CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 55-5

GEOLOGICAL RECONNAISSANCE, PRINCE PATRICK, EGLINTON, AND WESTERN MELVILLE ISLANDS, ARCTIC ARCHIPELAGO, NORTHWEST TERRITORIES

By

E. T. Tozer

OTTAWA

1956

Price, 50 cents

CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA
Paper 55-5

GEOLOGICAL RECONNAISSANCE PRINCE PATRICK, EGLINTON, AND WESTERN MELVILLE ISLANDS, ARCTIC ARCHIPELAGO, NORTHWEST TERRITORIES

By
E. T. Tozer

OTTAWA
(1955)

Price, 50 cents

71488-1

CONTENTS

Illustrations

GEOLOGICAL RECONNAISSANCE PRINCE PATRICK, EGLINTON, AND WESTERN MELVILLE ISLANDS, ARCTIC ARCHIPELAGO, NORTHWEST TERRITORIES

INTRODUCTION

Location

Prince Patrick, Eglinton, and Melville Islands lie in the western part of the Arctic Archipelago. This report describes the geology of parts of southeastern Prince Patrick, northern Eglinton, and western Melville Islands. The area examined is within latitude 75°00' and 77°00' north and longitude 116°00' and 121°00' west.

Present Investigation and Acknowledgments

This report is based on field work done by the writer during the summer of 1954. Through the co-operation of the Meteorological Division of the Department of Transport the weather station at Mould Bay, Prince Patrick Island, was used as base. Transportation to and from Mould Bay was provided by the Royal Canadian Air Force. The writer was assisted by A. H. Macpherson, and Amagualik, a native of Pond Inlet now resident at Resolute Bay, capably performed his duties as dog driver. Constable R. Gibson, of the Resolute Bay Detachment, Royal Canadian Mounted Police, assisted in many ways. W. R. Morris of the United States Weather Bureau kindly donated a collection of fossils made at Mould Bay. H. Frebold, W. L. Fry, J. A. Jeletzky, D. J. McLaren, R. Thorsteinsson, and Miss F. J. E. Wagner, all of the Geological Survey, have determined invertebrate and plant fossils collected, and Wann Langston, of the National Museum of Canada, has identified the vertebrates. J. D. Hale, of the Forestry Branch, Department of Northern Affairs and National Resources, determined some specimens of wood.

History of Exploration

Melville Island was discovered in 1819 by Captain (later Admiral Sir) W. E. Parry in the course of a search for the Northwest Passage. Parry entered Viscount Melville Sound from the east and wintered at Winter Harbour, on the south coast of the island. In the spring of 1820 he travelled north from Winter Harbour with a hand drawn cart; he crossed the island and reached Hecla and Griper Bay, which was named for his ships.

In 1853 the west coast of Melville, the entire coast of Eglinton, and the greater part of Prince Patrick Islands were charted by parties under Commander (later Admiral Sir) F. L. M'Clintock and Lieutenant G. F. Mecham. These officers were

attached to a squadron of the Royal Navy under Captain Sir Edward Belcher that had left England in 1852 to search for the missing expedition of Sir John Franklin. Two of Belcher's ships, the Resolute, commanded by Captain Kellett, and the Intrepid, under M'Clintock, wintered 1852-53 at Dealy Island, on the south coast of Melville Island. In the spring of 1853 sledge parties under M'Clintock and Mecham left Dealy Island to explore the coasts to the west, and so discovered Prince Patrick and Eglinton Islands. M'Clintock travelled overland to Hecla and Griper Bay and charted the northwest and west coasts of Melville Island as far south as Purchase Bay. He then turned west and explored northern Eglinton Island and the east coast of Prince Patrick Island from Intrepid Inlet to its northernmost cape. Mecham travelled west along the south coast of Melville Island. He then charted Eglinton Island and the south and west coasts of Prince Patrick Island from Disappointment Point to Discovery Point.

In 1915, the leader of the Canadian Arctic Expedition, Vilhjalmur Stefansson, travelled along the west coast of Prince Patrick Island. His party was the first to see the coast not reached by the Franklin search parties, between Discovery and M'Clintock Points. Later in the same year, having discovered land north of Prince Patrick Island, Stefansson travelled along the west coast of Melville Island, en route to Banks Island.

Between 1915 and 1948, when the Mould Bay weather station was established by air lift from Resolute Bay, no persons visited Prince Patrick Island, except Sir Hubert Wilkins, who, in August 1937, landed on Walker Inlet while seeking the lost Russian aviators.

Previous Geological Investigation

No geologist had previously visited the area. Collections of rocks and fossils made by explorers and travellers, and more recently air photographs, provided the only basis for geological interpretation.

Collections made by Parry were described by Konig (1824)[1]; those made by the Franklin search parties, in particular

---

[1]Dates and names in parentheses are those of publications listed in the References on page 4 of this report.

M'Clintock, were described by Haughton (1857, 1859) and Heer (1868).

Haughton is responsible for the first regional interpretation, according to which Carboniferous, Jurassic, and Miocene rocks were recognized, and this interpretation has formed the basis for subsequent small scale regional geological maps.

J. G. McMillan (1910), geologist of the Dominion of Canada Government Expedition of 1908-09, studied the geology of parts of southern Melville Island.

