Troedsson, 1926, 1928).

Fossils Common to Cornwallis Beds and the Cape Calhoun Formation of Greenland

Receptaculites arcticus Etheridge
Calapoecia anticostiensis Billings
C. arctica Troedsson
Halysites agglomeratiformis Whitfield
Hormotoma sp.
Leptaena sp.
Strophomena fluctuosa Billings
Rhynchotrema capax (Conrad)
Illaenus groenlandicus Troedsson
Ceraurinus daedalus Cox

Finally a correlation of the fauna high in the Cornwallis formation appears to be possible with forms collected below the band of *Climacograptus inuiti* on Akpatok Island by Cox (1933a, 1933b, 1936; Foerste and Cox, 1936; Wilson, 1938, 1939). The following list includes forms from uppermost Cornwallis strata identical or closely comparable to those from the lower limestone of Akpatok.

Fossils Common to Cornwallis Beds and the Limestone of Akpatok Island

Calapoecia canadensis ungava Cox
C. anticostiensis arctica Cox
Rhynchotrema capax (Conrad)
Ceraurus horridus Troedsson
Ceraurinus daedalus Cox
Illaenus groenlandicus Troedsson

ORDOVICIAN AND SILURIAN

ALLEN BAY FORMATION

Definition. The name Allen Bay formation is here proposed for a singularly uniform succession of mainly dolomitic rocks overlying Cornwallis strata with sharp but conformable contact and underlying the Read Bay formation with conformable and gradational relations. The Allen Bay beds are confined to the southern part of Cornwallis Island, south of the Stanley Head-Snowblind Bay line of facies change. The name is chosen from a prominent bay on the south coast of Cornwallis Island around which strata of this formation are well exposed. Exposures on a small unnamed creek (approx. lat. 74° 45′ 45″, long. 95° 05′ 30″), about 3 miles north of the R.C.A.F. station at Resolute Bay, are chosen as the type section.

Facies Equivalent. The Allen Bay formation is not developed in the north half of Cornwallis Island, nor is it present on Little Cornwallis Island. In these regions strata stratigraphically and chronologically equivalent to the Allen Bay formation, which is of shelly facies, are represented by the lower part of the Cape Phillips formation, of graptolitic facies (*see* Figure 3).

Thickness and Distribution. At the type locality a thickness of 4,800 feet of Allen Bay strata was measured by means of the plane-table from the upper contact with the Read Bay formation down to the fault near the axis of the Allen Bay anticline. Graphic measurements of more or less continuously exposed and complete sections suggest a thickness of about 5,500 feet for the entire formation.

Besides the exposures in the vicinity of Allen Bay, strata of this formation outcrop extensively throughout southern Cornwallis Island. Especially fine exposures may be found near the east coast along the main streams that cross the northerly extended limb of the Cape Hotham anticline.

Lithology. It is estimated that dolomite comprises over 90 per cent of the Allen Bay sequence. It forms a virtually uninterrupted succession of thin- to thick-bedded, flaggy to massive, dense to porous, and fine to coarsely crystalline beds. The prevailing colours are greyish yellow, yellowish grey, and brownish grey. Less common colours include light grey to medium dark grey, greyish orange-pink, pale yellowish brown, dark yellowish brown, and dark yellowish grey. Weathering colours are generally greyish yellow or yellowish grey. Dolomitic limestone and limestone constitute the remaining important lithologic elements of this formation. They are generally light grey to medium grey, yellowish grey to greyish yellow, thin- to thick-bedded, flaggy to massive, hard, dense, and very fine to finely crystalline. Two beds of dark grey argillaceous limestone and calcareous shale, neither over 6 feet thick, are also present. They contain important faunas and will be discussed below. Porous dolomite, bearing much solid bitumen, is locally abundant, especially in the axial region of the Allen Bay and Resolute Bay anticlines. Allen Bay dolomite generally weathers to sugary masses on gentle slopes, but most cliff faces weather with characteristic lattice or pock-mark patterns.

The contact of the Allen Bay beds with the underlying Cornwallis formation is sharp, yet conformable. This contact is well exposed at many places and in each place the lowermost Allen Bay beds consist of a 30- to 50-foot unit of greyish yellow, yellowish grey weathering, thick-bedded, massive, hard, generally porous, dolomitic limestone with a finely to medium-crystalline texture. This overlies the uppermost, highly fossiliferous shale of the Cornwallis formation. In marked contrast is the upper contact with the Read Bay formation which is generally one of undefined lithological transition.

The following section was made in the uppermost Allen Bay strata across the west limb of the Resolute Bay anticline near the head of Resolute Bay. Measurement was made by plane-table. A. E. Wilson identified the fossils.

Section of Allen Bay Formation in Southern Cornwallis Island (Locality 4)

Unit No.		Thickness Feet
	Overlying strata, Read Bay formation.	
17	Dolomite; very pale orange, weathering to moderate yellow, very thin-bedded, in part laminated, flaggy, hard, dense, finely crystalline; fetid odour when struck or broken	9·0
16	Limestone; brownish grey, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline; fetid odour when struck or broken	3·5
15	Limestone; yellowish grey, weathering to pale yellowish brown, very thin-bedded, in part laminated, flaggy, hard, dense, finely crystalline; fetid odour when struck or broken...	12·0
14	Dolomite; yellowish grey, weathering to light grey, very thin-bedded, blocky, hard, dense, finely crystalline; fetid odour when struck or broken	28·5
13	Dolomite; pale yellowish brown, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline	12·5
	Covered	11·0
12	Dolomite; pale yellowish brown, weathering to greyish yellow, thin-bedded, blocky, hard, dense, finely crystalline; pronounced petroliferous odour when struck or broken	11·0
	Covered	21·0
11	Dolomite; yellowish grey, weathering similar, very thin-bedded, slabby, hard, dense, medium crystalline	5·0
	Covered	27·0
10	Dolomite; dark yellowish brown, weathering to yellowish grey, thick-bedded, massive, hard, in part porous, coarsely crystalline; weathers to sugary rubble	13·0
	Covered	123·0
9	Dolomite; greyish yellow, weathering pinkish grey, thick-bedded, blocky, hard, dense, medium crystalline; contains numerous indeterminable stromatoporoids; weathers to sugary rubble	5·5
8	Dolomite; greyish orange-pink, weathering pinkish grey, thick-bedded, blocky, hard, vuggy, medium crystalline; contains numerous indeterminable fossils	4·8
	Covered	15·2
7	Dolomite; greyish orange-pink, weathering pinkish grey, massive, vuggy, medium crystalline; weathers to sugary rubble	3·0
6	Dolomite; biostromal, brownish grey, stained brownish black by bituminous residue, weathering to greyish yellow, thin-bedded, slabby, hard, vuggy,	

Section of Allen Bay Formation in Southern Cornwallis Island (Locality 4)—Concluded

Unit No.		Thickness Feet
	finely crystalline; petroliferous odour when struck or broken; fossils silicified; *Clathrodictyon* sp., ? *Stromatopora* sp., *Porpites* n. sp. A aff. *P. porpitus* (Linnaeus), *P.* n. sp. B, *Rhabdocyclus* (= *Acanthocyclus*) n. sp., *Amplexus propinquis* Poulsen, *Favosites favosus* (Goldfuss), *F.* n. sp. B aff. *F. pyriformis* (Hall), *Halysites catenulatus* (Linnaeus), *Halysites* sp., ? *Michelinia* sp.	6·0
5	Dolomite; brownish grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, porous, finely crystalline; petroliferous odour when struck or broken	1·5
4	Dolomite; biostromal, greyish orange, weathering similar, thick-bedded, blocky, hard, porous, finely crystalline; petroliferous odour when struck or broken; stromatoporoid, probably *Clathrodictyon variolare* Rosen, *Porpites* n. sp. A aff. *P. porpitus* (Linnaeus), *Rhabdocyclus* (= *Acanthocyclus*) n. sp., *Streptelasma* sp., *Amplexus* sp. cf. *A. propinquis* Poulsen, *Favosites* n. sp., *Halysites catenulatus* sp. cf. *H. c. nitidus* Lambe, ? *Loxonema* sp. fragment	10·0
	Covered	48·5
3	Dolomite; greyish orange, weathering to greyish orange and yellowish orange, massive, hard, vuggy, finely crystalline	4·0
	Covered	166·0
2	Dolomite; brownish grey, weathering to light olive-grey, thin-bedded, flaggy, hard, porous, finely crystalline	4·0
	Covered	26·0
1	Dolomite; dark yellowish brown, weathering to yellowish brown, thin-bedded, flaggy, hard, porous, finely crystalline	2·0
	Total thickness	573·0
	Underlying strata, continuing Allen Bay formation, unexposed.	

Faunas and Correlation. Compared with the overlying Read Bay formation, large thicknesses of Allen Bay strata are apparently devoid of fossils. Despite almost continuous exposures of 4,800 feet of beds measured at the type section, no fossils were collected. Though organic remains are not uncommonly observed in the massive beds of dolomite, they occur mainly in the form of undeterminable moulds and casts, some being vaguely determinable as impressions of corals or stromatoporoids. Nevertheless, a few collections of fossils were made in the Allen Bay formation at other places.

The fossils in the section at the head of Resolute Bay, described above, include several common Silurian coral species, but do not otherwise assist in the precise dating of the beds.

At two widely separated localities, the upper 50 feet or less of the Allen Bay formation is marked by beds of the long-ranging Middle and Upper Silurian brachiopod, *Conchidium* sp. cf. *C. knighti* (Sowerby). A small collection of these brachiopods from Locality 54, near Pioneer Bay, on the southwest coast of Cornwallis Island, was identified by A. E. Wilson. The other occurrence was noted near the headwaters of the main tributary stream (approx. lat. 75° 07′ 30″, long. 94° 07′) entering Read Bay on the east coast of the Island.

On Goodsir Creek, near the centre of the east coast of Cornwallis Island, a bed of thin-bedded, dark grey argillaceous limestone and calcareous shale occurs intercalated in the otherwise monotonous dolomite succession. This bed lies some 350 feet stratigraphically below the upper contact of the Allen Bay formation, and is replete with ostracods. The fauna, identified by A. E. Wilson, is as follows:

Fossils from Allen Bay Beds on Goodsir Creek (Locality 50)

Zygobeyrichia sp.
Mastigobolbina sp.
? *Kloedenia* sp.

Ostracods undetermined, one species occurring here is also found in the fauna from Locality 37. Miss Wilson suggests a Clinton, late Llandovery or early Wenlock age for this fauna.

A fossil collection from near the top and another from near the base of the Allen Bay formation are of particular importance in relating the formation to the lower part of the Cape Phillips formation, and thereby permitting indirect dating of the former in terms of European chronology. Convincing evidence of the correlation of the Allen Bay formation with the lower part of the graptolitic Cape Phillips formation is especially apparent on Snowblind Creek, where the shelly and graptolitic facies intergrade and interfinger. Description of the two localities and their faunas is as follows:

Faunas that relate Allen Bay and Cape Phillips Beds on Cornwallis Island

(i) Locality 35 is about midway between Claxton Point and Intrepid Bay on the south coast of Cornwallis Island, and a mile inland. Fossils were collected in a thin bed of dark grey calcareous shale interbedded with dolomite. Although it is difficult to determine the stratigraphic position of this bed precisely, it is probable that it lies near the base of the Allen Bay formation. The fauna comprises a new species of graptolite, *Orthograptus* n. sp. A and the trilobite *Pseudogygites latimarginatus* (Hall), identified by A. E. Wilson. Both species are also known to occur in the lower part of Cape Phillips formation on Little Cornwallis Island, and on Marshall Peninsula, northwestern Cornwallis Island. At both localities these species are associated with the oldest faunas in the Cape Phillips formation, and are tentatively regarded as of Ashgillian (Upper Ordovician) age (p. 84).

(ii) Locality 37. A thin bed of dark grey calcareous shale, in part petroliferous, was found interbedded in dolomite on Shellabear Creek, which empties into Barlow Inlet, on the east coast of Cornwallis Island. The upper part of this bed, which is 1·5 feet thick, is replete with ostracods which A. E. Wilson has identified as *Zygo-*

beyrichia sp., and an unnamed ostracod, similar to a species at Locality 50. Near the base of this bed a cyathaspidid heterostracan, *Tolypelepis* n. sp. A, occurs. This fish is not directly associated with the ostracods. The stratigraphic position of this bed within the Allen Bay formation can only be roughly estimated as 200 to 300 feet below the upper contact. It probably represents the same stratum of dark grey calcareous shale that outcrops on Goodsir Creek (Locality 50) (p. 46). *Tolypelepis* n. sp. A, occurs in strata of the Cape Phillips formation on the north coast of Cornwallis Island in the zone of *Monograptus riccartonensis* (Locality 19) (*see* Figure 3 and Figure 4). This zone is of lower Wenlockian age (Middle Silurian).

In view of the foregoing, the age of the Allen Bay formation may be considered to range from the Upper Ordovician to Middle Silurian. There is no evidence of a stratigraphic break within the formation that might correspond to the Ordovician-Silurian boundary.

The Silurian part of the Allen Bay formation, which includes Llandoverian and lowermost Wenlockian equivalents, is evidently correlative with the Cape Schuchert and Offley Island formations as well as to part of the Cape Tyson formation of northwest Greenland (Poulsen, 1934, 1943, *see* Table VI), but the Allen Bay fauna cannot be applied to support this correlation.

SILURIAN

READ BAY FORMATION

Definition. The Read Bay formation includes all strata lying with conformable and gradational contacts between the underlying Allen Bay dolomite and the overlying Snowblind Bay formation. It comprises limestone, argillaceous limestone, and minor amounts of dolomite, calcareous shale, sandstone, siltstone, and shale. Exceptionally good exposures of this formation are found in the general vicinity of Read Bay on the central-east coast of Cornwallis Island and this is chosen as the type locality. There both lithological and palæontological characters of the formation are well developed.

Facies Equivalent. In the approximate north half of Cornwallis Island and on Little Cornwallis Island, strata equivalent to the Read Bay formation, which is essentially a shelly facies, are represented by the upper part of graptolitic deposits named the Cape Phillips formation.

Thickness and Distribution. Outcrops of the Read Bay formation are confined to two areas in the south half of Cornwallis Island. Much the larger of these areas occupies an extensive tract of southeastern Cornwallis Island. The Read Bay formation is exposed in a series of major folds along the whole southeastern coastal area of Cornwallis from Cape DeHaven to Cape Martyr, a distance of nearly 80 miles, except for two small areas, one at Advance Bluff where it is overlain by the Snowblind Bay formation and one at Resolute Bay where the underlying Allen Bay formation is exposed along the axis of an anticline. The second, and smaller area, is in the southwest corner of Cornwallis Island where Read Bay strata are exposed along the western limb of the Stanley Head anticline.

Graphic measurement indicates an aggregate thickness of approximately 8,500 feet for this formation.

Subdivisions of Read Bay Formation

On the basis of lithology, the Read Bay formation has been divided into four members, designated in upward sequence, members A, B, C and D. In the east coastal region of Cornwallis Island these members are recognizable in four well-defined mappable belts along the east limb of the Cape Hotham anticline and both limbs of the Advance Bluff syncline. Structural and palæontological evidence indicate that probably only member A is exposed west of Cape Hotham, the southeastern extremity of Cornwallis Island. However, member B and the lower part of member C may be included in the Resolute Bay syncline. Although more detailed studies on Cornwallis and neighbouring islands may indicate the desirability of raising these members to the rank of formations, this does not seem warranted at present. The lithological distinction between the various members is not especially significant and despite the somewhat unusual thickness of the formation it does not range excessively in age but is approximately correlative with the upper part of the Wenlockian and the Ludlovian series. Moreover, it apparently embraces no major disconformities but comprises fairly uniform faunal and lithological assemblages.

The lithological and palæontological characteristics of the various members is discussed in ascending order.

Member A

In general, this member comprises repeated interlamination of two rock types: (1) generally light to medium grey, light olive-grey to olive-grey, very thin-bedded, flaggy, hard, dense, sublithographic to finely crystalline argillaceous limestone and (2) varicoloured, commonly mottled, thick-bedded, massive, hard, generally dense, finely to generally coarsely crystalline biostromal or fossil fragmental limestone. Beds of the first type are commonly separated by shale partings and average a few tens of feet but may attain thickness up to a few hundred feet. On the other hand, most beds of the second type are massive and rarely exceed 10 feet in thickness. Medium light-grey to medium dark-grey calcareous shale, shale, and dolomite constitute lithological elements of lesser importance.

The contact of this member with the underlying Allen Bay formation is gradational and therefore somewhat arbitrary. It is drawn where dolomite that characterizes Allen Bay formation gives place to limestone in the upward succession of strata. The contact is without topographic expression and, though it may be readily determined in the many well-exposed stream sections, it is located only with difficulty on the upland surfaces of inter-stream areas. There testing for limestone with acid is the easiest and surest means of differentiation. The contact of member A and overlying shale of member B is sharp yet conformable.

The stratigraphic section selected as representative of this member is exposed on Goodsir Creek on the central-east coast of Cornwallis Island (*see* Plate VII). There a thickness of 1,875 feet of almost continuous exposures was measured by plane-table. The section is as follows:

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)

Unit No.		Thickness Feet
	Overlying strata, member B of Read Bay formation.	
60	Argillaceous limestone; medium light-grey to medium dark-grey, in part light olive-grey and olive-grey, weathering to light grey and greyish yellow, very thin-bedded, in part laminated, flaggy, dense, in general sublithographic, in part very finely crystalline; irregularly bedded; beds separated by shale partings; breaks with a conchoidal fracture; talus has characteristic clinking sound underfoot; apparently unfossiliferous..............	271·8
	Covered..	59·0
59	Argillaceous limestone; lithological characters similar to Unit 60..........	80·0
58	Calcareous shale; dark grey, weathering to medium grey, fissile; a few beds of medium dark-grey, hard, dense sublithographic argillaceous limestone throughout; *Monograptus bohemicus* Barrande, (throughout unit), unidentifiable heterostracan fragment, *Gasconsoceras* sp. (ident. by Sweet and Miller)..	85·0
57	Argillaceous limestone; medium light-grey to medium grey, thin-bedded, slabby, dense, sublithographic; alternating with fissile calcareous shale that weathers greyish yellow; *Monograptus bohemicus* Barrande (throughout unit)..	51·0
56	Limestone; in part argillaceous and crinoidal, medium light-grey to medium grey, weathering similar and greyish green; thick-bedded, blocky, hard, dense, mixed sublithographic and coarsely crystalline; ? *Schuchertella* sp. C, *Cyclonema* sp., cephalopod fragment, *Encrinurus* sp............	12·0
55	Argillaceous limestone; medium light-grey to medium grey, very thin-bedded, flaggy, dense, very finely crystalline; light grey shale parting constitutes significant element; *Favosites gothlandicus* (Fought), *Hallopora* sp., ? *Eridotrypa* sp., *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, *Gypidula* sp. A, *Camarotoechia* sp. C, ? *Atrypella* sp., *Howellella* sp. A, *Cyclonema* sp.	34·0
	Covered..	24·0
54	Limestone; medium grey, weathering to light grey, massive, dense sublithographic; *Ischadites* sp., *Cyclotrypa* sp. cf. *C. silurica* Hennig, *Fenestella* sp., *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, *Camarotoechia* sp. C, *Delthyris* sp., *Nucleospira* sp. A, *Atrypella* sp. cf. *A. scheii* (Holtedahl),	

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)—Continued

Unit No.		Thickness Feet
	A. sp. cf. *A. shrocki* Cooper, *Cyclonema* sp. aff. *C. decorum* Billings, *Encrinurus*, n. sp. A, *E.* sp.	2·0
53	Argillaceous limestone; light grey to medium dark-grey, weathering yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic to finely crystalline; a few beds medium to coarsely crystalline; irregularly bedded; light to medium grey shale partings constitute significant elements. Fauna collected 8·2 feet below top of unit, *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, *Strophonella* sp. A., *S.* sp. B, *Camarotoechia* sp. C, *Howellella* sp. A., *Nucleospira* sp., *Meristina* sp. A, cephalopod fragment, *Calymene* sp. A, *Encrinurus* sp. cf. *E. moderatus* Poulsen, *E.* n. sp., *Proetus* sp. cf. *P. regalus* Poulsen; fauna collected 12 feet below top of unit, *Syringopora* sp. cf. *verticiliata* (Goldfuss), *Strophonella* sp. B, *Camarotoechia* sp. C, *Atrypella* sp., *Pterinea* sp.; fauna collected 74 feet below top of unit, branching bryozoa, *Gypidula* sp. A, ? *Nucleospira* sp. A, *Meristina* sp. A, *Encrinurus* sp.; fauna collected 79 feet below top of unit, ? *Eridotrypa* sp., *Fistulipora* sp. aff. *F. mutabilis* Hennig, *Fistulipora* sp., *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, ? *Fenestrellina* sp., *Schuchertella* sp. B, *Camarotoechia* sp. B, *Howellella* sp. A, *Atrypella scheii* (Holtedahl), *Atrypella* sp. cf. *A. shrocki* Cooper, *Atrypella* sp., *Encrinurus* sp.; fauna collected 103 feet below top of unit, brachiopod fragment, *Loxonema* sp. B?, *Calymene* sp., trilobite fragment; fauna collected 112 feet below top of unit, *Cyclotrypa* sp. cf. C. *silurica* Hennig, *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, *Schuchertella* sp. B, *Camarotoechia* sp. C, *Atrypella scheii* (Holtedahl), *Meristina* sp. A, ostracod, unident.	145·0
52	Limestone; coquina, greyish pink to light grey, weathering similar, massive, porous, coarsely crystalline; *Striatopora flexuosa* Hall, *Gypidula* sp. A, ? *Virgiana* sp., *Howellella* sp.	0·9
51	Argillaceous limestone; medium light-grey to medium grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic to finely crystalline; numerous light grey shale partings; irregular bedding planes. Faunas arranged below in descending stratigraphic sequence; position in feet has not been established. Lot 1. *Camarotoechia* fragments, *Howellella* sp. A, *Meristina* sp. A, *Atrypella* sp., cephalopod fragments, ? *Phragmoceras*, *Bonnemaia* sp.; Lot 2. *Howellella* sp., *Whitfieldella* sp., *Atrypella* sp. cf. *A. scheii* (Holtedahl); Lot 3. bryozoan, branching, undet., *Gypidula* sp. A, *Camarotoechia* sp. A, *C.* sp. C, *Howellella* sp. A, *H.* sp. B, ? *Delthyris* sp.; Lot 4. *Camarotoechia* sp. A, *C.* sp. B, *Howellella* sp. A, *Meristina* sp. A, *Atrypella borealis* Kirk and Amsden, *A.* sp. cf. *A. shrocki* Cooper, *Loxonema* sp. A aff. *L. rossi* Haughton, *Loxonema*, sp. B; Lot 5. ? *Onniella* sp., ? *Brachyprion* sp., *Howellella* sp. A, *Atrypella scheii* (Holtedahl), *A.* sp. cf. *A. borealis* Kirk and Amsden, *Encrinurus* sp.; Lot 6. *Chonophyllum* sp. A, *Camarotoechia* sp. A, *C.* sp. B, *Howellella* sp. A, ? *Whitfieldella* sp., ? *Atrypella* sp., ? *Hormotoma* sp. fragment	228·0
50	Limestone; biostromal, light grey to medium light-grey, weathering to greyish yellow and greyish pink, massive, in part porous, coarsely crys-	

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)—Continued

Unit No.		Thickness Feet
	talline; stromatoporoid, unident., *Chonophyllum* sp. A, *Favosites* sp. aff. *F. beechensis* Amsden, *Syringopora dalmani* Billings, *Alveolites* sp. A, bryozoan; branching, *Atrypella* sp. cf. *A. scheii* (Holtedahl)................	1·5
49	Argillaceous limestone; medium light-grey to medium dark-grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, sublithographic to finely crystalline; light grey shale partings........................	7·0
48	Limestone; biostromal, light to medium light-grey, weathering to greyish yellow, hard in part porous, coarsely crystalline......................	
47	Argillaceous limestone; light to medium light-grey, weathering similar, very thin-bedded, flaggy, hard, dense, very finely crystalline; very thin light grey shale partings; *Streptelasma* sp., ? *Zaphrentis* sp., *Chonophyllum* sp. A, *Striatopora flexuosa* Hall, *Favosites* sp. cf. *F. forbesi* Milne-Edwards & Haime, *Syringopora dalmani* Billings, *Streptis laevis* Poulsen, ? *Harpidium groenlandicum* Poulsen, *Camarotoechia* sp. A, *Howellella* sp. A, *Meristina* sp. A, *Atrypella scheii* (Holtedahl), *A.* sp., *Hormotoma* sp. A...	83·6
46	Shale; medium light-grey, fissile, alternating with light grey, very thin-bedded, flaggy, hard, dense, finely crystalline limestone; *Atrypella scheii* (Holtedahl)...	15·7
45	Limestone; medium light-grey, weathering to light grey and greenish grey, massive, finely crystalline; ? *Halysites* sp., *Schuchertella* sp., ? *Orthostrophia* sp., *Sieberella biplicata* Poulsen, *Atrypella scheii* (Holtedahl) large form, ? *A.* sp...	3·7
44	Argillaceous limestone; medium light-grey, weathering to medium light-grey and greyish yellow, very thin-bedded, flaggy, hard, dense, very finely to medium crystalline; light grey shale partings; *Streptelasma* sp. A, *Favosites* sp. cf. *F. forbesi* Milne-Edwards & Haime, ? *Schuchertella striatissima* Poulsen, *Strophonella* sp. fragment, *Howellella* sp. A, *Nucleospira* sp. cf. *N. hecetensis* Kirk and Amsden, *Atrypella borealis* Kirk and Amsden, *A.* sp. cf. *A. scheii* (Holtedahl), *A.* sp. cf. *A. shrocki* Cooper, cephalopod fragments..	90·0
43	Argillaceous limestone; medium light-grey to greenish grey, weathering similar, very thin-bedded, flaggy, hard, dense, very fine to medium crystalline; shale partings; virtually a brachiopod coquina; *Favosites* sp. cf. *F. forbesi* Milne-Edwards & Haime, *Brachyprion* sp., *Conchidium* sp. B, *C.* sp. C. aff. *C. arcticum* Holtedahl, *Camarotoechia* sp. A, *Howellella* sp. A, *Atrypella borealis* Kirk and Amsden, *A.* sp. cf. *A. scheii* (Holtedahl), *A.* sp. cf. *A. shrocki* Cooper, *A. tenuis* Kirk and Amsden, *A.* sp.........	14·7
42	Limestone; light grey, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline..	6·7
41	Limestone; fossil fragmental, medium light-grey to medium grey, weathering to greyish yellow, massive, dense, coarsely crystalline; *Amplexus* sp. A, *Favosites* sp. A, *Conchidium* sp. B, *Harpidium groenlandicum* Poulsen, *Armenoceras* sp. cf. *A. ommanneyi* (Salter)...........................	4·5
40	Argillaceous limestone; medium light-grey to medium grey, very thin-bedded, flaggy, hard, dense, very finely crystalline; shale partings; *Amplexus* sp., ? *Rhipidium*, *Conchidium* sp. A, *Merista brevirostris* Poulsen	16·0

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)—Continued

Unit No.		Thickness Feet
39	Limestone; biostromal, light olive-grey, weathering to greyish yellow, massive, hard, in part porous, coarsely crystalline; stromatoporoid, unident., *Streptelasma* sp. A, *Amplexus* sp. A, *Alveolites* sp. A, *Aulopora* sp., *Favosites* sp. cf. *F. cristatus* Milne-Edwards & Haime, ? *Merista brevirostris* Poulsen..	5·7
38	Argillaceous limestone; medium light-grey to medium grey, very thin-bedded, flaggy, hard, dense, a few medium crystalline beds in otherwise sublithographic and very finely crystalline sequence; shale partings; irregularly bedded; ? *Harpidium groenlandicum* Poulsen, *Merista* sp. cf. *M. brevirostris* Poulsen..	90·0
37	Limestone; biostromal, light olive-grey to greyish yellow, weathering to mottled greyish brown and greyish yellow, very thick-bedded, massive, hard, dense, mixed sublithographic and coarsely crystalline; stromatoporoid, unident., *Striatopora flexuosa* Hall, coral fragment, *Conchidium* sp. A, *Howellella* sp. A? fragment, ? *Whitfieldella* sp., *Atrypella* sp. cf. *A. shrocki* Cooper, *A.* sp., *Coelocaulus* fragments, *Leperditia* sp. A.....	17·9
36	Limestone; light grey to medium light-grey, weathering to light grey and greyish yellow, very thin-bedded, flaggy, sublithographic to very finely crystalline; shale partings; ? alga, ? *Eridotrypa* sp., *Mesotrypa* sp. cf. *M. suprasilurica* Hennig, favositoid coral, *Atrypella borealis* Kirk and Amsden, *A.* sp. cf. *A. shrocki* Cooper, *Coelocaulus* sp..................	15·2
35	Limestone; biostromal, mottled greyish brown and medium grey, weathering similar, massive, hard, dense, mixed sublithographic and coarsely crystalline; alga, massive type, *Striatopora flexuosa* Hall, *Hormotoma* sp., ? *Subulites* sp., ostracods, unident................................	4·0
34	Argillaceous limestone; light to medium grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, alternating sublithographic and very finely crystalline beds, light grey shale partings; *Spatiopora* sp., *Conchidium* sp. A, *Atrypella* sp., *Armenoceras* sp. cf. *A. ommanneyi* (Salter)	17·0
33	Limestone; in part fossil fragmental, light brown to yellowish grey, weathering to mottled greyish brown and moderate red, very thin and irregularly bedded, flaggy; alternating sublithographic and crystalline beds; stromatoporoid, unident; *Favosites* sp. A, *Striatopora flexuosa* Hall, *Howellella* sp. A, *Hormotoma* sp. A, *Coelocaulus* sp. D, *Armenoceras* sp. cf. *A. ommanneyi* (Salter), *Leperditia* sp. D..................................	59·2
32	Limestone; light grey, weathering to greyish orange-pink, very thin-bedded, flaggy, hard, dense, very finely crystalline; *Alveolites* sp. A, *Conchidium* sp. fragment, rhynchonellid brachiopod, *Atrypella* sp. cf. *A. borealis* Kirk and Amsden, ostracod, unident............................	33·8
31	Limestone; biostromal, light grey, weathering to yellowish grey, massive, hard, dense, finely crystalline; *Clathrodictyon* sp. cf. *C. variolare* Rosen, *Favosites* sp. cf. *F. cristatus* Milne-Edwards & Haime, *Conchidium* sp. cf. *C. knighti* (Sowerby)..	4·5
30	Limestone; light grey, weathering to greyish yellow and yellowish grey, very thin-bedded, flaggy, hard, dense, very finely crystalline...........	23·1

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)—Continued

Unit No.		Thickness Feet
29	Limestone; biostromal, light grey, weathering to greyish yellow, hard, dense, medium to coarsely crystalline; stromatoporoid, unident., *Favosites* sp. cf. *F. cristatus* Milne-Edwards & Haime, *Conchidium* sp. cf. *C. knighti* (Sowerby), *C.* sp. cf. *C. laqueatum* (Conrad), *Rhipidium* sp. B, cephalopod fragment	1·1
28	Limestone; light grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline; *Favosites* sp. cf. *F. cristatus* Milne-Edwards & Haime, *Conchidium* sp. cf. *C. knighti* (Sowerby)	14·2
27	Limestone; light grey, weathering to yellowish grey and greyish yellow, massive, hard, dense, medium to coarsely crystalline	1·1
26	Limestone; light grey, weathering to light grey and greyish pink, very thin-bedded, flaggy, hard, dense, alternating sublithographic and very finely crystalline beds	7·1
25	Limestone; biostromal, mottled yellowish grey and light grey, massive, hard, dense, medium to coarsely crystalline, ? *Stromatopora* sp., *Favosites* sp. A, *Striatopora flexuosa* Hall	0·9
24	Argillaceous limestone; light grey to light olive-grey, weathering to greyish pink and yellowish grey, very thin-bedded, flaggy, hard, dense, finely crystalline; *Conchidium* sp. cf. *C. knighti* (Sowerby)	16·8
23	Limestone; light grey to pale yellowish brown, weathering to yellowish grey, massive hard, dense, medium to coarsely crystalline, *Stomatopora* sp. A	1·3
22	Limestone; medium light-grey weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic	3·0
21	Limestone; biostromal, mottled brownish grey and light olive-grey, weathering similar, massive, hard, dense, medium to coarsely crystalline; *Stomatopora* sp. A, cephalopod fragment, *Armenoceras* sp. cf. *A. ommanneyi* (Salter)	2·9
20	Limestone; light grey, weathering similar, very thin-bedded, flaggy, hard, dense, alternating sublithographic and very finely crystalline beds; shale partings	48·4
	Covered	18·0
19	Limestone; yellowish grey to greyish red, weathering similar, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline; shale partings; ? *Syringostoma* sp., ? *Brooksina* sp., *Hormotoma* sp., *H.* sp. C, *Coelocaulus* sp., *C.* sp. A. ? *Loxonema* sp., *Armenoceras* sp. cf. *ommanneyi* (Salter), *Leperditia*	39·0
18	Limestone; biostromal, brownish grey, weathering to brownish grey and pale brown, massive, hard, in part porous, coarsely crystalline; ? *Syringostoma* sp., bryozoan, branching form, *Leperditia* sp. A., *L.* sp. B	2·9
17	Limestone; greyish yellow-green, weathering to yellowish grey and light grey, very thin-bedded, flaggy, hard, dense, finely crystalline, in part sandy; *Rhipidium* sp	11·1
16	Limestone; brownish grey to light olive-grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, finely crystalline; shale partings;	

Section of Read Bay (Member A) Beds on Goodsir Creek (Locality 40)—Concluded

Unit No.		Thickness Feet
	Striatopora flexuosa Hall, *Atrypella* sp. cf. *A. borealis* Kirk and Amsden, *Hormotoma* fragments, *Armenoceras* sp. cf. *A. ommanneyi* (Salter), Cyathaspididae n. gen. A and sp. A	11·0
15	Limestone; biostromal, mottled light red and greyish yellow, weathering similar, thick-bedded, blocky, hard, dense, mixed sublithographic and crystalline; ? *Clathrodictyon*, mixed with algæ, *Striatopora flexuosa* Hall	9·7
14	Argillaceous limestone; medium light-grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, very finely to finely crystalline; fauna in upper 4·9 feet— Cyathaspididae n. gen. A and sp. B (numerous); fauna in lower 3·5 feet—*Eurypterus remipes* DeKay (numerous)	13·8
13	Limestone; olive-grey, weathering to yellowish grey, massive, hard, dense, sublithographic; cut by numerous calcite veinlets	1·4
12	Limestone; yellowish grey, weathering to greyish yellow, thin-bedded, blocky, hard, dense, finely to medium crystalline; stromatoporoid, unident., *Hormotoma* sp., *Conchidium* sp. A	31·3
11	Limestone; greyish yellow, weathering similar, massive, hard, dense, medium crystalline; coral, unident	2·6
10	Limestone; light grey, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline	32·5
9	Limestone; in part dolomitic, light olive-grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, finely crystalline	11·4
8	Limestone; fossil fragmental, brownish grey, weathering to mottled brownish black and yellowish grey, very thin-bedded, hard, dense, finely to medium crystalline; *Atrypella* sp., *Coelocaulus* sp. A?, *C.* sp. B aff. *C. longispira* (Hall), *C.* sp. C	3·0
7	Dolomite; greyish yellow, weathering to yellowish grey, thin-bedded, massive, hard, dense, finely to medium crystalline	38·0
6	Limestone; yellowish grey, weathering similar, very thin-bedded, flaggy, hard, dense, very finely crystalline; *Virgiana* sp. cf. *V.* sp. A	15·0
5	Limestone; biostromal, brownish grey to pale yellowish brown, weathering to greyish yellow, massive, hard, dense, finely to coarsely crystalline; alga, massive, *Rhipidium* sp. A, *Conchidium* sp. A, spiriferoid brachiopod fragment, *Hormotoma* sp. A, *H.* sp. B, *Coelocaulus* sp. A, *C.* sp. B, aff. *C. longispira* (Hall), *Armenoceras* sp. cf. *A. ommanneyi* (Salter), *Leperditia* sp. A, *L.* sp. B	3·4
4	Dolomitic limestone; light grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, very finely crystalline	16·5
3	Limestone; in part dolomitic, yellowish grey, weathering similar, very thin-bedded, flaggy, hard, dense, very finely crystalline	3·5
2	Dolomitic limestone; light grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, very finely crystalline	6·5
1	Limestone; light grey to yellowish grey, weathering similar, massive, hard, dense, finely to coarsely crystalline	2·1
	Total thickness	1,875
	Underlying strata, Allen Bay formation, well exposed.	

At Locality 36 on Shellabear Creek a single well-preserved dorsal carapace of a new genus and species of Cyathaspididae was found associated with abundant *Atrypella* sp., and *Howellella* sp. The stratigraphic position of this occurrence can only be estimated as a few tens of feet below the zone of *Monograptus bohemicus*.

The following section was measured on a small tributary to Marshall Creek that empties into Assistance Bay on the south coast of Cornwallis Island:

Section of Read Bay (Member A) Beds on Tributary of Marshall Creek (Locality 25)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member A.	
7	Argillaceous limestone; medium light-grey to medium grey and olive-grey, weathering to brownish grey and greyish yellow, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline, irregular bedding surfaces; numerous shale partings. Fauna collected 22·5 feet above base of unit; *Streptelasma* type coral, *Favosites* sp. cf. *F. senex* Poulsen, *Conchidium* sp. cf. *C. knighti* (Sowerby), *Hormotoma* sp. C, ? *Armenoceras ommanneyi* (Salter)........	82·8
6	Sandstone; calcareous, very light grey, weathering similar, massive, fine-grained........	1·0
5	Argillaceous limestone; lithological character similar to Unit 7; fauna collected 98 feet above base of unit, *Streptelasma* type coral, favositoid coral fragment, *Conchidium* sp. cf. *C. knighti* (Sowerby), *Armenoceras* sp. cf. *A. ommanneyi* (Salter), ? *Geisonoceras* sp., ostracods; fauna collected 79·5 feet above base of unit, *Hormotoma* sp. C, *Armenoceras* sp. cf. *A. ommanneyi* (Salter); fauna collected 74 feet above base of unit, *Leperditia* spp., several small forms........	237·5
4	Limestone; light olive-grey, weathering to brownish grey, massive, hard, dense, sublithographic........	1·7
3	Limestone; light grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, sublithographic........	5·2
2	Limestone; lithological character similar to Unit 4; alga? coral—branching, indet........	1·9
1	Limestone; lithological character similar to Unit 3	3·2
	Total thickness........	333·3
	Underlying strata, covered interval in member A.	

The following section was measured on the eastern shore of Assistance Bay, south coast of Cornwallis Island:

Section of Read Bay (Member A) Beds on Shore of Assistance Bay (Locality 27)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member A.	
6	Limestone; fossil fragmental, mottled light grey and brownish grey, weathering to mottled brownish grey and light brownish grey, massive, dense,	

Section of Read Bay (Member A) Beds on Shore of Assistance Bay (Locality 27)—Concluded

Unit No.		Thickness Feet
	mixed finely to coarsely crystalline; ? alga, ? *Streptis* sp., several unidentified small rostrate brachiopods, *Liospira perlata* Hall, trilobite fragments, *Leperditia* sp.	6·0
5	Argillaceous limestone; light olive-grey to medium light-grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline; irregular bedding planes with shale partings	17·0
4	Limestone; light olive-grey, weathering to yellowish grey, massive, hard, dense, mainly finely crystalline; ? alga, ? *Streptis* sp., *Leperditia* sp. cf. *L. whiteavesi* Jones, *Leperditia* sp., with several other unidentifiable ostracods	1·5
3	Limestone; fossil fragmental, mottled light grey and brownish grey, weathering to mottled brownish grey and yellowish grey, very thin-bedded, dense, finely to medium crystalline; alga, *Syringopora* sp., *Howellella* sp. cf. *H. arctica* Poulsen, *Eospirifer* sp., *Streptis* sp.	3·9
2	Limestone; light olive-grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, finely crystalline	0·8
1	Argillaceous limestone; medium light-grey, weathering similar, very thin-bedded, flaggy, hard, dense, sublithographic; shale partings	32·7
	Underlying strata, covered interval in member A.	

The following section was measured in canyon of an unnamed stream that flows into Assistance Bay:

Section of Read Bay (Member A) Beds along Stream entering Assistance Bay (Locality 24)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member A formation.	
7	Argillaceous limestone; light grey to generally medium light-grey and medium grey, weathering to light grey and yellowish grey, very thin- to thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline; irregular bedding planes with thin shale partings; ? alga, cephalopod fragment	463·0
6	Dolomite; light grey, weathering to yellowish grey and medium grey, thin-bedded, hard, dense, medium crystalline	4·6
5	Limestone; greyish brown, weathering to light grey, massive, in part porous, medium crystalline; ? alga, ? *Striatopora* sp	3·5
4	Dolomite; lithological character similar to Unit 6	4·6
3	Argillaceous limestone; medium dark-grey, weathering to yellowish grey, very thin-bedded, hard, dense, sublithographic	15·0
2	Limestone; fossil fragmental, light olive-grey, weathering to brownish grey, massive, hard, dense, medium to coarsely crystalline; *Hormotoma* sp.	9·4
1	Limestone and shale; medium dark-grey, weathering to light grey, very thin-bedded, in part laminated; hard, dense, sublithographic limestone alternating with thin beds of light grey shale; ostracods, unident	9·4
	Total thickness	509·5
	Underlying strata, covered interval in Read Bay formation.	

At Locality 26, some 3 miles north of the head of Assistance Bay and in the vicinity of the Assistance Bay fault, the following fossils were collected in intimate association:

Fossils of Read Bay (Member A) Beds North of Assistance Bay

Favosites
Bryozoan—explanate
Bryozoan—branching
Schuchertella sp. cf. *S. interstriata sinuata* Holtedahl
Schuchertella sp.
Sieberella sp.
Camarotoechia sp. A
? *Atrypopsis*
Liospira sp.
Cephalopod, unident.

The following section was measured near the east entrance to Resolute Bay, central-south coast of Cornwallis Island. Graphic measurement suggests that this section lies about 1,000 feet above the base of the Read Bay formation.

Section of Read Bay (Member A) Beds near East Entrance of Resolute Bay (Locality 23)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member A.	
5	Argillaceous limestone; light grey to generally medium grey and olive-grey, weathering to light grey and yellowish grey, very thin-bedded, in part laminated, flaggy, hard, dense, sublithographic to very finely crystalline; some shale partings; *Coelocaulus* sp., ostracod, unident.	24·0
4	Limestone; biostromal, medium grey, weathering to brownish grey and yellowish grey, massive, hard, in part vuggy, mixed finely to coarsely crystalline; *Amplexus* sp., *Striatopora* sp. cf. *S. flexuosa* Hall, ? *Synaptophyllum* sp., *Conchidium* sp., ? *Harpidium groenlandicum* Poulsen, ? *Atrypella* sp., unident. pelecypods	6·1
3	Argillaceous limestone; lithological characters similar to Unit 5, ? *Atrypella* sp.	40·3
2	Limestone; very light grey to light olive-grey, weathering to greyish yellow, very thin-bedded, flaggy, hard, dense, sublithographic; ? *Atrypella* sp.	6·0
	Covered	24·0
1	Argillaceous limestone; lithological characters similar to Units 3 and 5	8·5
	Total thickness	109·8
	Underlying strata, covered interval in member A.	

A plane-table traverse was made from the lower contact of the Read Bay formation, along the west limb of the Resolute Bay anticline for a distance of about 5 miles in a northwesterly direction, to the west limb of the complementary Resolute Bay syncline. This traverse was made across numerous discontinuous exposures of the Read Bay formation and the low-lying coastal plains that extend between the heads of Resolute Bay and Allen Bay. The resulting section comprises Localities 1, 3, 5, 6, and 9, which have been placed on the accompanying map at points of maximum exposures.

Because of the absence of readily recognizable faunal zones and lithological markers in the Read Bay formation (other than the shales of member B which may lie covered within the measured section of this traverse) it is possible that beds younger than member A are included in the strata measured at these five localities. However, other than the excessive thickness of the composite section in comparison to member A at its type locality, no evidence supports this possibility. The section is as follows:

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay

Locality 9

Unit No.		Thickness Feet
	Overlying strata, covered interval in Read Bay formation.	
16	Limestone; medium light-grey, weathering to mottled greys, very thin-bedded, flaggy, hard, dense, finely crystalline; shale partings	6·0
15	Limestone; medium light-grey, weathering to mottled greys and yellowish grey, thin-bedded, finely to coarsely crystalline; upper 1·6 feet is coarsely crystalline; algæ, several types, stromatoporoids, several types, *Streptelasma* sp. cf. *S. latusculum* (Billings), *S.* sp., *Zaphrentis* sp. cf. *Z. offleyensis* Etheridge, *Heliolites* sp. cf. *H. subtubulatus* (McCoy), ? *Favosites* n. sp., *Syringopora* sp.	14·9
	Covered	29·2
14	Argillaceous limestone; medium light-grey to medium dark-grey, weathering to light grey and greyish yellow, very thin-bedded, flaggy, very finely crystalline; shale partings common	24·0
	Covered	39·0
13	Calcareous sandstone; pale olive-grey, weathering light grey, thin-bedded, fine-grained	5·0
12	Limestone; pale brown alternating with light grey beds, weathering mottled greys and yellowish grey, thin-bedded, dense, finely crystalline	24·0
11	Limestone; medium grey weathering to mottled greys and greyish yellow, very thin-bedded, hard, dense, sublithographic to very finely crystalline; shale partings common; ? alga, *Alveolites* sp. cf. *A. polaris* Tchernychev, *Coelocaulus* sp. E, *C.* sp., *Leperditia phaseola* var. cf. *L. phaseola guelphica* Jones	12·3
10	Limestone alternating with shale; light grey, very thin-bedded, finely crystalline limestone alternating with light grey shale	6·0
9	Limestone; lithological characters similar to Unit 12	7·5
	Covered	4·0
8	Limestone; pale brown, weathering to mottled greys and pale brown, thin-bedded, hard, dense, finely crystalline; fetid odour when struck or broken	4·0
	Covered	31·0

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay
—Continued

Locality 9—*Concluded*

Unit No.		Thickness Feet
7	Limestone; very dusky red, weathering to mottled greys and yellowish grey, thin-bedded, hard, dense, finely crystalline; petroliferous odour when struck; ? alga, *Alveolites* sp. cf. *A. polaris* Tchernychev, bryozoan, indet., *Conchidium* sp., pentamerid brachiopod, *Atrypella scheii* (Holtedahl), *Armenoceras* sp.	6·0
	Covered	19·0
6	Argillaceous limestone; medium light-grey to medium grey, weathering to light grey, very thin-bedded, hard, dense, sublithographic	11·6
5	Limestone; light grey, weathering to medium light-grey, thin-bedded, hard, dense, finely crystalline; ? alga, *Fistulipora* sp. cf. *mutabilis* Hennig, *Howellella* sp. A, *Atrypella scheii* (Holtedahl), *A.* sp., *Holopea* sp., *Leperditia* sp. cf. *L. hisingeri fabulina* Jones	4·0
	Covered	11·0
4	Argillaceous limestone; brownish grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, sublithographic; shale partings conspicuous	8·0
3	Quartzose limestone; greyish orange-pink, weathering similar, thin-bedded	5·0
2	Argillaceous limestone; lithological characters similar to Unit 4	10·1
1	Limestone; medium light-grey, weathering to light grey, thin-bedded, finely crystalline; calcite crystals partly fill vugs throughout unit	4·5
	Covered	100·0

Locality 3

4	Limestone; medium light-grey, weathering to mottled greys, very thin-bedded, hard, dense, finely crystalline	5·0
	Covered	10·0
3	Limestone; lithological characters similar to Unit 4; alga of *Solenopora* type, *Streptelasma* sp. A, *Schuchertella* sp. cf. *S. interstriata sinuata* Holtedahl, *Camarotoechia* sp. A, *C.* sp. B, *Howellella* sp. A, *Merista* sp., *Atrypella* sp. cf. *shrocki* Cooper, *A. scheii* Holtedahl, *A. tenuis* Kirk and Amsden, *Nucleospira* sp. cf. *N. hecetensis* Kirk and Amsden, *Coelocaulus* sp. B, *C.* sp., *Encrinurus* sp. A, *Frammia* sp. cf. *F. dissimilis* Holtedahl	2·0
	Covered	104·0
2	Limestone; brownish grey, weathering to mottled greys and greyish yellow, thin-bedded, in part porous, finely to medium crystalline; ? alga, *Favosites* sp. cf. *F. senex* Poulsen, ? *Diplophyllum* sp., *Conchidium laqueatum* (Conrad), ? *Hindella* sp.	6·0
1	Limestone; brownish grey, weathering to mottled greys, thin-bedded, porous, medium crystalline; irregularly bedded; numerous unidentified stromatoporoid	3·0
	Limestone; light grey, weathering to medium grey, very thin-bedded, hard, dense, finely crystalline	2·0
	Covered	21·2

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay
—Continued

Locality 1

Unit No.		Thickness Feet
10	Limestone alternating with siltstone partings; medium dark-grey, weathering to medium grey, very thin-bedded, hard, dense, finely crystalline limestone and very thin beds of medium grey siltstone........................	5·0
9	Limestone; medium dark-grey, weathering to medium grey, thin-bedded, in part porous, finely crystalline; rubbly weathering; alga, *Syringopora* sp. cf. *S. serpens* (Linnaeus), *Favosites* sp. cf. *F. senex* Poulsen, bryozoan, undet., ? *Whitfieldella* sp., *Howellella* sp. A, ? *Holopea* sp., *Hormotoma* sp., *Hormotoma* sp. A, *Coelocaulus* sp................................	4·0
8	Limestone; medium dark-grey, weathering to mottled greys, thin-bedded, hard, dense, finely crystalline; a few shale partings; fetid odour when struck; *Spatiopora* sp., *Hormotoma* sp. A, *Ormoceras* sp. A, ? *Oocerina* sp.	31·1
7	Limestone; light grey, weathering similar, massive, hard, dense, finely crystalline; ? *Merista brevirostris* Poulsen.........................	1·8
6	Limestone; olive-grey, weathering to light olive-grey, thin-bedded, hard, dense, finely crystalline; petroliferous odour when struck; fauna concentrated in biostromal-like development at base; alga, stromatoporoid, undet., *Cornulites* sp., *Amplexus* sp. cf. *A. polaris* Poulsen, *Striatopora* sp. cf. *S. flexuosa* Hall, *Syringopora* sp. cf. *S. serpens* Poulsen, *Favosites* sp. cf. *F. senex* Poulsen, *Virgiana* sp. cf. *V. decussata* (Whiteaves), *Coelocaulus* sp. E, *Ormoceras* sp. A, (probably n. sp.), *O.* sp. B, *Illaenus* sp...	8·1
5	Quartzose limestone; very light grey, weathering to pale orange-yellow, thin-bedded, hard, dense, fine-grained; *Striatopora* sp. cf. *S. flexuosa* Hall, *Conchidium laqueatum* (Conrad), *Howellella* sp. A, *Hormotoma* sp., *Armenoceras ommanneyi* (Salter), *Leperditia* sp. A, *L.* sp.............	9·5
4	Limestone; medium dark-grey, weathering to mottled greys, very thin-bedded, hard, dense, finely crystalline; siltstone partings common; *Favosites forbesi* E. & H., *F.* sp. cf. *F. hisingeri* E. & H., *Conchidium laqueatum* (Conrad), *Atrypella scheii* (Holtedahl), ? *Merista* sp., *Hormotoma* sp. C, *Spyroceras* sp. A, *Armenoceras ommanneyi* (Salter), ostracod fragments	18·9
3	Sandstone; medium grey, weathering similar, thin-bedded, dense, fine- to medium-grained, calcareous cement; grading into limestone in basal 2 feet; *Conchidium knighti* n. var..	7·2
2	Argillaceous limestone; medium dark-grey, weathering light grey, very thin-bedded, hard, dense, sublithographic to finely crystalline, *Favosites* sp. cf. *F. senex* Poulsen, ? *Orthostrophia* sp., *Conchidium knighti* (Sowerby), *Virgiana* sp. cf. *V. decussata* (Whiteaves), *Camarotoechia* sp., *Harpidium groenlandicum* Poulsen, brachiopod n. sp. aff. *Alaskospira*, ? *Hindella* sp. A, *Hormotoma* sp., *Armenoceras* sp. cf. *A. ommanneyi* (Salter), *Spyroceras* sp. A, *Michelinoceras* ? sp..	5·0
1	Limestone; medium light-grey, weathering to mottled greys, thick-bedded, hard, dense, finely crystalline; *Favosites* sp., *Virgiana decussata* (Whiteaves). *Conchidium knighti* (Sowerby), *C. laqueatum* (Conrad), ? *Hindella* sp., ? *Coelocaulus* n. sp., *Leperditia* sp. A and B, *L.* sp., *Isochilina* sp.....	17·0
	Covered..	7·7

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay
—Continued

Locality 6

Unit No.		Thickness Feet
24	Limestone; light grey, weathering similar, very thin-bedded, hard, dense, finely crystalline; fetid odour when struck or broken	1·5
	Covered	4·0
23	Limestone; lithological characters similar to Unit 24	5·5
	Covered	22·0
22	Argillaceous limestone; brownish grey, weathering to mottled greys and greyish yellow, very thin-bedded, hard, dense, sublithographic to finely crystalline; sponge, undet., *Atrypella* sp. cf. *A. scheii* (Holtedahl), ? *Hindella* sp	6·6
	Covered	4·5
21	Argillaceous limestone; medium light-grey to medium grey, weathering to mottled greys and yellowish grey, thin-bedded, flaggy, hard, dense, very finely crystalline to sublithographic	1·4
	Covered	5·0
20	Argillaceous limestone; lithological characters, similar to Unit 21	17·0
	Covered	8·0
19	Limestone; yellowish grey, weathering to light grey, very thin-bedded, hard, dense, very finely crystalline	2·0
	Covered	7·0
18	Limestone; light grey to pale red-purple, weathering similar, thin-bedded, hard, dense, finely crystalline	6·5
	Covered	3·0
17	Argillaceous limestone; brownish grey to medium grey, weathering to light grey and greyish yellow, very thin-bedded, hard, dense, very finely crystalline	8·5
	Covered	39·2
16	Argillaceous limestone; lithological characters similar to Unit 17; ? *Clathrodictyon* sp., *Favosites gothlandicus* (Fought), *Syringopora* sp. A, *Halysites catenulatus* (Linnaeus)	3·9
	Covered	147·0
15	Limestone; medium light-grey, weathering similar, very thin-bedded, hard, dense, finely crystalline	8·0
	Covered	21·5
14	Limestone; medium light-grey, weathering similar, massive, hard, dense, medium crystalline	3·0
13	Limestone; biostromal, composed entirely of stromatoporoids undet., lithological characters similar to Unit 14	1·3
12	Dolomite; yellowish grey, weathering to greyish yellow, thick-bedded, hard, dense, medium crystalline	26·0
	Covered	225·0
11	Limestone; mottled moderate red and medium grey, weathering to mottled greys, thin-bedded, hard, dense, finely crystalline; irregular bedding surfaces	5·0
	Covered	100·0

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay
—Continued

Locality 6—*Concluded*

Unit No.		Thickness Feet
10	Argillaceous limestone; olive-grey, weathering to mottled greys, thin-bedded, hard, dense, very finely crystalline	2·2
	Covered	12·0
9	Argillaceous limestone, lithological characters similar to Unit 10	2·2
8	Argillaceous limestone; light brownish grey, weathering to yellowish grey, very thin-bedded, hard, dense, very finely crystalline	2·5
7	Argillaceous limestone; medium light-grey, weathering to moderate yellow and greyish yellow, very thin-bedded, hard, dense, very finely crystalline	3·0
	Covered	2·0
6	Argillaceous limestone; lithological characters similar to Unit 7	3·0
	Covered	33·5
5	Argillaceous limestone; medium light-grey to light olive-grey, moderate red streaks throughout, weathering to mottled greys, very thin-bedded, hard, dense, sublithographic	4·0
	Covered	10·0
4	Limestone; biostromal, composed entirely of unidentified stromatoporoids, greyish yellow, weathering similar, massive porous, medium to coarsely crystalline	5·0
3	Limestone; medium light-grey, weathering to medium grey, thin-bedded, hard, dense, finely crystalline	4·2
2	Limestone; biostromal, composed entirely of unidentified stromatoporoids; lithological characters similar to Unit 4	1·0
1	Limestone; light olive-grey, weathering to yellowish grey, thin-bedded, hard, dense, sublithographic	4·0
	Covered	430·0

Locality 5

Unit No.		Thickness Feet
14	Limestone; medium grey to olive-grey, weathering to mottled greys and greyish yellow, thin- to thick-bedded, hard, in part porous, sublithographic to very finely crystalline; fetid odour when struck or broken	12·5
13	Limestone; medium light-grey, weathering to olive-grey, thin- to thick-bedded, hard, dense, sublithographic; stromatoporoids unident	10·5
12	Limestone; medium grey to olive-grey, weathering to mottled greys, very thin-bedded, hard, dense, sublithographic	4·5
11	Limestone breccia; light grey, angular, fragments of sublithographic limestone averaging ½ inch in diameter embedded in medium light-grey, very finely crystalline limestone matrix	4·0
10	Dolomitic limestone; yellowish grey, weathering light grey, thin-bedded, hard, dense, finely crystalline	1·5
9	Argillaceous limestone, medium light-grey to olive-grey, weathering to mottled greys, thin-bedded, hard, dense, finely crystalline to sublithographic	9·0

Composite Section of Read Bay (Member A) Beds in Folded Structures near Resolute Bay
—Concluded

Locality 5—*Concluded*

Unit No.		Thickness Feet
8	Limestone; very light grey, weathering similar, very thin-bedded, hard, dense, finely crystalline	1·7
7	Limestone; light olive-grey to medium light-grey, weathering to mottled greys, thin-bedded, hard, dense, finely crystalline	7·0
6	Limestone; oolitic, brownish grey, weathering similar, massive; rests with slight disconformity on underlying strata	2·0
5	Limestone; brownish grey, weathering to greyish yellow, thick-bedded, hard, dense, medium crystalline	10·0
4	Limestone; mottled brownish grey and light olive-grey, weathering similar, thick-bedded, vuggy, finely crystalline	4·5
3	Limestone and dolomite intermixed; medum light-grey, finely crystalline limestone; dolomite in the form of greyish yellow blebs about 1 inch in diameter	3·0
	Covered	3·0
2	Limestone; light olive-grey, weathering medium grey to greyish yellow, thin-bedded, hard, dense, finely crystalline	4·0
	Covered	3·0
1	Limestone; medium grey to brownish grey, weathering to mottled greys, thin-bedded, hard, in part porous, finely crystalline	8·3
	Total thickness	1,915
	Underlying strata, Allen Bay formation.	

The following fauna was collected from outcrops of mainly argillaceous limestone and limestone near the west shore of Resolute Bay, at Locality 2:

Fossils of Read Bay (Member A) Beds on West Shore of Resolute Bay

Favosites sp.
Syringopora sp.
? *Schuchertella* sp.
Pentamerid fragment
Cyrtina sp.
Howellella sp. A
Atrypella sp. cf. *A. borealis* Kirk and Amsden
A. sp. cf. *A. scheii* (Holtedahl)
A. sp. cf. *A. shrocki* Cooper
A. sp. cf. *A. tenuis* Kirk and Amsden

The following fauna was collected from an isolated limestone exposure in outcrops of Read Bay formation (Locality 31) exposed along the west limb of the Stanley Head anticline in the southwestern region of Cornwallis Island. Graphic measurement, though not very reliable owing to scarcity of outcrops, indicates that these fossils occur within 500 feet of the lower contact of the formation and therefore they are probably from member A.

Fossils of Read Bay (Member A) Beds in Southwestern Part of Cornwallis Island

Brachyprion n. sp.
Leptaena sp.
Idioglyptus sp. cf. *I. stigmatus* Northrop
Camarotoechia sp.
Howellella sp. A.
Delthyris sp. B.
Nalivkinia sp. cf. *N. marginalis* (Dalman)
? *Atrypa barbatus* Poulsen

Member B

This member is defined to include greenish black to black, friable, shale that overlies member A and underlies member C of the Read Bay formation with sharp yet conformable contacts. Member B varies from 60 to 100 feet in thickness and locally the upper 20 feet comprises alternating shale and light grey, very thin-bedded, flaggy, in part crossbedded, hard, fine-grained sandstone. Complete and typical exposures of this member occur on the south side of Goodsir Creek, central-east coast of Cornwallis Island and this is chosen as the type locality (Locality 8).

Owing to the relative softness of this shale member, streams following it have produced a striking alignment of valleys. The system is traceable as a moderately low, west-facing escarpment from Cape Hotham to Snowblind Creek and named the Cape Hotham Escarpment. The strike of bedrock is thus reflected by this remarkable topographic feature for several miles in the east coastal region of Cornwallis Island.

Only a few, indeterminable brachiopods, gastropods and heterostracan fragments were collected in the upper sandstone beds of this member on Goodsir Creek.

Member C

Rocks of this member occur to the east of the Cape Hotham Escarpment and outcrop along much of the east coast of Cornwallis Island from Cape Hotham to Cape DeHaven. Complete sections of this member are probably exposed only around the flanks of the Advance Bluff syncline.

Strata of member C are lithologically similar to those of member A in that generally light to medium grey, light olive-grey to olive-grey, very thin-bedded to thin-bedded, flaggy, hard, dense, sublithographic to finely crystalline argillaceous limestone and limestone alternate with vari-coloured, thick- to very thick-bedded, blocky to massive, hard, commonly porous, finely to coarsely crystalline biostromal and fossil fragmental limestone. Biostromal and fossil fragmental units of member C are generally thicker than those of member A and in a few places are represented by small to large dolomite and dolomitic limestone biohermal and reefoid massives that abound in mainly unidentifiable stromatoporoids and corals.

Best exposures and development of this member were found in an unnamed creek entering the southwestern side of Read Bay on the central-east coast of Cornwallis Island (approx. lat. 75° 07′; long. 93° 49′). This creek was traversed during inclement weather. Partly because of the extraordinary abundance of fossils and because the writer deemed this locality worthy of detailed study with zonal collecting, no fossils were taken at the time of this traverse. Unfortunately, unforeseen circumstances prevented a return. Nevertheless, this locality will be chosen as typical for member C. Graphic measurements made here indicate a thickness of approximately 4,725 feet for this member.

The faunas from the following localities can not be considered as completely representative of this fossiliferous member.

The following section comprises lower beds of member C measured on Goodsir Creek near the east coast of Cornwallis Island. Much of this section is shown in Plate VII.

Section of Read Bay (Member C) Beds on Goodsir Creek (Locality 39)

Unit No.		Thickness Feet
	Overlying strata, continuing member C of Read Bay series.	
12	Limestone and replacement quartz; biostromal, mottled pale greenish yellow, greyish yellow and light olive-grey, weathering to mottled pale yellowish orange and yellowish grey, thin- to thick-bedded, slabby, hard, dense, mixed sublithographic limestone and crystalline quartz; numerous well-preserved, silicified fossils, as yet unident........................	22·0
11	Limestone; light grey to medium grey, weathering greyish yellow and yellowish grey, thin- to thick-bedded, hard, dense, sublithographic to medium crystalline; fauna collected in upper 6 feet of unit, *Clathrodictyon* sp., *Striatopora* sp., *Fascicostella* sp. cf. *F. speciosa* Poulsen, *Strophonella* sp., ? *Rhipidium* sp., *Conchidium* sp., *Atrypella phoca* (Salter), *Hormotoma* sp., *Loxonema* sp., ? *Arctinurus* sp.; fauna collected 72 feet above base of unit, *Amplexus* sp., ? *Ptychophyllum, Striatopora* sp., *Conchidium* sp. cf. *A. alaskense* Kirk and Amsden, *Atrypella* sp. cf. *A. scheii* (Holtedahl), *Atrypa* sp..	142·4
10	Limestone; medium grey, weathering similar, very thin-bedded, flaggy, dense, sublithographic; very irregularly bedded with shale interleaves; *Amplexus* sp., *Favosites* sp., ? *Fascicostella* sp.......................	8·6
9	Limestone; light grey to medium grey, weathering to mottled greyish yellow and yellowish grey, thick-bedded, blocky, in part porous, sublithographic to medium crystalline; stromatoporoid, *Favosites* sp. cf. *F. gothlandicus* (Fought), *Rhipidium* sp., *Conchidium* sp............................	19·6

Section of Read Bay (Member C) Beds on Goodsir Creek (Locality 39)—Concluded

Unit No.		Thickness Feet
8	Limestone; pale brown, weathering to very pale orange and greyish yellow, massive, hard, dense, sublithographic; slight erosion surface appears to be present near base; stromatoporoid, *Favosites* sp., *Atrypella* sp., gastropod fragment	11·1
7	Limestone; in part dolomitic, pale orange to greyish orange, weathering to pale yellowish orange and greyish yellow, thin- to thick-bedded, finely to medium crystalline; numerous indeterminable fossils as casts and moulds, stromatoporoid	102·4
6	Limestone; pale orange to greyish orange, weathering to greyish yellow, very thick-bedded, massive, finely to medium crystalline; numerous indeterminable fossils as casts and moulds	86·2
5	Limestone; greyish yellow to yellowish grey, weathering similar, very thin-bedded, flaggy, hard, dense, alternating medium crystalline and sublithographic; irregularly bedded; *Stromatopora* sp., *Amplexus* sp., *Chonophyllum* sp., *Striatopora* sp., ? *Hormotoma* n. sp.	86·2
4	Limestone; fossil fragmental, yellowish grey, weathering to greyish yellow, massive, hard, dense, finely to coarsely crystalline; *Favosites forbesi eifelensis* Holtedahl	3·0
3	Limestone; light to medium grey, weathering similar, in part yellowish grey, very thin-bedded, flaggy, hard, dense, very finely crystalline to sublithographic; shale partings	20·1
2	Limestone; fossil fragmental, greyish yellow, weathering similar, thin-bedded, blocky, hard, dense, coarsely crystalline; ? *Streptelasma* sp., *Halysites gothlandicus* (Fought), *Striatopora* sp., *Favosites* sp. A, *Atrypella* sp., *Atrypa*, crinoid stems	10·0
1	Limestone; light to medium grey, weathering similar, very thin-bedded, flaggy, hard, dense, sublithographic	38·4
	Total thickness	563
	Underlying strata, covered interval in member C but within a few tens of feet of member B.	

The following section was measured on Goodsir Creek opposite that of Locality 39. Although occupying comparable stratigraphic positions and situated less than a mile apart, the sections at these localities cannot be correlated on lithological or palæontological evidence. Lack of stratigraphic and faunal continuities across the width of Goodsir Creek valley is doubtlessly attributable, for the most part, to reefoid development at Locality 38 but not at Locality 39.

Section of Read Bay (Member C) Beds on Goodsir Creek (Locality 38)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member C of Read Bay formation.	
9	Dolomite; biohermal, greyish yellow, weathering same to yellowish grey, very thick-bedded, massive, moderately hard, generally porous medium	

Section of Read Bay (Member C) Beds on Goodsir Creek (Locality 38)—Concluded

Unit No.		Thickness Feet
	to coarsely crystalline; section apparently through thickest region of bioherm; fossils fairly numerous but in the form of indeterminable casts and moulds that appear to be mainly stromatoporoids and corals.......	325·0
8	Limestone; crinoidal in part, greyish yellow, weathering similar, thin-bedded, flaggy to slabby, more or less dense, medium to coarsely crystalline; stromatoporoid, ? *Protarea* sp., ? *Harpidium groenlandicum* Poulsen, *Michelinoceras* sp. A..................................	54·0
7	Limestone; yellowish grey to greyish yellow, weathering to yellowish grey, thin-bedded, flaggy, in part porous, medium crystalline; indeterminable crinoid remains..	41·6
6	Dolomite; greyish yellow, weathering similar, thin- to thick-bedded, blocky to massive, hard, in part porous, finely to medium crystalline; indeterminable casts and moulds, mainly of stromatoporoids and corals..........	129·6
5	Limestone; greyish yellow to yellowish grey, weathering similar, thin-bedded, slabby, hard, dense, finely crystalline; upper 17 feet in part crinoidal..	38·5
4	Limestone; biostromal, greyish yellow, weathering similar, very thick-bedded, massive, soft, in part very porous, medium to coarsely crystalline	18·9
3	Limestone; light grey to medium grey weathering similar, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline; *Mesotrypa* sp. cf. *M. suprasiluria* Hennig, *M.* sp., ? *Fardenia* sp. A, ? *F.* sp. B, *Howellella arctica* Poulsen, ? *Atrypa*, *Michelinoceras*.............	12·0
2	Limestone; fossil fragmental, greyish yellow and light to medium grey, weathering similar, thin to thick beds, hard, dense, finely crystalline; *Streptelasma* sp., *Halysites* sp., *Protarea* sp., *Nalivkinia groenlandica* Poulsen, cystoid plates, crinoid stems..............................	14·5
1	Limestone; light to medium grey, weathering similar, and medium grey, very thin-bedded, flaggy, hard, dense, sublithographic to very finely crystalline..	51·
	Total thickness..	684·6
	Underlying strata, member B of Read Bay formation.	

Four faunas (Localities 7, 13, 21 and 58) were collected along the east coast of Cornwallis Island in beds of member C, all of which are probably contemporaneous with the two measured sections described above. Two additional faunas from strata higher in member C were obtained from Localities 52 and 57, also on the east coast. These faunas are as follows:

Fossils of Read Bay (Member C) Beds

(1) Locality 58, near Cape Hotham; collected from a coquina, 1 foot thick and situated about 300 feet above base of member C.

Harpidium sp. cf. *H. groenlandicum* Poulsen
Atrypella sp. cf. *A. scheii* (Holtedahl)
A. sp. cf. *A. shrocki* Cooper

Fossils of Read Bay (Member C) Beds—Concluded

(2) Locality 21, near Cape Hotham, approximately 500 feet above base of member C, silicified fossils were collected from a biostrome about 20 feet thick.

Stromatoporoid, undet.
Streptelasma, type coral
Amplexus sp. cf. *A. propinquus* Poulsen
? *Cystiphyllum* sp.
Favosites sp. cf. *F. multispinosus* Poulsen
F. sp. aff. *F. forbesi* E. and H.
F. sp. aff. *F. niagarensis* Hall
F. n. sp.
Acervularia sp. cf. *A. austini* Salter
? *Striatopora* sp.

(3) Locality 7, near Separation Point; fossils collected in beds determined by graphic measurement as approximately 500 feet above the base of member C; identified by G. Arthur Cooper.

Atrypella phoca (Salter)
Atrypa sp.
Sphaeirhynchia wilsoni (Sowerby)

(4) Locality 13, near Separation Point; roughly 100 feet stratigraphically above the fauna of Locality 7; forms were collected from an 18-foot biostromal bed.

Stromatoporoid
? *Ketophyllum* sp.
Omphymatidae—new form
Arachnophyllum sp. cf. *A. pentagonus* (Goldfuss)
? *Rhaphidophyllum* n. sp.
Favosites sp.
? *Fletcheria clausa* (Lindstrom)
Rhipidium sp.
Holopea sp.
Cephalopod—fragment

(5) Locality 52, near Depot Point Cairn; east coast of Cornwallis Island.

Brachyprion n. sp.
? *Chonetes* sp.
Atrypella borealis Kirk and Amsden
A. sp.
? *Modiolopsis* n. sp.

(6) Locality 57, near the head of Snowblind Bay; east coast of Cornwallis Island; youngest fossils collected in member C and the youngest significant fauna obtained from the Read Bay formation.

Favosites sp.
? *Dalmanella* sp. (ident. by G. Arthur Cooper)
? *Howellella* sp. (ident. by G. Arthur Cooper)
Protathyris sp. (ident. by G. Arthur Cooper)
Metaconularia sp. (ident. by G. Winston Sinclair)
Eurypterid leg segments
Cyathaspididae gen. and sp. indet.

A large reefoid mass, mainly dolomite, extends from about the latitude of Snowblind Bay to Cape Rescue on the east coast of Cornwallis Island, and is developed in beds roughly equivalent to the middle part of member C. Exposure of the reef rock is generally poor, except in the vicinity of Cape DeHaven (*see* Plate VI, figure 2) and Cape Rescue where good exposures occur and the intertonguing relationship of the reef with the darker impure limestones and calcareous shales of the Cape Phillips formation are well exhibited. This reefoid mass is traceable from Cape Rescue for about 8 miles in a southwesterly direction and along this distance it is reflected in the topography by virtue of its bolder relief. The reef is about 500 feet thick in its thickest part and is finely to coarsely crystalline dolomite and dolomitic limestone, with limestone a minor constituent. Bedding is virtually absent. Fossils are numerous but for the most part are poorly preserved, and are represented chiefly by moulds and casts of corals and stromatoporoids. One limestone bed composed almost entirely of comminuted crinoid remains, and about 50 feet thick, outcrops near Cape Rescue.

One collection of fossils made in the reef rock at Locality 30 has been identified as follows: corals resembling *Omphyma* and *Acervularia; Favosites* sp., and crinoid fragments.

Member D

Strata of member C pass gradationally upwards into beds of pale red, dusky red and greyish green, laminated to thin-bedded, flaggy, fine-grained, calcareous sandstone with minor quartzose limestone and siltstone that average about 15 feet thick. These alternate with thicker strata of light to medium grey, light olive-grey to olive-grey, generally very thin-bedded, flaggy sublithographic to very finely crystalline argillaceous limestone and limestone. The strata, designated as member D, represent the highest division of the Read Bay formation. The demarcation between this member and subjacent member C is drawn where the first persistent stratum of clastics enters the succession. The type locality is chosen along the lower reaches of the unnamed creek (Locality 14) entering the southeastern side of Read Bay and where stratigraphically lower strata on the same creek serve as the type section for member C. Graphic measurement indicates a thickness of approximately 1,800 feet for member D. Fossils are notably scarce.

The following section was measured on the north side of Read Bay, central-east coast of Cornwallis Island. Graphic measurement indicates that the uppermost unit of this section lies some 400 feet below the base of the Snowblind Bay formation.

Section of Read Bay (Member D) Beds near the Head of Read Bay (Locality 15)

Unit No.		Thickness Feet
	Overlying strata, covered interval in member D, Read Bay formation.	
14	Calcareous sandstone; light grey to medium light-grey, weathering similar, laminated, flaggy to slabby, hard, dense, fine-grained	35·0
13	Limestone breccia; autobreccia?, light grey, angular fragments averaging 1 inch in diameter in groundmass of medium light-grey limestone, fragments and groundmass weather to respective colours; massive, hard, dense, sublithographic fragments and groundmass	5·0
12	Limestone; medium light-grey, weathering light-grey, very thin-bedded, flaggy, hard, dense, sublithographic; limestone pebble bed at base, resting with slight erosional contact on underlying stratum	31·0
11	Quartzose limestone; pinkish grey, weathering similar, very thin-bedded, flaggy, hard, dense, fine-grained	4·0
10	Sandstone; brownish grey, weathering to light grey, very thin-bedded, flaggy, hard, porous, fine-grained; cement, in part calcareous	21·0
9	Sandstone; pale red to dusky red, alternating with greenish grey sandstone, very thin-bedded, flaggy, hard, dense, fine-grained; calcareous cement	4·0
8	Shale; greyish green, fissile	0·5
7	Siltstone; greyish green, laminated	0·5
6	Sandstone; pale red to dusky red, weathering similar, very thin-bedded, flaggy, hard, dense, fine-grained; crossbedded	2·0
5	Sandstone; alternating pale red to dusky red and greenish grey strata, weathering similar, very thin-bedded, flaggy, hard, dense, fine-grained	6·0
4	Limestone; olive-grey to medium grey, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline to sublithographic	31·0
3	Limestone; greenish grey, weathering similar, very thin-bedded, flaggy, hard, dense, finely crystalline	4·0
	Covered	4·5
2	Limestone; light grey, weathering to yellowish grey, very thin-bedded, flaggy, hard, dense, finely crystalline; *Leperditia* sp.	6·0
	Covered	51·0
1	Sandstone; greenish grey to light grey, weathering similar, very thin-bedded, flaggy, dense, fine-grained; calcareous cement	4·0
	Total thickness	209·5
	Underlying strata, covered interval in member D.	

Fossils collected from basal strata of this member at Locality 14 in outcrops on the unnamed creek entering the southeastern side of Read Bay include: *Favosites* sp. cf. *F. hisingeri* M. Ed. and H., *Howellella* sp. A., *Hormotoma* sp., and unidentified ostracods.

Correlation

T. E. Bolton identified bryozoans from the Read Bay formation and, except where stated otherwise, A. E. Wilson identified the remainder of the shelly faunas. From his studies, Bolton concluded that the Read Bay bryozoans do not closely resemble forms in Silurian formations of more southern latitudes in North America but that they show close affinities to Upper Silurian bryozoans of Gotland described by Hennig (1908). The remainder of forms in the shelly faunas comprise, for the most part, new assemblages of provincial aspect. Perhaps most forms are unnamed species including several new genera. Consequently, until they are systematically studied, they only serve to make an approximate correlation. Forms that have been identified specifically or have been compared to established species, suggest inconclusive correlations mainly with Niagaran and Cayugan formations of North America and Ludlovian beds of Europe. Only one correlation is worthy of special notice and this rests on the general similarity of the brachiopod faunas of the Read Bay formation, particularly those from member A, with a small brachiopod fauna from southeastern Alaska described by Kirk and Amsden (1952). Among the brachiopods of the Read Bay formation the following are identical or closely comparable to forms common in this Alaskan fauna.

Read Bay Fossils Common to Silurian Forms from Alaska

Conchidium sp. cf. *C. alaskense* Kirk and Amsden
Nucleospira sp. cf. *N. hecetensis* Kirk and Amsden
Atrypella borealis Kirk and Amsden
A. tenuis Kirk and Amsden
A. scheii (Holtedahl)

Kirk and Amsden (1952, p. 55) conclude that, "this Alaskan brachiopod fauna does not appear to have any close relationship with other known North American faunas. Its closest affinities seem to be with the Upper Silurian faunas of Asia and Europe". Kirk and Amsden consider that a fauna described by Khodalevich (1939) from the eastern slopes of the Ural Mountains is the only other fauna closely resembling their brachiopod fauna from southeastern Alaska. Khodalevich's paper is not available to the writer. However, Kirk and Amsden (1952, p. 54) state, "The strata from which he (Khodalevich) obtained his specimens was assigned to the Upper Wenlock and Lower Ludlovian on the basis of a faunal study which embraced not only brachiopods, but also corals, gastropods, pelecypods and cephalopods. The generic suite seems to be similar to that of the present report, and there are also some specific similarities."

Though the shelly faunas of the Read Bay formation permit only general reference of this formation to the Ludlovian series, certain graptolite and ostracoderm faunas transgress the Stanley Head-Snowblind Bay line of facies change and serve to relate lower members of the Read Bay formation to the Cape Phillips formation and thereby permit more precise, though indirect, classification of a part of the Read Bay formation. Figure

3 illustrates the stratigraphic position and approximate lateral extent of the key faunas employed in correlating the Read Bay and Allen Bay formations with equivalent parts of the Cape Phillips formation.

The ostracoderm Cyathaspididae n. gen. A and sp. B, which occurs abundantly in Unit 14 of the type section of member A of the Read Bay formation, occurs equally abundantly some 17 miles to the north at Locality 62 in the Cape Phillips formation (p. 100). At the latter locality Cyathaspididae n. gen. A and sp. B is associated with a graptolite fauna belonging to the zone of *Monograptus testis* and *Cyrtograptus trilleri,* the uppermost graptolite assemblage of the Wenlockian series. This association forms the basis for separating correlative beds of the Wenlockian and Ludlovian series within the type section of member A of the Read Bay formation, and provides additional assurance that the Read Bay-Allen Bay formational contact lies within the Wenlockian series (p. 46). The occurrence of *Monograptus bohemicus* in the upper part of member A relates, directly, a part of the Read Bay formation to the standard section of the Silurian system of Europe. In Europe *M. bohemicus* ranges throughout all lower Ludlovian graptolite zones. However, as will be noted in the discussion of the Cape Phillips formation (p. 102), the range of this graptolite appears to be considerably less in that formation than in Europe and is probably confined to the middle part of the lower Ludlovian sub-series on the Cornwallis Islands. At any rate, the position of *M. bohemicus* in the upper part of member A suggests that no part of this member is younger than lower Ludlovian, a suggestion that finds further substantiation in the light of the stratigraphic occurrence of *M. ultimus* discussed below.

A further interesting and precise correlation follows from the foregoing correlations. The rich shelly faunas comprising the part of member A that overlies Unit 14 (Locality 40) in which Cyathaspididae n. gen. A and sp. B occurs and underlie the occurrence of *M. bohemicus* in Unit 57 are approximately correlative with one graptolite zone in the Cape Phillips formation, that of *M. nilssoni.*

On the south side of the valley of Snowblind Creek, which flows directly across part of the transition zone of facies change between the Allen Bay-Read Bay and Cape Phillips formations, it is still possible to differentiate members A, B, and C of the Read Bay formation. This is principally because member B maintains its lithological characteristics and negative topographic expression (marked by the Cape Hotham Escarpment), up to the south side of that creek. However, in this same area, member A and the lower part of member C are manifest chiefly as graptolitic facies and have therefore been mapped as Cape Phillips formation. To the north of Snowblind Creek strata equivalent to these members (with the exception of the upper part of member C) have been completely replaced by calcareous shale and argillaceous limestone. Even member B or equivalent strata are no longer recognizable as such in the Cape Phillips formation.

At Locality 61 on Snowblind Creek the zone of *Monograptus ultimus* directly overlies strata recognizable as member B of the Read Bay formation and therefore its position is determined to be in beds equivalent to the lower part of member C. The zone of *M. ultimus* in Bohemia and the correlative zone of *M. leintwardinensis* in Great Britain (the latter zone including *M. ultimus*) constitute the basal zone of the middle Ludlovian sub-series of Europe. Thus tentative correlation of the base of member C of the Read Bay formation is suggested with the base of the middle Ludlow, and member B is tentatively assigned to the lower Ludlow.

The foregoing correlations suggest that the 6,500 feet or so of strata comprising members C and D are of middle Ludlovian age or younger. Unfortunately, though the upper part of member C is known to be fossiliferous, these beds have not been thoroughly collected, and as beds of member D are mostly unfossiliferous, the upper age limit of the Read Bay formation remains somewhat doubtful. It is, however, unlikely that any part of this formation is younger than upper Ludlovian, particularly in view of the age of the overlying Snowblind Bay formation which has been dated as Upper Silurian or Lower Devonian. Furthermore, G. Arthur Cooper's study of the three brachiopod species in the youngest fauna collected in member C (Locality 57) tends to dispose of any possibility of Devonian equivalents in beds at least as young as these. Cooper writes (personal communication), "I am uncertain as to the generic character of the little dalmanellids. They probably are closely related to *Dalmanella* in the strict sense, but I can not supply you with the generic name. They suggest the dalmanellas we have here from the Silurian of Eastport, Maine. The little spiriferoid seems to be a *Howellella.* There is nothing about either of these that will suggest Devonian. The third species belongs to the Silurian genus *Protathyris* described by Kozlowski, 1929. This species is not the same as any of his, but is somewhat suggestive of *P. didyma* (Dalman). This genus is an Upper Silurian one in Poland, also like the American genus *Greenfieldia* which is present in our Upper Silurian."

It appears from structural evidence that the youngest beds of the Read Bay formation, probably comprising the upper part of member C and all of member D, have no equivalents in the Cape Phillips as represented on the Cornwallis Islands. The youngest beds of the latter formation, which are probably correlative with about the lower half of member C of the Read Bay formation, are dated as middle Ludlovian on the basis of graptolites. Therefore, it seems possible that upper Ludlovian equivalents might well be represented in the upper beds of the Read Bay formation, which are younger than the Cape Phillips formation, but this suggestion rests mainly on circumstantial evidence.

The brachiopod, *Atrypella phoca* which is restricted in occurrence to the lower part of member C of the Read Bay formation is worthy of special consideration. This brachiopod was described first by Salter (1852) as *Rhynconella phoca* from material collected on Cornwallis and Devon Islands by members of Austin's and Penny's squadrons in 1850-51. In 1914, Holtedahl referred Salter's brachiopod to the genus *Lyssatrypa* Twenhofel, and described a new species of this genus as *Lyssatrypa scheii* from Per Schei's series B in southwestern Ellesmere Island. Commencing with the work of Holtedahl (1914), the name *Lyssatrypa phoca* came into usage as the index species of Silurian shelly faunas in the Arctic Archipelago that were characterized by forms described by Salter (1852) and Haughton (1857) and variously considered Middle or Late Silurian in age. Holtedahl (1914), considered series B to be Keyseran in age and though *Lyssatrypa scheii* and not *Lyssatrypa phoca* was represented in this series, Holtedahl, nevertheless suggested that the faunas from Cornwallis and Devon Islands, containing the latter fossil, were closely related in age to series B. In 1924, Holtedahl (p. 130) reaffirmed his belief that one general fauna was involved and its age, "fairly near to the Silurian-Devonian boundary line".

In 1952, Kirk and Amsden transferred *Lyssatrypa phoca* and *Lyssatrypa scheii* to the genus *Atrypella*, erected by Kozlowski in 1929.

The present work has brought to light three important facts concerning the so-called "*Atrypella phoca* fauna". (1) None of the species in Schei's series B, which Holtedahl considered diagnostic of a Keyseran age, are represented in the faunas of the Read Bay formation. Therefore, presumably series B is younger than any part of the Read Bay formation. Accordingly, *Atrypella scheii*, which occurs abundantly throughout much, if not all, of the Read Bay formation and also occurs in series B of Ellesmere Island, embraces virtually all "*Atrypella phoca* faunas" of previous writers. (2) The "*Atrypella phoca* fauna" is not of one age as considered by many writers but apparently ranges from Wenlockian to upper Ludlovian and possibly even higher in its occurrence in series B of Ellesmere Island. (3) The occurrence of *Atrypella phoca* itself is confined to Localities 3 and 39 in the lower part of member C of the Read Bay formation which very probably represent a restricted zone that is approximately middle Ludlovian in age. It would, therefore, seem that *Atrypella scheii* is a more suitable choice as index species of Arctic faunas formerly designated the "*Atrypella phoca* fauna".

SILURIAN OR DEVONIAN

SNOWBLIND BAY FORMATION

Definition, Distribution, and Thickness. The Snowblind Bay formation is here named for exposures mainly of limestone breccia and conglomerate, siltstone, and sandstone between Snowblind Bay and Read Bay on the east coast of Cornwallis Island. This formation is there preserved in a broad, open, northeast-plunging structure named the Advance Bluff syncline. The only truly vertical sea-cliffs on Cornwallis Island are developed in virtually horizontal outcrops of Snowblind Bay strata at Advance Bluff (*see* Plate VIII, figure 1). Snowblind Bay beds have not been found elsewhere on Cornwallis Island.

Snowblind Bay strata constitute the youngest formation thus far found in the conformable lower Palæozoic sequence of the Cornwallis Islands. The Snowblind Bay formation rests conformably upon the Read Bay formation, with which it is folded, and, though the actual contact of these formations has not been observed, in many places exposures are abundant within a few feet of the junction. The contact is drawn where the first persistent stratum of limestone conglomerate makes its appearance in the alternating limestone, siltstone, and sandstone succession of upper Read Bay strata. Above the contact typical Read Bay limestone is replaced by coarse clastic limestone. A gradational rather than a disconformable relationship between the Read Bay and Snowblind Bay formations is suggested by the nature of the boundary. Owing to greater resistance offered to erosion by the Snowblind Bay limestone breccias, the contact, as determined, serves well for mapping. The present erosion surface marks the upper limit of the Snowblind Bay formation. Graphic measurement indicates an exposed minimum thickness of 800 feet for this formation.

Lithology. The lower 300 feet or so of this formation consists of thick- to very thick-bedded, blocky to massive, hard, dense limestone breccia and conglomerate alternating with light to moderate dusky red, laminated to very thin-bedded, flaggy to slabby, generally fine-grained sandstone and siltstone, as well as minor greenish grey siltstone. Crossbedding is apparent in some sandstone and siltstone strata. Thin-bedded, slabby, varicoloured limestone, sandy limestone, and dolomite form a minor constituent in the lower strata. Near the base of the Snowblind Bay formation, sandstone and siltstone strata comprise the principal lithologic types. Upwards in the succession sandstone and siltstone are gradually, but nowhere entirely, replaced by limestone breccia and conglomerate. In the upper 500 feet or so of the formation, reddish sandstone and siltstone are relegated to mere partings between coarse clastic limestone strata.

Layers of sandstone and siltstone reach a maximum thickness of about 30 feet in the lower part of the formation, but average about 5 feet. Beds of limestone breccia attain thicknesses up to 30 feet throughout the formation but average about 15 feet. The limestone breccias are composed of angular, subrounded and rounded cobbles, pebbles, granules, and sand fragments of varicoloured, generally hard, dense, finely crystalline to sublithographic limestone, and of lesser amounts of finely crystalline dolomite all embedded in a matrix of aphanitic calcite. Cobble-sized fragments predominate. Though the colour of individual fragments ranges considerably, greyish yellow to light moderate-red are the dominant fresh-surface colours as well as the principal weathering colours. The siltstone and sandstone strata of the Snowblind Bay formation and of member D of the Read Bay formation impart a characteristic red hue to the tract of land between Read and Snowblind Bays where these outcrop.

Faunas and Correlation. Invertebrate and vertebrate fossils have been collected in Snowblind Bay strata at Locality 42, near the north entrance to Read Bay. The invertebrate fossils occur in fragments of breccia and conglomerate stratigraphically above the vertebrates. A few fragments bearing comminuted crinoidal remains were observed in the field but were not collected. The invertebrate fossils brought back have been identified by A. E. Wilson as *Favosites* sp. and *Cladopora* sp. cf. *C. laqueatus* Rominger. Evidently these fossils were derived from an older formation and are of no assistance in dating the Snowblind Bay formation, but they are of interest because they establish that Silurian formations probably contributed material to the Snowblind Bay breccias.

Two rather small faunas composed mainly of ostracoderm fish of the order Heterotraci were collected in strata approximately 200 feet above the base of Snowblind Bay formation at Read Bay. One fauna was collected in situ in sandstone strata, the other from limestone talus lying within a few feet of the former. An attempt was made to locate the source bed of the talus collection and on the basis of lithological similarity alone this was provisionally determined as occurring a few feet above strata that yielded fossil fish in situ. Preliminary investigation of these faunas by the writer has yielded the following tentative identifications, to which are appended notes pertaining mainly to age and correlation.

Two members of the heterotracan family, Cyathaspididae Kiaer are associated in the talus collection. These are:

(1) *Ctenaspis* n. sp. aff. *C. dentatus* Kiaer. Several fine casts and complete dorsal carapaces are represented. This genus was first described by Kiaer (1930, p. 3), from the Ben Nevis beds, comprising the uppermost group in the Red Bay series of Spitzbergen and considered to be early Devonian in age. Wills (1935, p. 427) records a form

similar to *Ctenaspis* from Downtonian beds of Shropshire, England, and Zych (1931, p. 45), has described a new species of *Ctenaspis (C. kiaeri)* from Poland in strata generally regarded as Downtonian in age. Cursory examination of the Cornwallis Island forms suggests fairly close relationship to *Ctenaspis dentatus* from Spitzbergen.

(2) *Anglaspis* n. sp. This genus, represented by several undescribed but figured species (Kiaer, 1932, p. 20), constitutes the zone fossil of uppermost Fraenkelryggen strata, the lowermost group of the Red Bay series of Spitzbergen (Kiaer and Heintz, 1935, p. 16). For many years the entire Red Bay series has been regarded as of Downtonian age but more recently Gross (1950, pp. 37-38) has considered that the Downtonian-Dittonian boundary lies within the Fraenkelryggen group. According to this interpretation, the *Anglaspis* zone is of Dittonian (Early Devonian) age. The genus is however represented by one species, *A. macculoughi* (Woodward), from Downtonian beds of Shropshire, England (Wills, 1935, p. 429).

The following forms were collected in situ:

(1) Cyathaspididae gen. and sp. indet.; one ventral and a partly preserved dorsal carapace.

(2) *Pteraspis* sp. indet. cf. *P. podolica* (Zych). Only a poorly preserved part of the dorsal carapace is represented but the presence of enlarged cornual plates suffices to relate this form to the pteraspidid species group that are characteristic of Downtonian and Dittonian rocks in Poland (Gross, 1950, p. 46). A single, large and well preserved medial dorsal spine and a poorly preserved ventral carapace may also be referable to this species.

(3) Shagreen-like scales, resembling *Kallostrakon podura* described by Lankaster (1870, p. 60) as occurring in "Siluro-Devonian" strata in Great Britain.

(4) Several indeterminable bone fragments and spines probably referable to acanthodian fish.

The problem of the Silurian-Devonian boundary remains today a matter of considerable contention and this is especially true in England where type sections of the Ludlow, Downton, and Ditton series are found. In Great Britain authorities on this subject are divided in opinion as to whether the systemic boundary should be drawn at the top of the Ludlow or top of the Downton series. King (1934) would even include the Ditton series in the Silurian. Even the separation of Ludlow, Downton, and Ditton series from each other is a question on which there appears to be little unanimity of opinion. These problems are by no means easily resolved, and until some degree of stability is established in Europe, the placement of the Silurian-Devonian intersystemic boundary remains arbitrary. The writer, therefore, chooses to follow White (1950) who argues in favour of placing the Silurian-Old Red boundary at the base of the Ludlow bone-bed, mainly for reasons of priority and as most closely agreeing with Murchison's original boundary.

Admittedly, correlation on the basis of genera is unsafe, but may serve as guide to approximate age and faunal relationships. Faced with normal problems of classification, tentative reference of the Snowblind Bay fish fauna to the Downtonian or Dittonian series (a Devonian age) would have appeared reasonably secure. In view, however, of the Keyseran age determination (Late Silurian in terms of North American chronology) for the Disappointment Bay formation, which rests with structural unconformity on Cape Phillips formation and which from consideration of structural relationships is clearly younger than the Snowblind Bay formation, the writer has extended the tentative age assignment of the Snowblind Bay formation to Upper Silurian or Lower Devonian.

The possibility that the fish fauna of the Snowblind Bay formation may, in fact, be late Silurian in age may be reasoned from other premises. Pre-Downtonian nonmarine sequences and associated vertebrates are unknown and presumably such vertebrates, should they exist, would be very similar to their descendents in Downtonian and Dittonian rocks. This possibility is anticipated by White (1950, p. 63) who states, "... somewhere or other there are in strata coeval with the Silurian Upper Ludlow, faunas immediately ancestral and perhaps hardly to be distinguished from, the Downtonian faunas, although they may never be brought to light".

The problem of the age relationship of Snowblind Bay and Disappointment Bay formations will be discussed further under the heading of the latter formation.

ORDOVICIAN AND SILURIAN

CAPE PHILLIPS FORMATION

Definition. North of the Stanley Head-Snowblind Bay line of facies change on Cornwallis Island and on Little Cornwallis Island, strata chronologically and stratigraphically equivalent to the Allen Bay formation and much of the Read Bay formation are represented as a graptolitic facies to which the name Cape Phillips is here given. Stanley Head is situated on the middle part of the west coast of Cornwallis Island and Snowblind Bay at a comparable latitude on the east coast. The Stanley Head-Snowblind Bay line of facies change is, in actual fact, a transition zone that is unusually narrow and sharply defined. As strata of these three formations are inclined rather steeply in the vicinity of Stanley Head and Snowblind Bay, the zone or line of facies change is readily accessible to study and mapping. To the south of this line occur relatively pure carbonate sediments of the previously described Allen Bay and Read Bay formations, which are characterized by shelly faunas. In marked contrast, north of this line the latter formations are replaced by mainly impure carbonates, shales, and cherty carbonates of the Cape Phillips formation (*see* Figure 3). The latter is generally less resistant and darker in colour than its correlatives to the south. Moreover, the Cape Phillips beds are characterized by faunas consisting mainly of graptolites, radiolarians, and cephalopods. The separation thus effected by the facies change is both lithological and biological.

The coast-line along the northeastern extremity of Cornwallis Island, facing Maury Channel, trends obliquely across the strike of Cape Phillips beds which dip northeasterly at fairly gentle angles. There bedrock is almost continuously exposed for about 8 miles along the shore from Cape Phillips to Disappointment Bay and between these two places 5,070 feet of the Cape Phillips formation was measured by plane-table (*see* Figure 4). Though the base of the Cape Phillips-Disappointment Bay section is terminated by a fault and though here, as elsewhere, the upper contact of this formation has not been found, this section represents the largest continuous exposure of Cape Phillips beds and for this reason it is chosen as typical.

The shifting line of facies separation has been mapped somewhat diagrammatically as a vertical contact in the vicinity of Snowblind Creek, where intertonguing and intergrading relationships are well exposed. The same facies-formational demarcation has also been partly mapped near Stanley Head. At both these localities several hundred feet of dolomite strata in the lower part of the Allen Bay formation continue northwesterly as basal strata of the Cape Phillips formation and beyond the line of facies change as it is mapped (*see* Figure 3). At Stanley Head this northwesterly extension of resistant dolomite is marked by the promontory of Stanley Head itself. Except for the northwesterly continuation of dolomite strata, the mapped vertical contact essentially illustrates the contact relationship of the three formations, although it constitutes a somewhat broad boundary. Northwesterly, as far as the Cape Phillips formation has been traced on the two islands, dolomite strata in the lower part of the formation are gradually but not entirely replaced by shales and cherty carbonates.

Distribution and Thickness. The Cape Phillips formation is exposed mainly in two relatively long belts. One of these, in the northeastern part of Cornwallis Island borders Wellington Channel and occupies a large area that extends northwesterly from about the latitude of Snowblind Bay to the north end of Cornwallis Island. In this region, the bedrock strikes more or less parallel to the coast and dips fairly gently towards the channel. The second belt of Cape Phillips exposures occupies a part of northwestern Cornwallis Island and may be traced from about the latitude of Stanley Head northwesterly to and across the central region of Little Cornwallis Island. The structure of the northwest belt is not well known as the region has not been traversed thoroughly and exposures generally are scarce. Furthermore, the outcrop area is known to be complicated by normal faulting as well as by folding. Nevertheless, this belt of Cape Phillips exposures appears to be characterized by a northwesterly strike. The attitude of Cape Phillips beds in the two main belts of outcrops suggests that complementary limbs of a broad anticline or anticlinorium are involved. A third, minor exposure of Cape Phillips formation occurs along the axis of a syncline in eastern Little Cornwallis Island where a very small part of lower Cape Phillips strata is exposed.

In considering the thickness of Cape Phillips strata it should be remembered that this formation is the youngest formation in the lower Palæozoic succession thus far found in the Island area lying north of the Stanley Head-Snowblind Bay line of facies change and that nowhere has an upper contact with younger deposits been found. Based on faunal evidence, probably the youngest strata of the formation are found along the northeast coast of Cornwallis Island in the vicinity of Abandon Bay and Copeland Point. There, graphic measurement indicates a thickness of approximately 8,500 feet of Cape Phillips strata. This figure may serve to indicate the order of maximum thickness of this formation, but evidence based on the relative position of one of several well-defined graptolite zones shows that the thickness varies within wide limits throughout all regions of Cape Phillips outcrops. A comparison of the stratigraphic position of the zone of *Monograptus bohemicus* with respect to the top of the Cornwallis formation illustrates that the Cape Phillips beds and contemporary deposits are thickest in the southern parts of the area and thin to the north and northwest. In the Read Bay formation, the interval below this zone is about 7,000 feet, in the northern part of the northeast belt of Cape Phillips formation it is about 4,500 feet, and on Little Cornwallis Island it is only about 2,500 feet. As no thinning appears to have taken place in the Allen Bay and Read Bay formations, thinning is probably effected entirely within the Cape Phillips formation. Moreover, as the many graptolite zones between that of *M. bohemicus* and the base of Cape Phillips formation are generally recognizable throughout outcrop areas of the formation, it is evident that this northwesterly thinning represents decreased but nevertheless continuous sedimentation.

Subdivisions of Cape Phillips Formation

Three members are generally recognized throughout outcrop areas of this formation. Areally these members vary considerably in relative thickness and development and the contacts between them are more gradational than distinct. In certain regions, notably that of the type locality (*see* Figure 4), it is possible to delineate stratal divisions other than the three outlined below. However, these have not been recognized outside of this area and appear to bear little significance to the general tectonic and stratigraphic development of the formation as a whole. The general lithological characters and contact relationships of these members are discussed in ascending order.

Member A

This member comprises mainly an alternation of dolomite, argillaceous limestone, petroliferous shale and cherty argillaceous limestone; less significant constituents include limestone, cherty limestone, cherty calcareous shale, calcareous shale, and dolomitic limestone. Oblate to spheroid dolomite and calcite concretions are sparingly present. Mainly on the basis of graptolite faunas this member may be correlated approximately with Ashgillian series (Ordovician) and the lower and middle Llandoverian sub-series (Silurian).

As already noted, dolomite forms a notable constituent in the lower part of the Cape Phillips formation, especially near the Stanley Head-Snowblind Bay line of facies change. The dolomite is yellowish grey and greyish yellow, weathering to the same colours, thin- and thick-bedded, porous to dense, medium to coarsely crystalline. Pores up to 1 inch in diameter and commonly filled with solid bitumen are a conspicuous feature in certain dolomite beds, particularly in the northern parts of both belts of Cape Phillips outcrops where the proportion of dolomite is considerably reduced in the sequence.

A persistently developed stratum, 30 to 50 feet thick, marks the base of the Cape Phillips formation. It consists of dolomitic limestone, generally greyish yellow, weathering to yellowish grey, thick-bedded, massive, hard, generally porous, finely to medium crystalline. This stratum rests with sharp yet conformable contact on the uppermost, highly fossiliferous, greyish green shale of the Cornwallis formation and apparently represents a continuation of the same stratum that marks the base of the Allen Bay formation (p. 43).

The chert that occurs in the argillaceous limestone, limestone, and calcareous shale in succeeding beds of this member is brown, bluish grey, or various other shades of grey. It occurs as nodular replacements, irregular to regular, very thin individual strata or as intimate yet variable admixtures of the carbonate rocks. Strata of this division, other than the dolomite, dolomitic limestone, and dark grey bituminous shale, are generally various hues of grey and are very thin-bedded, hard, dense, sublithographic and finely crystalline.

Member B

Member B overlies member A with gradational contact. It is composed of cherty argillaceous limestone, argillaceous limestone, cherty calcareous shale, cherty limestone, limestone, calcareous shale, and minor shale. The upper beds and enclosed faunas of this member are shown in the columnar section of the type locality (*see* Figure 4). Graptolite-bearing calcite concretions are sparingly represented throughout member B, which is approximately correlative with the upper Llandoverian sub-series.

Lithologically, member B differs from member A in several respects. Dolomite is absent, shale is no longer a conspicuous constituent, nor is it petroliferous. Moreover, the proportion of chert in the sediments has increased greatly.

Member C

Member B grades imperceptibly into the overlying member C, which includes an extremely monotonous succession of alternating calcareous shale, argillaceous limestone, limestone and shale strata. Cherty argillaceous limestone is a lesser constituent of the lowermost beds. Graptolite-bearing concretions are found throughout this division but are most common in the lower beds. Member C is approximately correlative with the Wenlockian and the lower and middle subdivisions of the Ludlovian series (Silurian). The lithological and palæontological characters of this member are well exhibited in the columnar section of the type locality (*see* Figure 4).

Though marked lateral variations in thickness characterize the three members throughout outcrop areas of the Cape Phillips formation, member C is much the thickest and appears to account for roughly three-quarters of the aggregate thickness. There is a marked increase in argillaceous content of sequentially higher beds of member C and this is particularly evident on Little Cornwallis Island and nearby Marshall Peninsula where strata of this member attain the composition of shale.

Fresh-surface and weathering colours of member C are generally various shades of grey, brownish grey and yellowish grey. Almost without exception, strata are thin-bedded to laminated. Shale partings are common and generally spaced at 2- to 5-inch intervals and in consequence the interbedded limestones weather to flagstone. Textures of the limestone beds range from sublithographic to finely crystalline and these rocks commonly fracture conchoidally. They generally produce a clinking sound underfoot.

Graptolite-Bearing Concretions

The Cape Phillips formation is characterized by well-preserved graptolites that occur in brownish grey to brownish black sublithographic to lithographic, very hard, dense, calcite concretions. These possess oblate to spheroid shapes and range from cobble to boulder size. Calcite concretions are developed in certain strata throughout the Cape Phillips formation. The stratigraphic distribution of the concretionary bands in the type section is shown in Figure 4. Certain strata may yield dozens of concretions whereas others yield very few. A few graptolite-bearing dolomite concretions were found in lower strata of the Cape Phillips formation, particularly on the Marshall Peninsula.

Graptolites are preserved in these concretions as uncompressed specimens and may be freed from their calcite matrix by treatment in hydrochloric or acetic acid. The number of graptolite specimens obtained from a single concretion varies from a very few to several hundred. Radiolarions, triaxon sponge spicules, and cephalopods are commonly associated with the graptolites in these concretions and these also vary considerably in abundance. Polychaete jaws, ostracods, and desma sponge spicules are less common associates. In certain specimens the camerae of cephalopods and the common canals of graptolites are filled with solid bitumen. Concretions apparently devoid of fossils were observed commonly but owing to limitations on amount of materials that could be transported by canoe, none was brought back for critical examination.

Each concretion is generally "case-hardened" by a shell of pyrite a millimetre or more thick and this, in part at least, accounts for the difficulty experienced in breaking the concretion with a hammer. Finely disseminated pyrite occurs less abundantly throughout the concretions. Moreover the pyrite shell generally is surrounded by a shell of pure clay 1 to 5 mm. thick by reason of which concretions are easily extricated from the outcrop. Bedding planes are faintly developed to absent, depending directly upon the shale content of the concretion; the greater the proportion of calcite in the concretion the less apparent are bedding planes. Uncompressed graptolites are generally disposed along one or more planes within the concretion and in a haphazard fashion, and beds surrounding concretions either arch around them or are truncated.

Graptolite-bearing concretions are found only in calcareous shales and argillaceous limestones. Rocks of this type are well developed in member C of the Cape Phillips formation, in which concretions are particularly abundant. Compared with graptolite-bearing formations in other parts of the world, compressed graptolites are generally few in the bedded sediments of the Cape Phillips formation. Few of those seen in concretions were observed in a compressed state in the bedded sediments enclosing the concretions. Indeed most of these sediments are unfossiliferous. Compressed graptolites are moderately conspicuous in rocks of Ludlovian age, especially high in the Cape Phillips formation where the composition of rocks commonly approaches or attains that of shale. Even there, intervals up to several hundred feet are seemingly devoid of graptolites and other fossils.

Faunas and Correlation

The graptolitic assemblages of the Cape Phillips formation have provided the zonal scheme shown in Table VI, where they are compared to the graptolite zones of Great Britain and Bohemia.

The distribution, characteristics, and correlation of the Cape Phillips faunas are presented in approximate order of their stratigraphic succession, commencing with the oldest.

Cape Phillips Ordovician Faunas

Four localities have yielded a predominantly cephalopod fauna of "Arctic Ordovician" aspect that represents the oldest fossils discovered up to the present in the Cape Phillips formation. Correlation of these faunas is summarized following a discussion of the local succession at each locality and the relationship of the Ordovician faunas to some immediately overlying Silurian faunas.

Locality 46, Marshall Peninsula. Graphic measurement indicates that about 450 feet of lowermost Cape Phillips strata are exposed in this northwest coastal region of Cornwallis. The beds are typical of member A. Also included in this exposure are the persistent dolomitic limestone beds that everywhere mark the base of the Cape Phillips formation.

A variety of cephalopods, and one species of graptolite and one species of trilobite, were obtained from a 32-foot section of alternating dark grey argillaceous limestone and dark grey petroliferous shale. The base of this fossiliferous interval lies approximately 125 feet stratigraphically above the base of the formation. There, as elsewhere, no fossils were observed in the lowermost hundred or more feet of Cape Phillips beds. The graptolite and trilobite species occur in prodigious numbers and no zonal sequence was apparent among the fossils collected in the 32 feet of strata. The fauna is as follows:

Fossils of Cape Phillips (Member A) Beds on Marshall Peninsula

Charactocerina eximia Sweet and Miller
Cyclendoceras intermedium Sweet and Miller
Endoceras proteiforme Hall
Ormoceras cornwallisense Sweet and Miller
Probillingsites sutherlandi Sweet and Miller

Fossils of Cape Phillips (Member A) Beds on Marshall Peninsula—Concluded

Parryoceras euchari Sweet and Miller
Spyroceras? nodosum Sweet and Miller
Spyroceras spp.
Pseudogygites latimarginatus (Hall)
Orthograptus n. sp. A

Approximately 55 feet stratigraphically above the interval in which the foregoing fauna was found, 16 feet of dark grey concretionary limestone beds yielded numerous uncompressed specimens of *Climacograptus latus* Elles and Wood. From an isolated outcrop, approximately on strike with exposures yielding *C. latus*, a single limestone concretion yielded several specimens of *Climacograptus supernus* Elles and Wood. The outcrops containing these two climacograptid species are about 400 feet apart. Although it is reasonably certain that *C. supernus* lies stratigraphically above beds bearing the above listed cephalopod fauna, its exact stratigraphic relationship to the *C. latus* band is uncertain. *C. latus*, as well as *C. supernus*, was first described from the Upper Ordovician of Scotland and it is therefore reasonable to assume that on Cornwallis Island they are very close in age.

Approximately 175 feet of apparently unfossiliferous strata overlie the *Climacograptus latus* band, and above this dolomite concretions yielded *? Armenoceras donetti* Foerste, *Orthograptus* n. sp. B aff. *O. bellulus* Tornquist, and *Climacograptus* n. sp. A aff. *C. rectangularis* (McCoy). By themselves these graptolites are not especially diagnostic of age. However, both species occur associated with numerous other graptolites at Locality 64 (p. 91) which permit correlation with the European zone of *Monograptus cyphus* of the lower Llandoverian (Münch, 1952, p. 47). It is therefore, obvious that the 175 feet of underlying unfossiliferous strata transgresses the Ordovician-Silurian boundary.

Locality 41, southeastern Little Cornwallis Island. Outcrops of Cape Phillips beds are scarce at this locality. Fossils were collected from dark grey argillaceous limestone 2 to 3 feet thick, which is estimated to lie somewhere within the basal 200 feet of the formation. This thin bed has yielded the following forms:

Fossils of Cape Phillips (Member A) Beds on Little Cornwallis Island

Cyclospira sp.
? *Apsidoceras elegans* Troedsson
Billingsites borealis (Parks)
Charactocerina borealis Sweet and Miller
Charactocerina thorsteinssoni Sweet and Miller
Diestoceras brevidomum Foerste
Endoceras bellicinctum Sweet and Miller

Fossils of Cape Phillips (Member A) Beds on Little Cornwallis Island—Concluded

? *Gorbyoceras maro* (Billings)
Westonoceras greggi Roy?
Pseudogygites latimarginatus (Hall)
Orthograptus n. sp. A.

Locality 44, southeastern Little Cornwallis Island. A faunal succession is found there in the lower part of the Cape Phillips formation that is broadly comparable to that found at Locality 46 on Marshall Peninsula, Cornwallis Island. However, several differences in faunal associations are significant. From a 9-foot exposure of dark grey, medium-bedded, argillaceous limestone situated approximately 125 feet stratigraphically above the base of the Cape Phillips formation, the following intimately associated fauna was found:

Fossils of Cape Phillips (Member A) Beds on Little Cornwallis Island

Apsidoceratidae gen. and sp. indet.
Beloitoceras spp.
? *Billingsites deformis* (Eichwald)
Billingsites sp. cf. *B. bellicinctus* Miller
Deiroceras subfusiforme Sweet and Miller
Diestoceras arcticum Sweet and Miller
? *Narthecoceras* sp.
Nybyoceras ventrolineatum Sweet and Miller
Oncoceras sp.
Richardsonoceras bellatulum Sweet and Miller
Pseudogygites latimarginatus (Hall)
Climacograptus latus Elles and Wood
Orthograptus n. sp. C

Pseudogygites latimarginatus occurs sparingly in this fauna, but approximately 30 feet stratigraphically lower in the formation it is abundantly represented in a small isolated exposure of dark grey bituminous shale. At this locality the basal 125 feet or so of Cape Phillips strata is for the most part not exposed.

Approximately 170 feet (covered interval) stratigraphically above strata yielding the cephalopod fauna, graptolite-bearing concretions were found with faunas that permit accurate correlation with the upper Llandoverian zone of *Monograptus turriculatus* (p. 97). A younger age than that of the Lower Silurian graptolites occurring stratigraphically above the Ordovician cephalopod fauna on Marshall Peninsula (Locality 46) is thus indicated.

Locality 22, western region of Little Cornwallis Island. At this place approximately 70 feet of Cape Phillips strata are exposed along a small creek. They comprise alternating dark grey, thin-bedded, flaggy, finely crystalline to sublithographic argillaceous limestone and dark grey shale. *Digenuoceras latum* (Foerste) and *Huroniella* sp. were collected in about the middle of this exposure but the stratigraphic relationship of these cephalopods to one another could not be determined. Stratigraphically higher and separated by a considerable covered interval, late Llandoverian graptolites were observed in outcrops along the same creek, but none was collected. The stratigraphic relationship of the above named cephalopods to the Ordovician cephalopod assemblages of Localities 41, 44, and 46 is not known. Presumably they too occur in the lower and Ordovician part of the Cape Phillips formation.

Walter C. Sweet and A. K. Miller identified the cephalopods from these four localities; A. E. Wilson identified *Pseudogygites latimarginatus* (Hall); and G. Arthur Cooper identified *Cyclospira* sp.

Sweet and Miller (MS. rept.) regard the cephalopods that dominate the oldest faunas in Cape Phillips formation as constituting part of the widespread so-called "Arctic Ordovician" fauna. These authors have noted that certain faunal differences distinguish the cephalopod faunas on Marshall Peninsula (Locality 46) from those on adjacent Little Cornwallis Island (Localities 41 and 44) and state that presence of *Probillingsites* in the fauna at Marshall Peninsula may indicate a somewhat older age than the faunas from Localities 41 and 44 where *Billingsites*, the presumed descendant of *Probillingsites*, occurs in some abundance and to the exclusion of the latter form. Sweet and Miller thus suggest that the fauna on Marshall Peninsula containing *Probillingsites* may be more closely correlative with other occurrences of "Arctic Ordovician" faunas, such as that of the Fremont formation of central Colorado and Silliman's Mount in southwest Baffin Island, which are similarly characterized by *Probillingsites* but do not include *Billingsites*. The presence of *Billingsites* in the faunas from southeastern Little Cornwallis may suggest correlation of these beds with the Dog Head member of the Red River formation in southern Manitoba and the several other "Arctic Ordovician" faunas characterized by this genus and not *Probillingsites*. Nevertheless, Sweet and Miller doubt that significant difference in age, if any, is indicated by these faunal dissimilarities and they regard the lower Cape Phillips cephalopods as well as those of the underlying Cornwallis formation as representing part of one general fauna and age. On the basis of generic comparisons, Sweet and Miller consider the "Arctic Ordovician" cephalopods in the upper part of the Cornwallis formation and lower part of the Cape Phillips formation as approximately correlative with the faunas of such formations as the Nelson River and Shamattawa of northeastern Manitoba, Stewartville of Iowa and Minnesota, Whitewood of South Dakota, Bighorn of Wyoming and several others.

Sweet and Miller favour a post-Trenton and pre-Richmond age for these "Arctic Ordovician" faunas and therefore correlation with the Eden or Maysville, or both. However, they point out that no direct comparisons of faunas can be made and therefore it is impossible to affirm a more exact correlation.

The age significance of *Digenuoceras latum* and *Huroniella* sp. from Locality 22 is somewhat difficult to appraise, as the stratigraphic relationship of these forms to Arctic Ordovician faunas at Localities 41, 44, and 46 is not clearly understood. *Digenuoceras latum* is a fairly well-known form in "Arctic Ordovician" faunas, whereas *Huroniella* has never been reported from strata older than Silurian. Sweet and Miller however tentatively regard both forms as part of the "Arctic Ordovician" fauna.

In Scotland *Climacograptus latus* and *Climacograptus supernus* occur in the highest Ordovician graptolite zone, that of *Dicellograptus anceps*, in the upper Hartfell shales (Elles and Wood, 1906, p. 208). This zone, together with the subjacent zone of *Dicellograptus complanatus*, comprises the two faunal zones of the Ashgillian series. (In connection with the discussion of *Pseudogygites latimarginatus* which follows, it may be worthwhile at this time, to note that the zone of *Dicellograptus complanatus* overlies the zone of *Pleurograptus linearis*, highest graptolite zone in the Caradocian series). The only other occurrence of *C. latus* and *C. supernus* known to the writer is that reported by Sun (1933, p. 50), who records these species from the Wufeng shale in China. Presumably these two graptolites are the chief basis for Sun's classification of the Wufeng shale as Ashgillian. The occurrence of these two climacograptids stratigraphically above the Ordovician cephalopod fauna on Marshall Peninsula and the association of *C. latus* with the Ordovician cephalopods at Locality 44 appears to substantiate, in part at least, Sweet and Miller's suggestion that the Marshall Peninsula assemblage is somewhat older than those at Localities 41 and 44. Moreover the presence of *C. latus* suggests an Ashgillian age for the Ordovician cephalopods at Locality 44. Furthermore, it is of interest to note that *Orthograptus* n. sp. A occurs in association with the Ordovician cephalopod faunas at Localities 41 and 46, but apparently is not associated with the Ordovician cephalopods at Locality 44. In view of the age relationship of the faunas from Localities 41, 44, and 46 suggested by Sweet and Miller, the occurrences of *Orthograptus* n. sp. A may suggest an intermediate age for the fauna from Locality 41, though at the same time lending support to the contention by these authors that the discussed faunas probably do not differ markedly in age.

Orthograptus n. sp. A and C are not closely related to any known species, though related generally to several high Caradocian and Ashgillian forms. Consequently, these alone provide no basis for precise age determination.

G. Arthur Cooper, who identified *Cyclospira* sp. from Locality 41, reported on this form as follows (personal communication): "I am unable to give...a specific name for this species but...it seems to be intermediate between *Cyclospira bisulcata* from the Trenton and Cobourg formations and *Cyclospira glansfagea* described by Kindle and me from the Whitehead formation in Gaspe, Quebec. This would suggest to me a probable age for your specimens of very high Middle Ordovician or low Upper Ordovician." Cooper's use of Middle and Upper Ordovician are in terms of American chronology.

Pseudogygites latimarginatus is a common trilobite in the Collingwood formation of Ontario and is reported (Sproule, 1936, pp. 102-103) to occur throughout the underlying Cobourg formation in the region of Collingwood, Ontario. Kay (1937, p. 280) records *P. latimarginatus* in the Hillier, the upper member of the Cobourg formation in New York. Correlation of the Collingwood and overlying Gloucester formations (*P. latimarginatus* is not known to occur in the latter formation) is firmly established with the Holland Patent (or Upper Utica), the uppermost member of the Utica formation in New York, mainly on the basis of graptolites (Ruedemann, 1925, pp. 63-64). The graptolite faunas of Collingwood, Gloucester, and Holland Patent strata permit correlation with the zone of *Pleurograptus linearis*, highest zone in the Caradocian series of the standard of the Ordovician system in Great Britain. Though the top and base of the *P. linearis* zone is somewhat ill-defined in eastern North America, it is evident that *P. latimarginatus* does not range to the top of this zone and may even be ranging lower in its occurrence in the Cobourg formation.

Besides the occurrences of *Pseudogygites latimarginatus* in Ontario and New York, the only other records of this trilobite are from several widely scattered localities in southeastern Baffin Island and neighbouring regions of the mainland, though there, it has never been collected in situ. In the talus or drift collections of these Arctic occurrences fossils directly associated with *P. latimarginatus* have either been typical Utica forms (using this term in the broad sense) or forms of Utica aspect[1].

Several authors (Kay, 1935, p. 589; Kirk, 1925, p. 446), who have dealt with the difficult age problem of "Arctic Ordovician" faunas, have considered that establishment of the stratigraphic relationship of the Collingwood elements occurring in the Arctic to an "Arctic Ordovician" fauna would provide the solution to the age of the latter. The occurrence of a typical Collingwood species, *P. latimarginatus*, with a typical "Arctic Ordovician" cephalopod fauna in Cape Phillips formation is interesting, but

[1] A typical sample of one of these Utican faunas was collected by Y. O. Fortier in 1949 in drift at Noble Inlet, southwestern Baffin Island. From one rock specimen, G. Winston Sinclair has identified the following forms: *Leptobolus insignis*, n. var., juvenile orthid, cf. *Dalmanella*, *Geisonoceras* sp., *Isotelus*, *Triarthrus* sp., aff. *becki*, *Pseudogygites* sp. and crinoid fragments. The writer has identified the following and associated graptolites: *Climacograptus typicalis* n. subsp. ? *Climacograptus aequalis* Parks, and *Diplograptus* sp.

its age significance is somewhat difficult to appraise. In view of the comparatively restricted range of *P. latimarginatus* in Ontario and New York, and as this trilobite seemingly maintains a similar range in its occurrences on Baffin Island and neighbouring regions of the mainland, the occurrence of *P. latimarginatus* in lower strata of Cape Phillips formation suggests, at first sight, a Cobourg or Collingwood correlation. Presumably, therefore, the upper part of the underlying Cornwallis formation, in which "Arctic Ordovician" fauna is well developed but which does not include this trilobite, would be approximately correlative with Cobourg or even older formations in the type section of the Ordovician for North America. However, such precise correlations based solely upon *P. latimarginatus* lose some effect in view of the following facts: *P. latimarginatus* is apparently associated with other Collingwood forms as far north as Baffin Island, but none of these occur with this trilobite in the Cape Phillips formation. The graptolites with which *P. latimarginatus* is associated in Cape Phillips strata appear to bear no relation to Collingwood or Utica forms. Moreover, the association of *P. latimarginatus* with *Climacograptus latus* indicates that either the former ranges higher than previously recorded or the latter ranges lower.

Two Ordovician faunal zones are established tentatively in the lower part of the Cape Phillips formation: (1) a zone of *Orthograptus* n. sp. A, and (2) a zone of *Climacograptus latus.* On the basis of *C. latus* the fauna of Locality 44 is correlated with the zone of *Dicellograptus anceps* in the Ashgillian series (Upper Ordovican). The faunas of Localities 41 and 46 are referred to the subjacent zone of *Dicellograptus complanatus* also of the Ashgillian series. This suggested correlation is based on (1) the apparent close biological and stratigraphic relationships of the cephalopod faunas of Localities 41 and 46 to those of Locality 44 and (2) the convenience of regarding the stratigraphic break represented by the Cornwallis—Cape Phillips formational contact as separating the Caradocian and Ashgillian series. However, in view of the absence of forms at Localities 41 and 46 that might permit direct comparison with the zone of *D. complanatus* together with the presence of possible Caradocian elements (*P. latimarginatus* and *Cyclospira* sp.) the suggested correlation of the faunas included in the zone of *Orthograptus* n. sp. A cannot be considered to be more than a guess.

Cape Phillips Silurian Faunas

Twenty-two Silurian graptolite zones have been recognized in the Cape Phillips formation and most of these can be correlated directly with the Silurian graptolite zones of Europe. A few of the Cape Phillips graptolite zones—those characterized by new forms as index species—represent new assemblages. Except for the two youngest graptolite zones

(*Monograptus* n. sp. P and *Monograptus* n. sp. T) little difficulty has been experienced in establishing approximate correlation of these new zones with those of European successions, for they are narrowly limited between zones of the Cape Phillips formation that permit precise correlation.

The graptolite zones and three small, shelly facies faunas of the Cape Phillips formation will now be discussed in ascending order.

I. Zone of *Monograptus cyphus*

About 5 miles east of Abandon Bay, which is situated on the northeast coast of Cornwallis Island, several graptolite-bearing concretions were collected within a radius of 100 feet. These were not found in situ but lay loose in the clay and boulder mantle on an upland surface through which sporadic outcrops of Cape Phillips strata project. The occurrence of these concretions is designated as Locality 64. The stratigraphic level in the underlying bedrock from which the concretions presumably were derived is roughly 300 to 400 feet above the base of the Cape Phillips formation. The concretions have yielded the following fauna:

Fossils of Cape Phillips (Member A) Beds near Abandon Bay

Climacograptus extremus Lapworth
C. extremus Lapworth, n. sub sp.
C. hughesi (Nicholson)
C. n. sp. A aff. *C. rectangularis* (McCoy)
C. sp. cf. *C. trifilis* Manck
Orthograptus n. sp. B aff. O. *bellulus* Tornquist
O. n. sp. D
Glyptograptus n. sp. B aff. *Climacograptus trifilis* Manck
G. tamariscus Nicholson
Diplograptus n. sp.
D. modestus Lapworth
Amplexograptus n. sp.
Dimorphograptidae n. gen. A and sp. A aff. *Orthograptus bellulus* Tornquist
Dimorphograptidae n. gen. A and spp. B and C
Retiolitidae n. gen. A, and sp. A
Monograptus sp. cf. *M. cyphus* Lapworth
M. sp. cf. *M. sandersoni* Lapworth
M. gregarius Lapworth

The general aspect of this fauna and particularly specifically identified forms suggest well-substantiated correlation with the central European zone of *Monograptus cyphus* (Münch, 1952, p. 47) in the lower Llandoverian sub-series. The above faunal list comprises the aggregate faunas of several concretions and though faunal differences were apparent in each, indicating that several stratigraphic horizons probably are represented, no aspect of these faunas suggests the possibility of any other correlation.

TABLE V

Sequence of Graptolite Zones in Cape Phillips Formation and Correlation with Bohemia and Great Britain

System	German Subdivisions	Standard Series and Sub-Series	Bohemia Stages	Graptolite Zones of Bohemia (after Münch 1952)	Graptolite Zones of the Cape Phillips formation	Graptolite Zones of Great Britain (after Elles and Wood 1901-18)
Silurian	20c	Upper Ludlow	e γ	*M.*[1] *hercynicus*		
	20b	Middle Ludlow	e β 2	*M. angustidens*		
				M. uncinatus uniformis		
				M. transgrediens		
				M. perneri and		
				M. bouceki		
				M. lockovensis	? *M.* n. sp. T	
				M. spectatus	? *M.* n. sp. P	
				M. ultimus and *M. leintwardinensis*	*M. ultimus*	*M. leintwardinensis*
	20a	Lower Ludlow	e β 1	*M. tumescens*	*M. tumescens minor*	*M. tumescens*
				M. fragmentalis	*M.* n. sp. O ? *M.* n. sp. N ?	
				M. longus	*M. bohemicus*	
				M. leintwardinensis primus		

Silurian			*M. scanicus* and *M. nilssoni*	*M. nilssoni*	*M. scanicus* *M. nilssoni* *M. vulgaris*
19	Wenlock	e α 2	*M. testis*	*M. testis* and *Cyrto. trilleri*	?
19	Wenlock	e α 2	subzone: *Cyrto.*[2] *lundgreni*	*Cyrto. lundgreni*	*Cyrto. lundgreni*
19	Wenlock	e α 2	subzone: *Cyrto. radians*		
19	Wenlock	e α 2	*Cyrto. perneri* and *Cyrto. ramosus*	*Cyrto. perneri*	*Cyrto. ellesi* (= *C. rigidus* of Elles and Wood)
18	Wenlock	e α 2	*M. flexilis*	*Cyrto.* n. sp. G *Cyrto.* n. sp. F *Cyrto.* n. sp. C	*Cyrto. linnarssoni*
18	Wenlock	e α 2	*Cyrto. rigidus*	*Cyrto. rigidus*	*Cyrto. rigidus* (= *C. symmetricus* of Elles and Wood)
17	Wenlock	e α 2	*M. riccartonensis*	*M. riccartonensis*	*M. riccartonensis*
17	Wenlock	e α 2	subzone: *M. firmus*		
17	Wenlock	e α 2	*Cyrto. murchisoni*	*Cyrto. murchisoni*	*Cyrto. murchisoni*
17	Wenlock	e α 2	*Cyrto. centrifugus*		

[1]*M.* = *Monograptus* [2] *Cyrto.* = *Cyrtograptus*

TABLE V—*Concluded*

Sequence of Graptolite Zones in Cape Phillips Formation and Correlation with Bohemia and Great Britain—Concluded

System	German Subdivisions	Standard Series and Sub-Series	Bohemia Stages	Graptolite Zones of Bohemia (after Münch 1952)	Graptolite Zones of the Cape Phillips formation	Graptolite Zones of Great Britain (after Elles and Wood 1901-18)
Silurian	16	Llandovery, Upper		*Stom.*[3] *grandis*	*Cyrto.* n. sp. A and *Stom. grandis*	
				M. prosbosciformis	*M. spiralis*	
				M. spiralis		
				subzone: *Diverso.*[4] *pergracilis*		
			e α 1	subzone: *M. crenulatus*		*M. crenulatus*
				M. griestoniensis		*M. griestoniensis*
				M. crispus	?	*M. crispus*
	15			subzone: *M. runcinatus*	*M. turriculatus*	*M. turriculatus*
	14			*M. turriculatus*		
				Rastrites linnaei		band of *Rastrites maximus*
	13			*M. sedgwicki*		*M. sedgwicki*

	12b	Llandovery	Middle		subzone: *Cephalograptus cometa*		band of *Cephalograptus cometa*
	12b	Llandovery	Middle		*M. convolutus*	? *M. millepeda*	*M. convolutus*
	12b	Llandovery	Lower		subzone: *Rastrites peregrinus*		*M. gregarius* a) subzone: *M. argenteus* b) subzone: *M. triangulatus* c) subzone: *M. fimbriatus*
	12b	Llandovery	Lower		subzone: *Rastrites approximatus geinitzi*		
	12a	Llandovery	Lower		*M. triangulatus* *M. pectinatus*		
	11	Llandovery	Lower		*M. cyphus*	*M. cyphus*	*M. cyphus*
	10	Llandovery	Lower		*Akidograptus acuminatus*		*Diplograptus modestus* and *Orthograptus vesiculosus*
	10	Llandovery	Lower				*Akidograptus acuminatus*
Ordovician		Ashgill		dζ2	?	*Climacograptus latus*	*Dicellograptus anceps*
Ordovician		Ashgill		dζ1	*Dicellograptus anceps*	*Orthograptus* n. sp. A	*Dicellograptus complanatus*
Ordovician		Caradoc (uppermost)		d ε 2 c	*Diplograptus vulgatus*		*Pleurograptus linearis*

[3] *Stom.* = *Stomatograptus*   [4] *Diverso.* = *Diversograptus*

No representatives have been found in this formation of the zone of *Akidograptus acuminatus,* lowest Silurian graptolite zone observed in Europe.

Concretions from two other localities in Cornwallis Island have yielded small collections of graptolites that are assigned tentatively to the zone of *M. cyphus.* At Locality 63 on Snowblind Creek, the following graptolites were collected some 1,500 feet stratigraphically above the base of Cape Phillips formation:

Fossils of Cape Phillips (Member A) Beds on Snowblind Creek

Climacograptus n. sp. A aff. *C. rectangularis* (McCoy)
Dimorphograptidae n. gen. A and sp. B
Retiolitidae n. gen. A and sp. B

At Locality 65, situated 3·5 miles southeast of the head of Disappointment Bay, the following graptolites were collected at a level in Cape Phillips strata estimated as 300 to 400 feet above the base of the formation:

Fossils of Cape Phillips (Member A) Beds near Disappointment Bay

Climacograptus sp. indet.
C. hughesi (Nicholson)
C. sp. cf. *C. trifilis* Manck
Retiolitidae n. gen. A and sp. A
Monograptus sp. indet.
Rastrites sp. indet.

With the exception of *Rastrites* sp. indet., all species from Localities 63 and 65 are represented in the zone of *Monograptus cyphus* as it is developed at Locality 64. Though it is possible that the *Rastrites* from Locality 65 indicates a somewhat younger age for the fauna of this locality no significant age difference seems likely.

II. Zone of *Monograptus millepeda*

The following graptolites were isolated from a dolomite concretion that was collected at an indeterminable level in Cape Phillips strata on Marshall Peninsula (Locality 70):

Fossils of Cape Phillips (Member A) Beds on Marshall Peninsula

Climacograptus n. sp. B. aff. *C. scalaris* Linnarsson
Climacograptus extremus Lapworth
Diplograptus n. sp. aff. *D. thuringiacus* Eisel
Plegmatograptus sp. indet.
Monograptus sp. indet.
Rastrites sp. indet.

About 5·5 miles east-southeast of the above locality and on Rookery Creek (Locality 69) another dolomite concretion yielded a similar graptolite fauna. The stratigraphic level from which this concretion was collected is estimated as 400 feet stratigraphically above the base of the Cape Phillips formation. The fauna is as follows:

Fossils of Cape Phillips (Member A) Beds on Rookery Creek

Climacograptus n. sp. B. aff. *C. scalaris* Linnarsson
Orthograptus n. sp. D
O. n. sp. E
O. n. sp. F
Diplograptus n. sp. aff. *D. thuringiacus* Eisel
Retiolitidae n. gen. A and sp. B
Retiolitidae n. gen. B and sp. B
Retiolitidae n. gen. C and sp. A
Monograptus sp. indet.
M. millepeda McCoy
M. regularis Tornquist cf. sub sp. *solidus* Přibyl

The faunas of Localities 69 and 70 undoubtedly are very close to one another in age and it is probable that both concretions came from the same stratigraphic level. Except for *Orthograptus* n. sp. D, none of the graptolites of these localities indicates correlation with the European zone of *Monograptus cyphus* that occurs in the fauna of Locality 64. The graptolites of Localities 69 and 70 can, however, be closely correlated with the European zone of *M. convolutus* (Münch, 1952, p. 46) in the middle part of the Llandoverian sub-series. As the European index species is apparently absent, the very characteristic and abundant, *M. millepeda* is tentatively chosen as index fossil for this zone in the Cape Phillips formation.

III. Zone of *Monograptus turriculatus*

Mention has already been made of the only occurrence of this graptolite zone in the Cornwallis Islands, at Locality 44. Two horizons of graptolite-bearing concretions are exposed about 170 feet stratigraphically above the Ordovician zone of *Climacograptus latus* on Little Cornwallis Island. The lower of these concretions has yielded abundantly of a single species only, *Monograptus runcinatus* Lapworth. Nine feet stratigraphically higher graptolite-bearing concretions yielded the following forms:

Fossils of Cape Phillips (Member A) Beds on Little Cornwallis Island

Orthograptus n. sp. D
Petalograptus palmeus (Barrande)
Monograptus n. sp. aff. *M. spiralis* (Geinitz)
M. turriculatus (Barrande)
M. sp. indet.
Diversograptus runcinatus Strachan

These graptolites permit secure correlation with the zone of *Monograptus turriculatus* in the upper Llandoverian sub-series of Europe (Münch, 1952, p. 45). It is interesting to note that Münch does not record *M. runcinatus* in this zone but in an immediately overlying subzone with this form as an index species. The reverse sequence apparently prevails on Little Cornwallis. In this region *M. runcinatus* will be tentatively included in the zone of *M. turriculatus.*

IV. Zone of *Monograptus spiralis*

The zone of *Monograptus spiralis* constitutes one of the most widely recognized zones in the Cape Phillips formation. Figure 4 illustrates the extent of this zone through a thickness of 320 feet of beds in the type section. None of the other many occurrences of this zone in the Cape Phillips beds is indicated on the accompanying map. Correlation of the zone with European graptolitic facies is not entirely satisfactory, as is not surprising in view of the comparatively long range of *M. spiralis* in Great Britain. Elles and Wood (1914, p. 542) record this form as ranging from the zone of *M. turriculatus* to the zone of *M. crenulatus* in the upper Llandoverian sub-series. In Bohemia on the other hand *M. spiralis* constitutes the index species of one of several graptolite zones that are apparently younger than any of the British upper Llandoverian zones (*see* Table VI). In the Cape Phillips formation the zone of *M. spiralis* appears to comprise all beds above the zone of *M. turriculatus* and below the zone of *Cyrtograptus* n. sp. A and *Stomatograptus grandis* (*see* Figure 4).

Correlation of the zone of *M. spiralis* in the Cornwallis Islands with that of Europe is further complicated by the stratigraphic position of *M. griestoniensis* in the Cape Phillips formation. In this formation *M. griestoniensis* is not associated with *M. spiralis* but occurs immediately above in the zone of *Cyrtograptus* n. sp. A and *Stomatograptus grandis,* where it is abundant near the base of that zone. In Bohemia and Great Britain *M. griestoniensis* comprises correlative zones stratigraphically below the Bohemian zone of *M. spiralis.* Apparently, the range of *M. griestoniensis* is greater than known hitherto.

Other graptolites associated with *Monograptus spiralis* do not aid in effecting more precise correlation of the zone of *M. spiralis* as it is developed in the Cape Phillips formation. The correlation of this zone as shown in Table V cannot be regarded as more than approximate.

V. Zone of *Cyrtograptus* n. sp. A and *Stomatograptus grandis*

The associated forms and stratigraphic position of the zone of *Cyrtograptus* n. sp. A and *Stomatograptus grandis* is shown in the section of the type locality (*see* Figure 4). This is the highest zone in upper Llandoverian beds of the Cape Phillips formation and this zone may be correlated with the zone of *S. grandis* in Bohemia (Münch, 1952, p. 42).

Two other localities on the Cornwallis Islands have yielded faunas of special interest, one of which is very probably, the other less probably, related to this zone.

At Locality 67 on Rookery Creek, in the northwest coastal region of Cornwallis Island, numerous specimens of the ostracoderm Anaspidida n. gen. A, and sp. A were collected in calcareous shale in intimate association with numerous, though rather poorly preserved, graptolites. The latter are identified as follows:

Fossils of Cape Phillips (Member B) Beds on Rookery Creek

Paraplectograptus sp. cf. *P. eiseli* (Manck)
Monograptus sp. cf. *M. griestoniensis* (Nicholson)
M. sp. cf. *M. priodon* (Bronn)
M. sp. indet.
Cyrtograptus sp. indet.

These fossils were collected directly below the zone of *Cyrtograptus murchisoni* and above an occurrence of *Cyrtograptus* n. sp. A. The common stratigraphic position of anaspidids at this locality and at about the 4,650-foot level in the type section (*see* Figure 4) suggest that identical stratigraphic levels are involved. Moreover, the composition of the associated graptolites suggests affinities with faunas of the Llandoverian rather than with the Wenlockian series, and it is mainly for this reason that the anaspidid faunas of Localities 19 and 67 are considered as part of the zone of *Cyrtograptus* n. sp. A and *Stomatograptus grandis* and not included in the overlying Wenlockian zone. This is the oldest recorded occurrence of anaspidids below late Ludlovian beds and probably represents the oldest known occurrence of Silurian ostracoderms.

At Locality 53 in the eastern part of Little Cornwallis Island several well-preserved specimens of *Monograptus convolutus coppingeri* Etheridge were collected in a small and isolated outcrop of shale. This is the only occurrence of this characteristic Arctic graptolite in the Cape Phillips formation. There *M. convolutus coppingeri* is not associated with other forms but appears to lie below strata bearing *Stomatograptus grandis* and above beds yielding *M. spiralis.* Because of inadequate exposures it is however impossible to determine its zonal position. Tozer (1956) has found this species on the west coast of Melville Island, where it is directly associated with *M. priodon* and *M.* sp. cf. *M. vomerinus,* thus suggesting affiliation with the zone of *Cyrtograptus* n. sp. A and *S. grandis* rather than with the zone of *M. spiralis.* It is possible that future investigation may prove that a distinct faunal zone is involved, but at the same time one considerably younger than the typical form in Europe.

VI. Zones of *Cyrtograptus murchisoni* to *C. lundgreni*

Characteristic faunal assemblages and successions of these zones are well shown in the type section of the Cape Phillips formation (Figure 4). Correlation of these zones with European zones is shown in Table V.

VII. Zone of *Monograptus testis* and *Cyrtograptus trilleri*

A small graptolite fauna represents the zone of *Monograptus testis* and *Cyrtograptus trilleri* in the type section (Figure 4), where, however, one of the index species, *M. testis*, is apparently absent. Two other graptolite collections made outside the type locality serve to elaborate the general characteristics of this zone.

On Rookery Creek, near Marshall Peninsula, *Gothograptus nassa* (Holm) n. sub sp., *Plectograptus* n. sp. B and fragments of *Monograptus testis* (Barrande) were obtained from a concretion (Locality 68). Nine feet stratigraphically below this concretion, compressed yet well-preserved specimens of *Paraplectograptus eiseli* Manck and *Cyrtograptus trilleri* Eisel were collected. This is the only occurrence of *M. testis* and *C. trilleri* at one locality in Cape Phillips formation and even there they are not directly associated. As these two forms are associated in the European zone of *M. testis* (Münch, 1952, p. 42) and as *M. testis* and *C. trilleri* apparently occur in close proximity in Cape Phillips beds they are tentatively regarded as comprising a single zone that is the uppermost of the Wenlockian series.

At Locality 62 on Snowblind Creek in the central-east coastal regions of Cornwallis Island, the following graptolites were obtained from concretions in strata that also yielded heterostracan remains:

Fossils of Cape Phillips (Member C) Beds on Snowblind Creek

Gothograptus nassa (Holm) n. sub sp.
Spinograptus spinosus (Wood)
Monograptus dubius (Suess)
M. testis (Barrande)
Cyathaspididae n. gen. A and sp. B

Spinograptus spinosus occurs sparingly in the above fauna but associated with *Monograptus dubius* it ranges stratigraphically higher. Approximately 50 feet stratigraphically above the *M. testis* assemblage, *S. spinosus* occurs in prodigious numbers in a 2- to 3-inch bed. Above this occurrence, a considerable covered interval prevails.

Bouček and Münch (1952, p. 134) state that the range of *Spinograptus spinosus* lies within the lower Ludlovian sub-series of Britain, Sweden, Bohemia, and Bulgaria. The occurrence of this species associated with the high Wenlockian *Monograptus testis* assemblage at Locality 62 is therefore not unexpected, particularly in view of a record of *S. spinosus* in the middle part of the Wenlock series of Britain (Elles and Wood, 1914, p. 522). However, it is probable that the strata above the zone of *M. testis* and *Cyrtograptus trilleri*, into which *S. spinosus* ranges at Locality 62, should be regarded as lower Ludlovian.

VIII. Zone of *Monograptus nilssoni*

At Locality 60 on Snowblind Creek and at an undetermined horizon stratigraphically above the fauna at Locality 62, the following graptolites were collected in concretions and interbedded calcareous shales:

Fossils of Cape Phillips (Member C) Beds on Snowblind Creek

Plectograptus n. sp. C.
Monograptus nilssoni (Barrande)
M. colonus (Barrande) n. sub sp.
M. sp. cf. *M. praeultimus* Münch

The discovery of this fauna is particularly significant in establishing the presence of another lower Ludlovian fauna in the Cape Phillips formation. The zone of *Monograptus scanicus* and *M. nilssoni* comprise the lowest zone in the lower Ludlovian of continental Europe where, among other forms, *M. nilssoni*, *M. colonus*, and *M. praeultimus* are associated. In Great Britain the zone of *M. nilssoni* constitutes the second lowest Ludlovian zone (*see* Table V).

At Locality 59 on Snowblind Creek, stratigraphically above the foregoing fauna and separated by a considerable covered interval, another faunal assemblage was obtained which is also included in the zone of *Monograptus nilssoni* for the Cape Phillips formation. The fauna which was collected in shale comprises the following forms:

Fossils of Cape Phillips (Member C) Beds on Snowblind Creek

Ceratiocaris sp. cf. *C. acuminatus* Hall
Monograptus n. sp. U
M. nilssoni (Barrande)
M. tumescens Wood n. sub sp.
M. sp. indet. cf. *M. uncinatus* Tullberg

A similar assemblage of graptolites was collected at Locality 66 on Rookery Creek.

IX. Zones of *Monograptus bohemicus* to *M. tumescens minor*

The graptolite zones that succeed the zone of *Monograptus nilssoni* in the Cape Phillips formation are represented mainly by single species. A somewhat similar situation prevails in the carefully collected graptolitic facies of Europe where generally two to five species characterize the highest Silurian zones (Münch, 1952, p. 41).

Monograptus bohemicus, M. n. sp. N, *M.* n. sp. O and *M. tumescens minor* are represented in the type section of the Cape Phillips formation (*see* Figure 4) and of these four graptolites only *M. bohemicus* and *M.* n. sp. O have been collected outside the type section. *M. bohemicus* constitutes a well-marked zone in the Cape Phillips formation, as well as in member A of the Read Bay formation (Locality 47, near Cape Hotham and in the type section of member A on Goodsir Creek). Only a few of the many localities yielding this form have been recorded on the accompanying map. *M. bohemicus* was collected at Locality 28 on Snowblind Creek stratigraphically above the two faunas representing the zone of *Monograptus nilssoni* at Localities 59 and 60. *M. bohemicus* was also collected farther north near the head of Helen Haven (Locality 29) and stratigraphically higher at Locality 11, *M.* n. sp. N was collected in stream canyon developed in shale.

In Bohemia, *Monograptus bohemicus* ranges throughout all graptolite zones in the lower Ludlovian sub-series (Münch, 1952, pp. 41-42) and this species occurs in all but the lowest zone of *M. vulgaris* in the British lower Ludlow (Elles and Wood, 1911, p. 368). However, it is apparent that the range of *M. bohemicus* in Cape Phillips beds is considerably less than in Europe. In this formation *M. bohemicus* is not found in the lowest Ludlovian zone of *M. nilssoni* nor does it range into the three overlying zones of the lower Ludlow. Though two of the latter zones (*M.* n. sp. N and *M.* n. sp. O) are represented by new species and therefore do not permit direct correlation with European zones, it seems likely that the age of *Monograptus bohemicus* in the Cornwallis Islands is approximately middle lower Ludlow.

Monograptus tumescens minor McCoy is confined to the zone of *M. tumescens,* highest zone in the lower Ludlow of Bohemia and Great Britain (Münch, 1952, p. 41; Elles and Wood, 1912, p. 381). Though the zone of *M. tumescens minor* in the Cape Phillips formation is represented by this species only, its stratigraphic position, particularly as it occurs directly below the zone of *M. ultimus* adds further support to the correlation of this zone with the zone of the typical form in Europe.

X. Zone of *Monograptus ultimus*

Though *Monograptus ultimus* Perner is not associated with other graptolites, it constitutes one of the most widely distributed graptolite zones in Cape Phillips beds. *M. ultimus* comprises the lowest graptolite zone of the middle Ludlovian sub-series in Bohemia (Table V) and *M.* sp. cf. *M. ultimus,* associated with *M. leintwardinensis* in the zone named for the latter species, represents the youngest British graptolite zone and occurs in the well-known Aymestry limestone.

Besides the occurrence of *Monograptus ultimus* in the type section of Cape Phillips beds (*see* Figure 4), this species has been collected at several other localities in the Cornwallis Islands. At Locality 61 on Snowblind Creek, and approximately 700 feet stratigraphically above the highest occurrence of *M. bohemicus, M. ultimus* occurs in abundance throughout about 75 feet of argillaceous limestone. *M. ultimus* has been collected at Locality 45 on the Little Cornwallis Island. This species also occurs near Decision Point at Locality 17 on the east-central coast of Cornwallis Island. At this locality *M. ultimus* occurs sparingly throughout approximately 170 feet of argillaceous limestone and limestone. Stratigraphically higher and above an apparently unfossiliferous interval of 410 feet occurs a 5-inch bed composed solely of *Atrypella scheii* (Holtedahl) (ident. by G. Arthur Cooper). From Decision Point this bed of *Atrypella scheii* may be traced intermittently south along the coast as far as Locality 55 between Helen Haven and Cape Rescue. This occurrence of *A. scheii* is of particular interest as it confirms the range of this widely distributed Arctic brachiopod into strata of middle Ludlovian age.

XI. Zones of *Monograptus* n. sp. P and *M.* n. sp. T

The occurrence of *Monograptus* n. sp. P is recorded in the upper part of the type section of the Cape Phillips formation (*see* Figure 4). This species occurs abundantly in the exposures at the promontory for which Cape Phillips is named. No rocks are exposed along the coast for about a mile south of Cape Phillips and graphic measurement indicates that about 150 feet of strata are covered. South and beyond this covered interval higher strata of this formation, comprising about 300 feet of calcareous shale, are exposed up to the north entrance to Abandon Bay. In about the middle of this exposure, *M.* n. sp. T occurs abundantly through approximately 35 feet of beds and constitutes the youngest graptolite zone discovered in the Cape Phillips formation.

To the writer's knowledge the only other record of monograptids younger than *Monograptus ultimus* and *M. leintwardinensis* is that of the Bohemian occurrences (*see* Table V). Though it is impossible to effect direct correlation of *M.* n. sp. P and *M.* n. sp. T with the higher Bohemian zones, both species bear fairly close resemblance to one another and to the Bohemian forms *M. spectatus* Přibyl, and *M. lockovensis* Přibyl, that constitute index species of the zones succeeding the zone of *M. ultimus* in Bohemia, but very little resemblance to still younger Bohemian forms.

It is evident that *M.* n. sp. P and *M.* n. sp. T are post-lower Ludlow in age and their assignment to the middle Ludlow and tentative correlation with the Bohemian zones of *M. spectatus* and M. *lockovensis* respectively, rest upon stratigraphic position and suggested genetic relationship.

XII. Shelly faunas of Uppermost Cape Phillips Beds

Three small collections of shelly faunas were made on the northeast coast of Cornwallis Island and from isolated limestone exposures that apparently overlie the highest occurrence of graptolites at Locality 10. The stratigraphic relationship of the three faunas is not clearly understood but they appear to lie approximately on strike with each other and therefore presumably do not differ greatly in age. The faunas are as follows:

Fossils of Uppermost Cape Phillips (Member C) Beds

Locality 49, Copeland Point
- *Gypidula* sp.
- *Plectorhyncia* 2 spp.
- ? *Colpomya* sp.

Locality 18, Copeland Point
- *Coelospira* sp.
- *Nalivkinia* sp. cf. *N. groenlandica* Poulsen
- *Modiolopsis* sp.

Locality 51, Abandon Bay
- Unidentified bryozoan
- Brachiopod, new?
- *Howellella* sp. B

These collections represent the youngest fossils collected from the Cape Phillips formation and possibly indicate at least a temporary return of shelly facies conditions in the upper part of this formation. Owing to lack of diagnostic forms A. E. Wilson, who identified these faunas, was unable to state more than that the general aspect of the fauna suggests an Upper Silurian age.

The cosmopolitan graptolite faunas of Cape Phillips formation that range from Middle Ordovician to Upper Silurian permit correlation of this formation with graptolitic facies of other Arctic regions and Europe (*see* Table VI).

SILURIAN OR DEVONIAN

DISAPPOINTMENT BAY FORMATION

Definition and Distribution. A relatively thin and narrow selvage of rock rests with slight, yet noticeable angular unconformity upon Cape Phillips strata along the upper surface of the north-facing sea-cliffs at the eastern entrance to Disappointment Bay (*see* Plate VIII, figure 2) near the northeastern extremity of Cornwallis Island. The strata above the unconformity at this locality are chosen as the type section of a formation named for the bay near which it occurs. Another outcrop of this formation, similarly small in area but less well exposed, occurs near the eastern head of Disappointment Bay but there the contact with the underlying Cape Phillips formation is not exposed. Apparently these exposures of Disappointment Bay strata represent the remnants of a once more extensive cover.

Lithology and Thickness. The basal stratum of Disappointment Bay formation consists of light grey, greyish yellow weathering, partly porous, limestone and chert conglomerate about 35 feet thick, parts of which are impregnated with solid bitumen. Fragments range from sand- to cobble-size, and are rounded to subrounded and embedded in carbonate cement. The basal conglomerate is succeeded by a transitional interval approximately 75 feet thick and comprising greyish yellow to greyish green, thin-bedded, flaggy, fine-grained sandstone, and shale of the same colour. These strata alternate with greyish yellow, thin-bedded, flaggy, finely crystalline dolomite. The remainder of the formation consists of greyish-yellow, weathering to yellowish grey, thin- to very thick-bedded, massive, hard, in part porous, finely crystalline dolomite. An aggregate thickness of 280 feet of this formation is exposed at this locality.

Structural Relations. At its type locality, the Disappointment Bay formation rests unconformably on the bevelled, west limb of a gentle anticline developed in Cape Phillips formation. To the northeast, Disappointment Bay strata are truncated along the downthrown side of a northwest-striking normal fault that dips steeply to the southwest. The Disappointment Bay formation is itself broken by several normal faults of similar attitude but of small displacement. Undoubtedly, both outcrop areas of Disappointment Bay strata owe their present position to depression and preservation along normal faults. At the type locality basal Disappointment Bay strata lie within a few feet of the lowest Wenlockian (Middle Silurian) graptolite zone of *Cyrtograptus murchisoni* in the Cape Phillips formation (Locality 20). Approximately 3,700 feet east of this occurrence and on the upthrown side of the main normal fault, the zone of *Cyrtograptus murchisoni* outcrops again and is succeeded by an additional 5,100 feet or more of Cape Phillips strata that outcrop almost continuously from Disappointment Bay to Abandon Bay. The youngest strata of the Cape Phillips formation occur in the vicinity of Abandon Bay and on the basis of graptolites these have been dated as middle Ludlovian age. The figure of 5,100 feet of Cape Phillips strata mentioned above also represents the minimum thickness of Cape Phillips formation removed by erosion prior to deposition of the Disappointment Bay formation, which could not have been laid down until at least middle or post-middle Ludlow time. The angle of discordance between Disappointment Bay and Cape Phillips strata at the type locality is about 7 degrees.

Fauna and Correlation. During the 1953 field season a few rather poorly preserved fossils were obtained from the upper massive dolomite in the Disappointment Bay formation (Locality 12). Because of the importance in dating this formation which would place an upper time limit on the period of deformation affecting the conformable Lower Palæozoic sequence in the Cornwallis Islands, this collection of fossils was sent to J. Brookes Knight, G. Arthur Cooper and Helen Duncan, who kindly agreed to report on gastropods, brachiopods, and corals respectively. Miss Duncan's report (personal communication) is as follows:

> "The collection contains two forms of corals. One is branching or digitate alveolitid. Because it is impossible to be sure just how far structures have been altered in the process of dolomitization, I am unable to tell whether the species is an *Alveolites* or a *Cladopora.* Both genera are common in the Silurian and the Devonian and, interpreted strictly, are restricted to these systems. The other is a colonial rugose coral of uncertain relationship. The specimen does not appear to have the globose dissepiments characteristically developed in disphyllid genera, which are so diagnostic of Devonian faunas. There are vague indications that this coral had approximately horizontal tabulæ. The septa appear very short, but no certainty can be held regarding their original length because thin axial edges would probably have been destroyed by dolomitization. This coral certainly cannot be identified with either of the species described from Cornwallis Island; I have not found any species that bears close resemblance. My original impression was that these corals were of Silurian age. The material examined is too poorly preserved to confirm a Silurian assignment. On the other hand, no evidence was found that weakens my first impression."

G. Arthur Cooper (personal communication) identified the brachiopod *Spirifer modestus* and two pelecypods, *Conocardium* sp., and *Ctenodonta* sp. Cooper considers that these forms indicate a Silurian age. Furthermore, on the basis of the brachiopod, a correlation with the Keyser formation of northeastern United States, which is Upper Silurian in terms of North American chronology, is suggested. *Conocardium* and *Ctenodonta,* Cooper states, could be Silurian and possibly rule out a late Devonian age.

J. Brookes Knight (personal communication) reported that the gastropods were either too poorly preserved or so completely new as to defy accurate determination. He states that his first impression of age was late Devonian, but adds that no aspect of the indeterminable gastropods is inconsistent with the Silurian age determination of Cooper and Miss Duncan.

If indeed, the fauna of the Disappointment Bay formation is correlative with the Upper Silurian series of the standard section of Great Britain and approximately late Ludlovian in age, and if the Snowblind Bay formation is in fact Early Devonian in age, then it follows that the unconformity between the Disappointment Bay and Cape Phillips formations represents a period of deformation pre-dating the deposition of the Snowblind Bay formation and probably the upper part of the Read Bay formations, which are conformable and folded some 36 miles to the south. Moreover, the time of the earlier period of deformation at Disappointment Bay would almost certainly be confined to late middle or early late Ludlow and the dating of the younger deformation probably post-early Devonian. This explanation which is seemingly most compatible with the faunal evidence is, however, untenable in the light of structural evidence. The structure of Cornwallis Island, as presently known, shows no indication of more than one period of folding. The structure upon which Disappointment Bay strata rest, appears to extend more or less continuously southward along the east coast of Cornwallis Island and thereby lie in continuity with structures affecting the Snowblind Bay formation.

Though in no way providing conclusive evidence that Disappointment Bay strata are younger than the deformation affecting Snowblind Bay and underlying formations on Cornwallis Island, it is, nevertheless, noteworthy that there is no evidence of folding within the Disappointment Bay formation. Moreover, normal faulting alone, most readily explains the present and slight inclination from the horizontal characterizing outcrops of this formation.

The Keyser formation has been variously considered as Upper Silurian and Lower Devonian in terms of the North American type sections. Though there is as yet no unanimity of opinion on its proper systematic position, recent consensus of opinion appears to favour including the Keyser in the Upper Silurian. The correlation of the Keyser formation with the standard of the Silurian or Devonian systems in Europe presents even greater difficulties for which there is apparently no direct evidence (Swartz, 1939, pp. 49-50).

In view of the apparent post-Snowblind Bay age for the Disappointment Bay formation and the probably Early Devonian age of the former formation, the age assignment of Disappointment Bay formation is given here as Silurian or Devonian. The alternative Devonian age assignment is the responsibility of the writer only. However, because of the meagre nature of the faunas from the Snowblind Bay and Disappointment Bay formations it should not be inferred that a Devonian age has been proven for the Keyser formation.

Three possible age relationships tentatively relate the Snowblind Bay and Disappointment Bay formations: (1) both may be Late Silurian; (2) the Snowblind Bay may be Late Silurian, and the Disappointment Bay, Early Devonian; (3) both may be Early Devonian. Needless to say, in any case the Disappointment Bay formation is the younger and the period of deformation affecting the conformable lower Palæozoic sequence on the Cornwallis Islands is Late Silurian or Early Devonian and approximately correlative with the Caledonian orogeny of Europe.

SILURIAN AND DEVONIAN ROCKS ON MARSHALL PENINSULA

Marshall Peninsula forms a club-shaped projection jutting off the northwestern coast of Cornwallis Island. The contact between the Cornwallis and Cape Phillips formations strikes parallel with the northern part of this peninsula and clearly relates the geology of Cornwallis Island to Little Cornwallis. However, the southern extension of Marshall Peninsula is underlain by Silurian and apparently also Devonian strata, faunally and stratigraphically unrelated to the formations recognized elsewhere on the islands. Unfortunately, the structural relation between these Silurian and Devonian rocks is unknown.

At Locality 71 approximately 125 feet of strata comprising medium light-grey to medium dark-grey, thin-bedded, flaggy, dense, finely crystalline to sublithographic limestone are exposed in the bed of a small stream. Shale partings are present and contribute to rubbly weathering. The beds dip 8 degrees in a southeasterly direction. A fault (probably a normal fault), is presumed to separate these strata from the Cape Phillips formation exposed to the north. Abundant bone fragments, very probably representing fossil fish, are scattered throughout these rocks. Invertebrate fossils collected are as follows:

Fossils from Silurian Rocks of Marshall Peninsula

Algal nodules
Stromatoporoids
Favosites 3 spp.
Cystiphyllum sp.
Gypidula sp.
Parvicostellate stropheodontid
Atrypella sp.
Lyssatrypa sp.

D. J. McLaren, who identified the fauna, considers it indicative of Late Silurian age. He states that the *Lyssatrypa*, though probably an undescribed species, strongly suggest Late Silurian age, as does the *Atrypella*.

Locality 33 is situated on the upland surface of Marshall Peninsula some 175 feet above outcrops at Locality 71. The intervening rocks are covered. Over several acres of this upland surface the mantle of clay and frost-riven debris are replete with Devonian fossils. Numerous boulders of limestone lithologically similar to but more massive than the presumably underlying Silurian strata appear to rim the upland surface, and many of these boulders may well constitute actual outcrops. They also yield Devonian fossils. The fauna collected from boulders and mantle is as follows:

Fossils from Devonian Rocks of Marshall Peninsula

Stromatoporoids
Favosites spp.
Syringopora sp.
Cystiphylloid corals
Phillipsastraea sp. cf. *P. boloniensis* (Edwards and Haime)
Euarges sp.

D. J. McLaren, who identified the fauna, comments as follows: "*Phillipsastraea* is a very typical high Devonian coral and is commonest in the Frasnian Stage and its equivalent in North America. The species of *Favosites* and the cystiphylloid corals, however, are probably of Middle Devonian age. As the collection is largely from drift, it seems possible that more than one age is represented."

The Devonian fauna has not been found elsewhere in the Cornwallis Islands. The unusual abundance of fossils at this locality and the possibility that some may have been obtained from actual outcrops appear to rule out the possibility that they are from transported materials. Even though the presence of actual outcrops could not be established, the fossils and the boulders containing them are very probably weathering out of a small outlier of a formation now covered by a mantle of clay and debris. Moreover, the beds that have provided these fossils are probably, as are the Disappointment Bay and Intrepid Bay formations, preserved along the downfaulted side of a normal fault. As neither thickness nor structural relationship to other formations in this region could be established for these beds no name is proposed for them.

From the available information, several structural and stratigraphic relationships between the Silurian and Devonian rocks of Marshall Peninsula are possible. Two are discussed below.

(1) The Devonian rocks are certainly younger than the Disappointment Bay formation that rests unconformably on folded Cape Phillips formation

on the north coast of Cornwallis Island. Therefore, the relationship of these Devonian rocks to the underlying Lower Palæozoic sequence is also presumably unconformable. The age relationship of the Upper Silurian fauna on Marshall Peninsula to other Upper Silurian faunas on the islands is however not understood and consequently it is not possible to state with certainty whether these strata are younger or older than the major Upper Silurian or Lower Devonian unconformity. If they are younger, then they and the Devonian rocks of Marshall Peninsula may represent a conformable series, possibly conformable above Disappointment Bay formation or equivalent strata.

(2) In view of the very late Silurian or even early Devonian age of the Snowblind Bay formation, the writer is more inclined to the view that the Silurian strata of Marshall Peninsula may represent deposits of shelly facies high in the Cape Phillips formation such as those present at localities 18, 49 and 51 (p. 104) on the northeast coast of Cornwallis Island.

If this is the case, the Devonian rocks must be unconformably above the Silurian strata on Marshall Peninsula. Moreover, as there appears to be insufficient stratigraphic interval between the two occurrences (roughly 175 feet) for Disappointment Bay strata to intervene, presumably the Devonian rocks, like those of the younger Intrepid Bay formation, were deposited in a transgressive sea and are separated from strata deposited in Disappointment Bay time by an interval of erosion.

PENNSYLVANIAN

INTREPID BAY FORMATION

Definition, Distribution and Thickness. The Intrepid Bay formation is named for beds of mainly sand, sandstone and clay that occur in two relatively restricted areas on Cornwallis Island and rest with structural unconformity on folded lower Palæozoic rocks. One outcrop locality is situated in the southwest of Cornwallis Island, at the head of Intrepid Bay (*see* Plate V) from which the formation is named. This is chosen as the type locality. There, approximately 2,000 feet of Intrepid Bay strata, containing coal seams, have been preserved along the downfaulted side of the northwest-trending Intrepid Bay fault and rest on Allen Bay formation.

The other outcrop area is considerably smaller and is near Rookery Creek some 21 miles to the north-northwest of the occurrence at Intrepid Bay. In this region roughly 500 feet of strata have been preserved along the downfaulted side of the Rookery Creek fault. At this locality, Intrepid Bay strata rest on Cornwallis formation. No coal seams are exposed at this locality and the formation is considerably less well exposed than at Intrepid Bay.

Intrepid Bay beds support a comparatively dense cover of mainly cryptogamic plants that cause this formation to stand out as darker areas contrasting with the surrounding barren terrain of Lower Palæozoic rocks. Consequently, identification and mapping of these isolated outcrop areas is a relatively simple matter. Areas of Intrepid Bay formation are readily recognized on air photographs and examination of these photos prompts the suggestion that a third outcrop area of this formation lies along the downthrown side of a normal fault in the unmapped interior of Cornwallis Island (approx. lat. 75°00′, long. 95°55′).

Lithology. The Intrepid Bay formation is generally poorly exposed, owing to the almost completely unconsolidated character of the strata. Parts of the formation that were observed comprise an alternating series of white to light grey quartzose sand, sandstone, clay, and coal seams. Fine- to medium-grained sand constitutes the principal lithological type. Locally, a few strata are characterized by poorly consolidated friable sandstone to fairly indurated sandstone. Many sand beds are crossbedded and iron-strained. In others, bedding is hardly apparent except for bituminous laminae. The clay is generally pale green to greyish green and very plastic. Coal seams (sub-bituminous), at least 12 in number, occur at the type locality near the top of the formation and range from a few inches to 5 feet in thickness.

Flora and Correlation. Neither vertebrate nor invertebrate fossils were observed in this formation. Samples of clay and sand were collected at Locality 32, at the outcrops on Rookery Creek, for microflora analysis. These were sent to N. W. Radforth for study, and his report (personal communication) is as follows: "From a selection of 33 microfossil forms derived from the Intrepid Bay formation, it is possible to produce graphical comparisons in which microfossil form conspectus is related to horizon. This reveals that the conspectus favours Pennsylvanian and in particular mid-Pennsylvanian age.

"This correlation was made using Potonie and Kremp's scheme and hence is based on comparisons with European standards. It might, therefore, though not necessarily, apply more to Europe than North America".

CHAPTER IV

STRUCTURAL GEOLOGY

A thick sequence of folded lower Palæozoic marine sediments of miogeosynclinal origin underlies the greater part of Cornwallis and Little Cornwallis Islands. A few widely scattered remnants of late Palæozoic formations rest unconformably upon these older folded rocks on Cornwallis Island. The area shows evidence of two periods of tectonism, an early orogenic deformation that folded the lower Palæozoic strata and a younger period of normal faulting that affected all formations.

Folding

On Little Cornwallis Island fairly steeply dipping, northwest-striking folds lie in parallel juxtaposition, which contrasts with the considerably more complex folding of Cornwallis Island. The larger Island has been deformed into a series of mainly broad open folds, the overall strike of which is northwesterly, although certain structures deviate radically from the regional trend. The attitude of lower Palæozoic beds ranges from horizontal to vertical, but low angles prevail over large areas. No overturning, except in local structures, seems to have taken place. The lower Palæozoic structures of Cornwallis Island are rather unusual in that moderately steep-dipping folds are separated by larger areas of gently dipping folds. Thus, fold axes are generally widely separated. In conjunction with the general absence of thrust faulting, this attests to compressive forces of only mild to moderate intensity. Several of the major folds on Cornwallis Island have received formal designation (*see* map in pocket).

The Centre anticline is one of the most conspicuous folds on Cornwallis Island. This structure extends from near the geographic centre of the Island to the northwest coast. The Centre anticline is a long curving structure that trends northwesterly for the greater part of its length but curves sharply to the east at its southern end where it parallels the Stanley Head-Snowblind Bay line of facies change. It plunges gently to the northwest and steeply to the east. The Eleanor River formation outcrops in a circular pattern along the axis of this fold near the centre of Cornwallis Island. Because of incomplete mapping the structure in which Eleanor River beds are exposed south of the Centre anticline is not clearly understood. Possibly it is a bifurcating limb of the Centre anticline or an entirely separate anticline or dome.

With exception of the Stanley Head anticline in the southwestern region of Cornwallis Island, the remaining folds appear as subsidiary structures along the periphery of, and complementary to, the Centre anticline or its presumed related structure discussed in the foregoing paragraph. Presumably the Centre anticline has determined the structural framework of Cornwallis Island. Many of the subsidiary folds show marked deviation from the northwest regional strike and, like the Centre anticline, many are gently curved and plunge towards the coast. This, together with the fact that progressively younger formations of the lower Palæozoic sequence crop out towards the periphery of the Island, marks the central region of Cornwallis as the structural high of the Island.

Age of Folding. The age of the folding of the lower Palæozoic formations has already been discussed. It is probable it took place about the end of Silurian time and is therefore broadly referable to the Erian phase (Stille, 1924, p. 64) of Caledonian mountain building.

Faulting

Normal faulting that post-dates deposition of the Intrepid Bay and Disappointment Bay formations has affected this region and is directly responsible for the preservation of these formations. With few exceptions, the trend of the faults roughly parallels that of the regional strike of lower Palæozoic structures. The faults, which as a rule are unusually straight for considerable distances, are most readily detected by marked linear segments in streams or by linear topographic depressions extending in random manner across country and structure; the depressions evidently developed from the more readily erodible, shattered rock of the fault zone. The possibility that some faults are transcurrent or even reverse cannot be discounted. Four factors make classification of many faults in this region uncertain: excessive thickness of the older Palæozoic formations; scarcity in these of marker horizons; scarcity of actual exposures of fault surfaces; and the apparently small stratigraphic displacement of many faults.

Because of the structural relationship of the Airport fault to the Allen Bay anticline this fault is tentatively considered as a thrust fault. The Intrepid Bay fault is marked by a prominent fault-line scarp that extends from Intrepid Bay to Stanley Head (*see* Plate V); the larger of the two outcrop areas of the Intrepid Bay formation occurs along the downthrow side of this fault. The Assistance Bay fault, presumably a normal fault, is characterized by a zone of calcite filling up to 320 feet thick.

Jointing

Jointing is very persistent in all lower Palæozoic rocks. In general, one system of jointing with two vertical sets prevails. One set generally parallels the strike of strata, the other the direction of dip. Jointing is strongly reflected in the drainage, particularly in small tributary streams in the eastern coastal areas of Cornwallis Island to which it has imparted rectangular drainage patterns.

Regional Relationships of Cornwallis Islands

Study of air photographs has revealed that the northwesterly regional strike that characterizes the Cornwallis Islands is also identified on small islands in Queens Channel, directly to the north of Cornwallis Island, as well as in the western regions of Grinnell Peninsula (*see* Figure 5). In the latter regions structural lineaments assume a more northerly direction than is evident in the structures of Cornwallis and Little Cornwallis Islands. Certain north-south structures along the eastern coast of Bathurst Island also may be cogenetic with structures of the Cornwallis Islands. Presumably the north-south structures on islands adjacent to Cornwallis and Little Cornwallis Islands are genetically related to the Caledonian deformation of the latter regions.

The north-south linear features of western Grinnell Peninsula seem to breach the continuity of the west-by-southwest trending folds of Bathurst Island in the Parry Islands Fold Belt (Fortier and Thorsteinsson, 1953) and the similarly trending folds in northeastern Grinnell Peninsula that extend from the Ellesmere-Greenland Fold Belt. Evidence of these two different structural trends affecting each other is lacking as the north-south structures of western Grinnell Peninsula are separated from Bathurst by the waters of Queens Channel and from the Ellesmere-Greenland Fold Belt by a region apparently without folding or faulting.

The age of the orogeny affecting the Ellesmere-Greenland Fold Belt has been a subject of controversy for many years. Probably the opinions of Lauge Koch and Hans Frebold represent best the two prevailing and contrasted opinions held with regard to the age of this deformation. Koch (1920, pp. 71-74; 1929, pp. 280-285) concluded that the folding of this belt was of Caledonian age. Later, however, he stated (1935, p. 619), that the date of this orogeny was post-Wenlockian and pre-Permian. On the other hand, Frebold (1934, p. 308) has stated that the time of the orogeny could be Variscan or even younger. In 1951 (p. 42) Frebold, though not denying the possibility of a Caledonian age, maintained that conclusive evidence of this age of folding did not exist.

In 1952 Troelsen investigated the region of Canyon Fiord in western Ellesmere Island where he found Middle Pennsylvanian sediments resting with structural unconformity upon Ludlovian beds (Upper Silurian). Although Troelsen's discovery placed the age of the deformation of the Ellesmere- Greenland Fold Belt within fairly narrow time limits the problem of

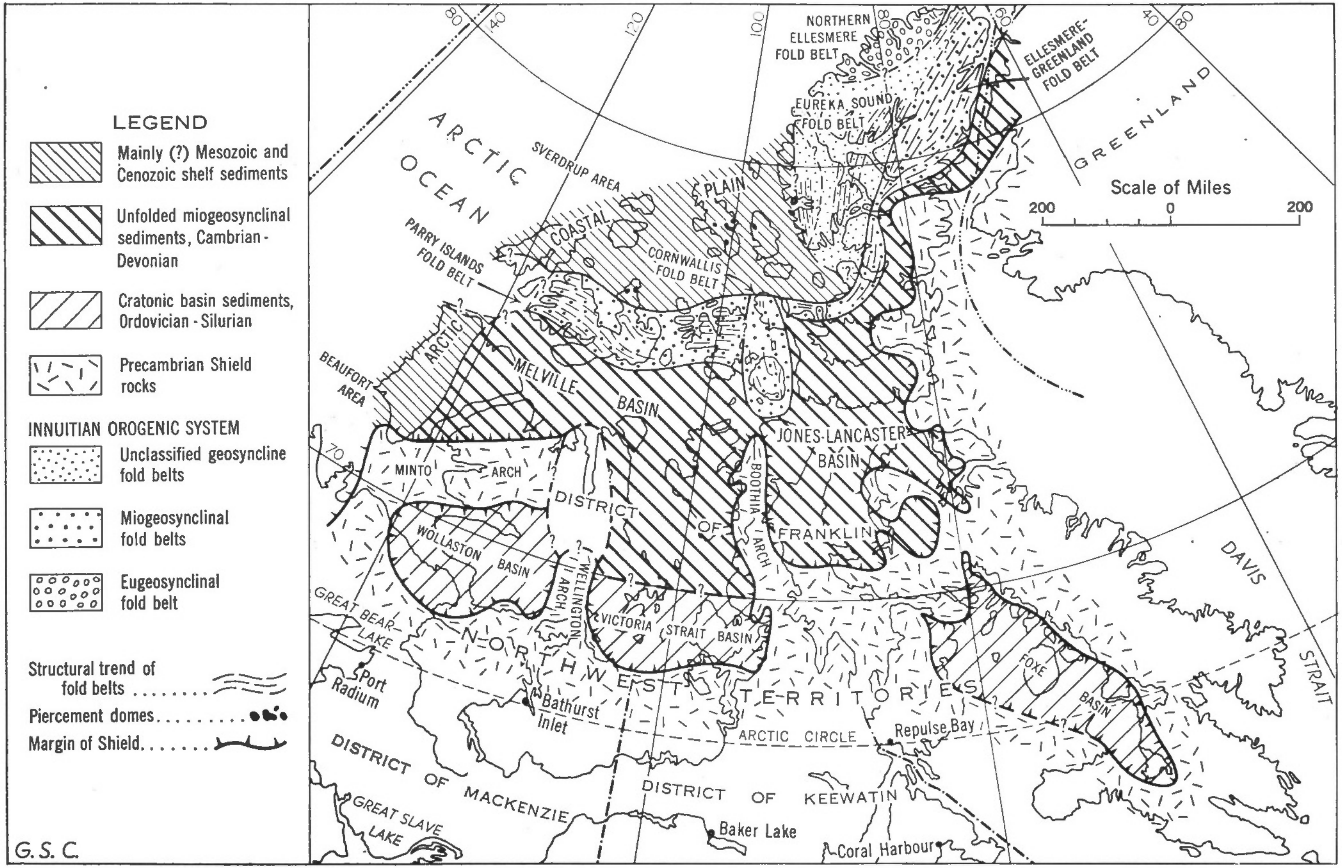

Figure 5. Structural-stratigraphic elements of Arctic Archipelago. *Revised after* Fortier, McNair and Thorsteinsson (1954).

whether the orogeny was Caledonian or Variscan remained unsolved. It is now clear that strata as young as Devonian are involved in the folding of this belt. On air photographs, Per Schei's series (Holtedahl, 1917) in southwestern Ellesmere Island, which includes strata as young as Upper Devonian, may be traced into the extension of this belt in northeastern Grinnell Peninsula. Moreover, it was in this region of Grinnell Peninsula that Belcher collected Devonian fossils described by Salter in 1855.

Fortier and Thorsteinsson (1953) included the fold structures of the Cornwallis Islands with that of the Parry Islands Fold Belt, which was defined by these writers as extending from Cornwallis Island through Bathurst and Melville Islands. In 1954, Fortier, McNair, and Thorsteinsson pointed out the marked variance of the regional strike in the Cornwallis Island with that of Bathurst and Melville and suggested that more than one orogeny affected the Parry Islands. Recent work by Tozer (1956), and the present investigation have borne out this suggestion that separate deformed belts occur within the Parry Islands Fold Belt described by Fortier and Thorsteinsson. Tozer's observations have shown that Middle and Upper Devonian clastics rest conformably on, and are folded with Ordovician and Silurian formations on Melville Island. In the light of Troelsen's (1952) post-Silurian and pre-Middle Pennsylvanian dating of the Ellesmere-Greenland Fold Belt, Tozer suggested that the folds of this belt and those of Melville Island are contemporary structures, the deformation of which is post-Devonian but pre-Pennsylvanian and therefore an early phase of Variscan orogeny.

The various tectonic elements of the Innuitian Region (Fortier, 1955) and the time of their orogenies are now more clearly understood than ever before. It appears that the Ellesmere-Greenland Fold Belt and the structures of Melville and Bathurst regions of the Parry Islands Fold Belt are genetically related Variscan structures, probably referable to the Bretonic or Sudetic phase of that orogeny (Stille, 1924, p. 82), and separated from each other by another orogenic belt effected by Caledonian deformation that extends from the Cornwallis Islands to Grinnell Peninsula. For the structures of the latter region the name Cornwallis Fold Belt is here proposed. The Cornwallis Fold Belt is separated from the Parry Islands Fold Belt, a name that is here restricted to the folded structures of Bathurst and Melville Islands.

The position of the Cornwallis Fold Belt within the general structural framework of the Arctic Archipelago is shown in Figure 5. The overall trend of this belt is approximately north-south and directly on strike with the Precambrian rocks of the Boothia Arch. This suggests that the latter structure may also have resulted from Caledonian deformation.

CHAPTER V

ECONOMIC GEOLOGY

Oil and Gas

Many special factors must be taken into account in considering the economic possibilities of the Cornwallis Islands as potential sources of oil and gas. Although Arctic winter temperatures are in general comparable to those of Western Canada, where exploration for petroleum has proved feasible all year round, the "dark period" and long winters may impose special limitations on oil exploration in the Cornwallis Islands. Moreover the season for ship transportation is short and may prove hazardous because of moving ice. These and other problems are beyond the scope of the present report.

For accumulations of oil and gas to exist in an area underlain by a thick series of marine sediments, such as those of the Cornwallis Islands, both source rocks and reservoirs must be present. The latter may be deformational, depositional, or post-depositional, or a combination of two or more of these types. Traps of such nature have not yet been delineated on the Cornwallis Islands, but the age, lithology of the rocks, and general structural conditions are such as to warrant further exploration, not only for this region but adjacent islands and the Archipelago, as well. The numerous occurrences of bituminous residues in favourable reservoir beds, such as the Allen Bay dolomite and the porous, dolomite beds in the lower part of the Cape Phillips formation indicate the existence of past accumulations of petroleum. The graptolitic facies of the Cape Phillips formation, particularly the petroliferous shales of member A, are considered favourable source beds. The numerous biostromes and bioherms in the Read Bay formation and the large interfacies reef near Cape DeHaven would possibly constitute both reservoirs and source rocks for petroleum if located at depth in structures with closure.

The Ordovician-Silurian facies change that trends roughly east-west across Cornwallis Island is of special interest. The thick sedimentary sequence comprising the Cape Phillips, Allen Bay, and Read Bay formations was evidently deposited in contrasted marine environments. Along this line of facies change the source beds of the Cape Phillips formation and the especially favourable reservoir rocks of the Allen Bay dolomite lie in direct continuity. Thus a zone of stratigraphic traps could exist where these rocks may be buried at depth in adjacent regions of the Archipelago that lie on strike with the Stanley Head-Snowblind Bay line of facies change.

Closure probably occurs in the Centre anticline and possibly in another less well known structure near the geographic centre of Cornwallis Island.

Unfortunately, the oldest formation (Eleanor River) studied in this region occurs in axes of these structures and therefore nothing is known about the lithological characters of the older rocks at depth that might be conducive to oil and gas accumulation.

The rocks outcropping on the Cornwallis Islands are entirely unmetamorphosed and deformation appears to have been mild. The orogeny and later normal faulting affecting these islands probably destroyed several petroleum-bearing structures but may well have favoured the development of others, especially in neighbouring islands.

Coal

Coal occurs in the Intrepid Bay formation in southwestern Cornwallis Island. At least twelve sub-bituminous coal seams ranging in thickness from a few inches to 5 feet, occur interbedded with sand and clay. No coal seams more than 2 inches thick were observed in the outcrops of this formation on Rookery Creek.

W. J. Montgomery, of the Division of Fuels, Mines Branch, Ottawa, obtained the following analysis of a single specimen of coal from the Intrepid Bay formation.

TABLE VII

Analysis of Coal from Intrepid Bay

—	At capacity moisture	As rec'd	Dry
Proximate analysis			
Moisture	20·8	7·0	0·0
Ash	4·5	5·3	5·7
Volatile matter	40·4	47·4	51·0
Fixed Carbon (by difference)	34·3	40·3	43·30
Ultimate analysis			
Carbon	—	—	—
Hydrogen	—	—	—
Sulphur	1·4	1·8	1·9
Nitrogen	—	—	—
Ash	—	—	—
Oxygen (by difference)	—	—	—
Calorific value			
B.T.U./lb. gross	7,950	10,033	10,785

Bank A.S.T.M.—Sub-bituminous C.

Moisture mineral matter free B.T.U., 8,367.

REMARKS: The capacity moisture is probably on the low side because of the dry state of the sample on which the determinations were made. (Dashes (—) indicate no determination made.)

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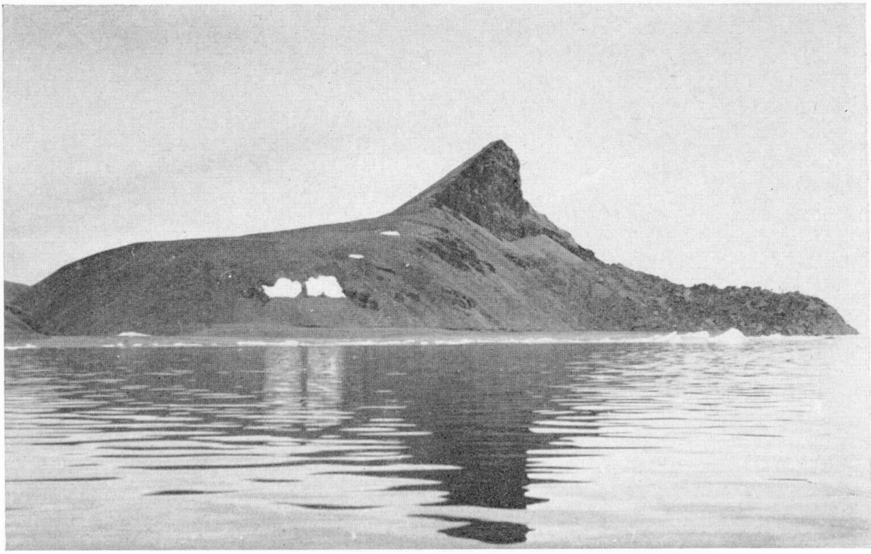
PLATE I



R.T. 11-7-52

Figure 1. Cape Hotham and landslide as seen from Barrow Strait. (Page 18.)

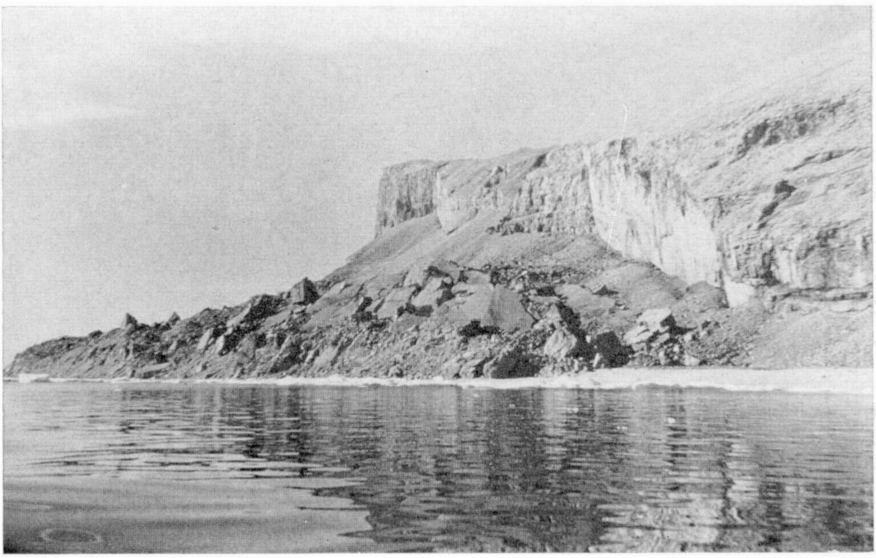


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Figure 2. Cape Hotham and landslide as seen from Wellington Channel.

PLATE II

Cornwallis Island Lat 74.31 N Long 94.20 and

These are to Certify that the Felix Discovery Vessel
under the Direction of Captain Sir John Ross, R.N in
Search of the Expedition under Captain Sir John Franklin
arrived here on the 12th of September 1850, and remained untill
the 12th of August 1851 in Company with the Lady Franklin
and Sophia Brigs, While the Squadron under Capt. H.T. Austin
Consisting of the Resolute, Assistance D.S. the Pioneer and Intrepid
S.V. were frozen in near to the North of Griffiths Island, that Search
has been made, between Cape Walker and Banks's Land, between
Cornwallis Island and Melville Island and up the Wellington
Channel to Lat 76..26 N and Long 102 West without finding any
traces of the missing Ships, since they left Beechey Island in
September 1846, where they had wintered. —

That the Yacht "Mary", with Provisions is left as a Relief
Vessel at Cape Spencer, and Notices at the Several places the
parties visited are left besides at Port Leopold where there is
a large Depot

Given under my hand this
12 day of August 1851 - and
Left in a Cairn by

John Ross

Capt Royal Navy in Charge of a
private Expedition in Search of
the missing Ships under Sir J Franklin

Facsimile of note by Captain Sir John Ross found in a cairn on Prospect Hill near Assistance Bay. (Page 6.)

PLATE III

R.C.A.F. photo

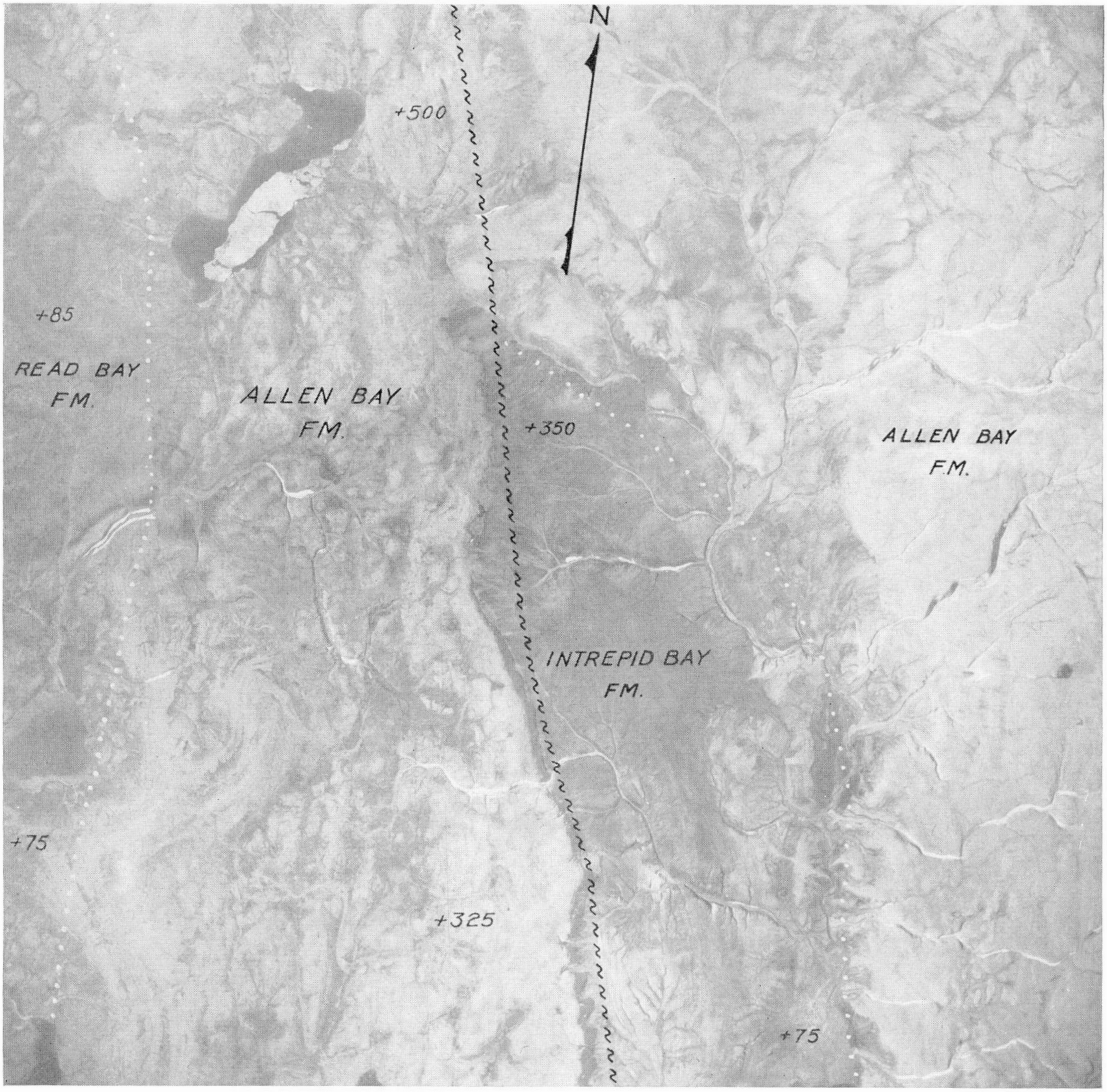
Looking east across plateau remnant in southeastern Cornwallis Island. Devon Island in background. Note extreme youthful character of terrain; also fiord and cirque-like features along east coast. Photograph taken June 27, 1950. (*Pages 11, 16.*)

PLATE IV

R.C.A.F. photo

Looking east across southern Cornwallis Island. Wellington Channel and Devon Island in background. Characters of the plateau remnant in southeastern region of Cornwallis Island are not discernible. The more maturely dissected terrain of Cornwallis is clearly shown in the land foreground. Light coloured terrain is more or less barren of vegetation; darker coloured areas, other than lakes and swale ponds, indicate vegetation. Note concentration of plant cover along the broad valley floors of Ward River and Taylor River. Emerged strand lines are well exemplified features in land foreground where they parallel the present-day shoreline and are cut, more or less at right angles, by second-cycle streams. Note also emerged strand lines extending up the valley sides of Ward River and Taylor River, which are first-cycle streams. Photograph taken August 3, 1950. *(Pages 11, 12, 17.)*

PLATE V

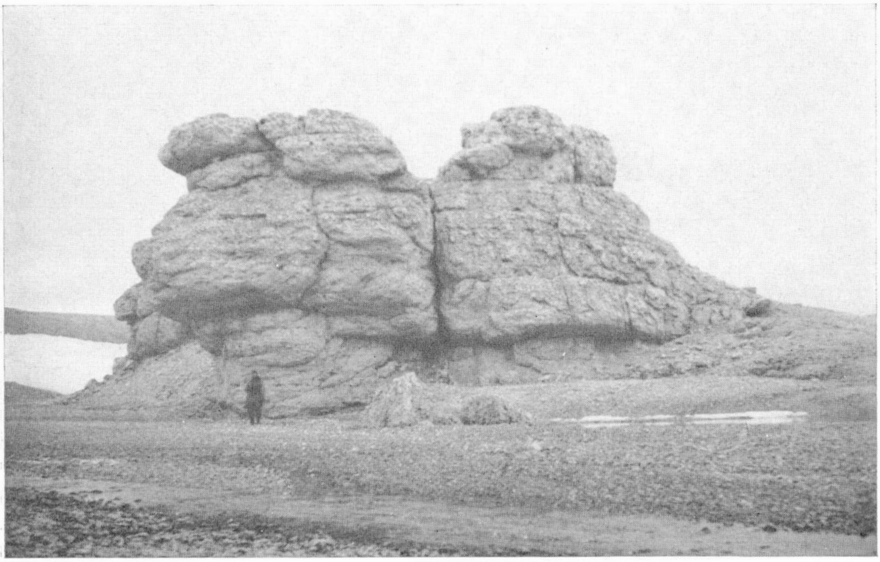


R.C.A.F. photo

View near head of Intrepid Bay showing character of terrain underlain by Read Bay, Allen Bay and Intrepid Bay formations. Degree of dark colour indicates degree of vegetation cover. Very light coloured areas are barren of vegetation. Most prominent topographic feature in this region is the fault line scarp of the Intrepid Bay fault that strikes approximately north-northwesterly across centre of photograph. Elevations (e.g. + 500) by aneroid barometer. Approximate scale, 1 inch = 3,000 feet. Photograph taken August 3, 1950.

(Pages 14, 110.)

PLATE VI



R.T. 2-3-53

Figure 1. Thick-bedded dolomite beds of the Cornwallis formation showing typical castellated and pock-marked weathering characteristics. Outcrops of dolomite in the Cornwallis formation are virtually indistinguishable from Allen Bay dolomite. *(Page 35.)*

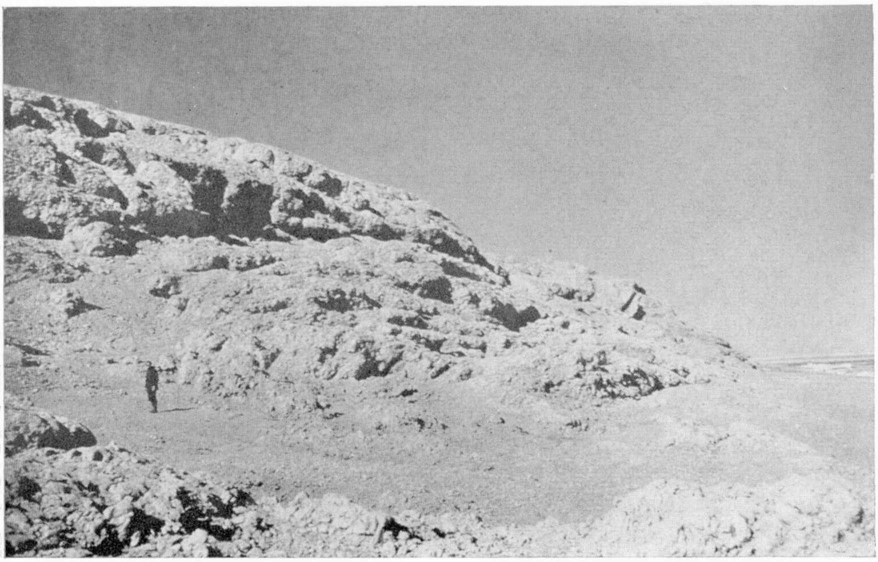


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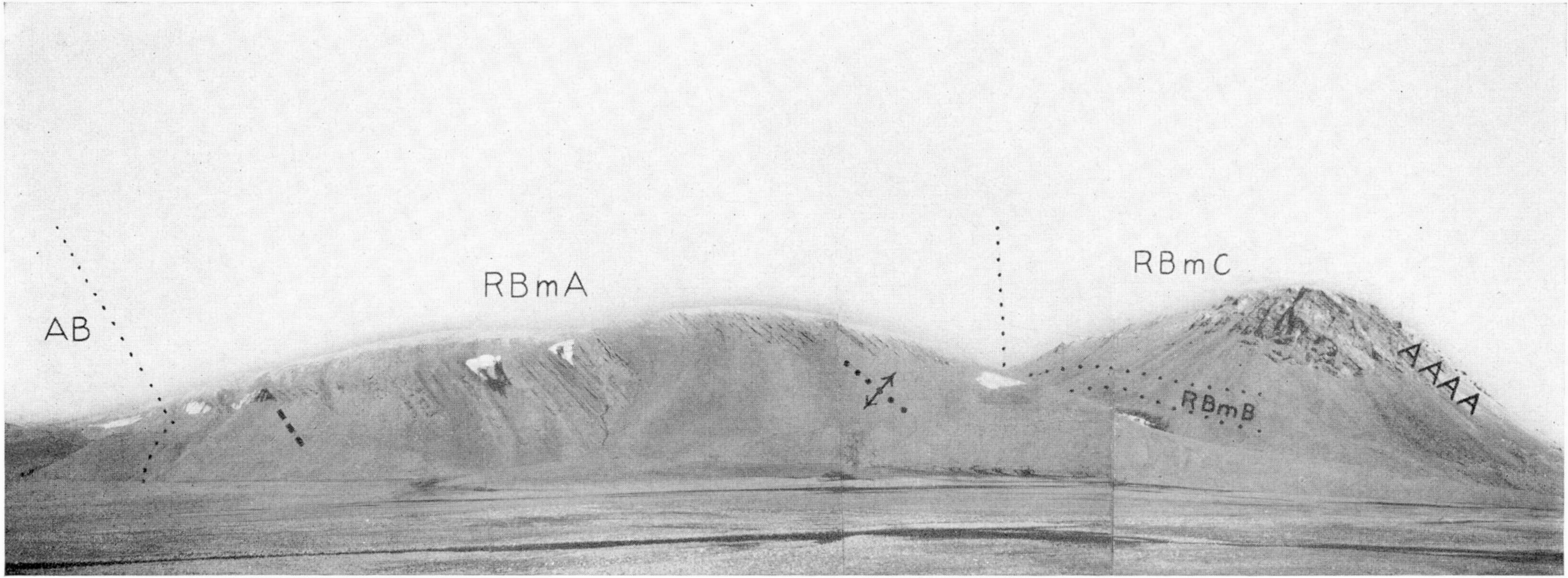
Figure 2. Reef-rock in Read Bay formation exposed at Cape DeHaven on the east-central coast of Cornwallis Island. Note almost complete absence of bedding. *(Page 69.)*

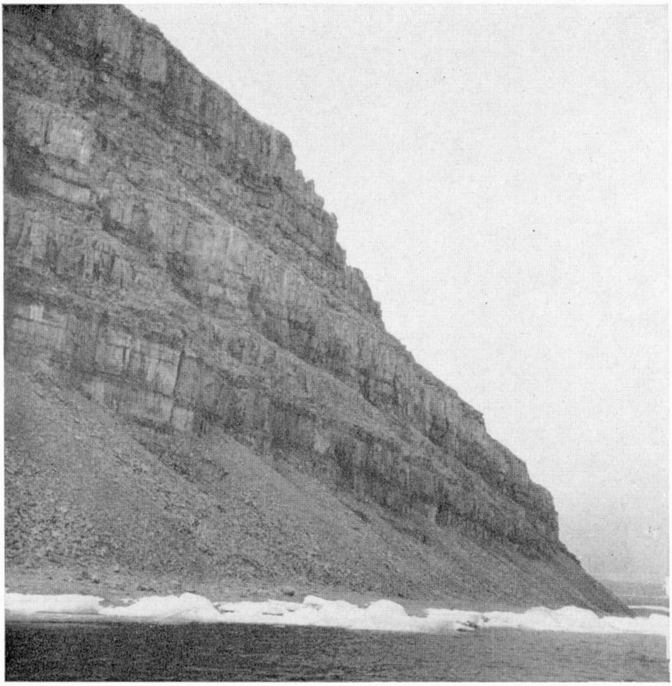
PLATE VII



R.T. 3-6-7-2-52

Type section of member A (RBmA), Read Bay formation on Goodsir Creek east-central coast of Cornwallis Island. Talus derived from member C (RBmC) has buried member B (RBmB) which is, however, well exposed on the opposite side of the valley. (AB = Allen Bay formation; horizon of Cyathaspididae n. gen. A and sp. B indicated by bold dashed line; zone of *Monograptus bohemicus* indicated by bold dotted line; AAAA = zone of *Atrypella phoca*.) (Page 49.)

PLATE VIII



R.T. 9-3-52

Figure 1. Snowblind Bay formation in sea-cliffs at Advance Bluff east-central coast of Cornwallis Island. Thick beds of limestone breccia alternate with thin strata of dusky red sandstone and siltstone. Approximately 250 feet of beds are shown here. *(Page 75.)*

R.T. 7-1-53

Figure 2. Type section of Disappointment Bay formation (DB) resting with structural unconformity on Cape Phillips formation (CP) at eastern entrance to Disappointment Bay. *(Page 105.)*

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