Since the establishment of the Mould Bay weather station S. D. Macdonald, in 1949 and 1952, and P. F. Bruggeman, in 1952, have conducted biological investigations on Prince Patrick Island, for the National Museum of Canada and the Department of Agriculture respectively. In the course of this work a collection of fossils was made that Jeletzky (1954) considers to be of Upper Jurassic or Lower Cretaceous age.

In 1950 the Royal Canadian Air Force took trimetrogon air photographs of Prince Patrick, Eglinton, and Melville Islands, and these photographs, together with flights over the area, enabled Y. O. Fortier and R. Thorsteinsson of the Geological Survey to detect a belt of folded rocks in the western part of the Arctic Archipelago. This structural feature, named the Parry Island Fold Belt, was shown to extend to the west coast of Melville Island (Fortier and Thorsteinsson, 1953).

Accessibility and Travel

Mould Bay weather station is accessible by air. Owing to persistent winter ice the channels and straits between Prince Patrick and Melville Islands have not, as yet, been reached by ship. The ice in these straits does not break up until late in the season and some years it probably does not break up at all.

Dog teams provide a satisfactory means of travel and one was used in 1954 by the party from late April to the end of July. After July 7, however, the dog team was used only in the vicinity of Mould Bay. It would probably have been possible to reach Eglinton and Melville Islands all through July but the party wished to study the geology along the shores and the presence of wide shore leads and cracks in Mould Bay suggested that similar conditions elsewhere would have made such a study impossible.

The snow cover prevented the start of geological work until the end of May.

Vegetation and Wildlife

Little vegetation is found on these islands above an elevation of 300 feet; at lower elevations the development of vegetation is evidently controlled largely by the type of bedrock. Some formations, particularly the lower members of the Wilkie Point and Mould Bay formations and the Landing Lake formation, support a flora including mosses, grass, and stunted willow. The

parts of the Wilkie Point and Mould Bay formations that support vegetation comprise sandstones with considerable carbonate cement and the Landing Lake formation consists of shale. The upper part of the Wilkie Point and Mould Bay formations consists mainly of unconsolidated quartz sand and silt on which practically nothing grows and areas in which these rocks are flat-lying constitute veritable deserts. An example of this barren country developed in the Wilkie Point formation is seen on the west side of Intrepid Inlet 4 miles north of Salmon Point. Similarly, the northern part of Eglinton Island represents a vegetation-free desert developed in the upper beds of the Mould Bay formation. The hard sandstones of the Melville Island formation commonly form ridges and plateaux with little vegetation except for black lichen, but where underlying lower areas this formation is moderately conducive to plant life. An example is on the west coast of Melville Island where quite large meadows are present in the wide valleys at the head of Blackley Haven and south of Comfort Cove. The vegetation supported by the Beaufort formation was found to vary. On the west side of Intrepid Inlet, where this formation overlies the barren upper beds of the Wilkie Point formation, the valleys contain nothing but rocks encrusted with black lichen, but north of Landing Lake, valleys cut in the Beaufort formation are quite well vegetated.

The wildlife of Prince Patrick Island has recently been studied by Macdonald (1954), who records polar bear, musk-ox, caribou, fox, wolf, hare, weasel, and lemming, also ringed and bearded seal and twenty-three species of birds. No musk-ox was seen on Prince Patrick Island in 1954. On the west coast of Melville Island, musk-ox, caribou, hare, and ringed and bearded seals were seen.

Climate

The Meteorological observations made at Mould Bay for the years 1948-50 have been summarized by Rae (1951). The mean daily maximum temperature is 6.3 degrees Fahrenheit and the mean mimimum -6.6 degrees Fahrenheit. During that period the lowest temperature recorded was -42 degrees (in January) and the highest 44 degrees (in July). During the summer of 1954 a high of 52 degrees was recorded. The annual precipitation is low, and amounts to less than the equivalent of 3 inches of rain.

References

Arkell, W. J. (1946): Standard of the European Jurassic; Bull. Geol. Soc. Am., vol. 57, pp. 1-34.

Armstrong, A. (1857): A Personal Narrative of the Discovery of the Northwest Passage .....; Hurst and Blackett, London.

Bernier, J. E. (1910): Report of the Dominion of Canada Government Expedition to the Arctic Islands and Hudson Strait on board the D. G. S. "Arctic" (1908-1909); Government Printing Bureau, Ottawa.

Donovan, D. T. (1953): The Jurassic and Cretaceous Stratigraphy and Palaeontology of Trail Island, East Greenland; Medd. om Grønland, bd. 111, No. 4.

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

Fortier, Y. O., McNair, A. H., and Thorsteinsson, R. (1954): Geology and Petroleum Possibilities in Canadian Arctic Islands; Bull. Amer. Assoc. of Pet. Geol., vol. 38, No. 10, pp. 2075-2109, 7 figs.

Frebold, H. (1929): Oberer Lias and Unteres Callovien in Spitzbergen; Skrifter om Svalbard, og Ishavet; bd. 20.

Haughton, S. (1857): Geological Notes and Illustrations; in M'Clintock, 1857, pp. 238-250.

_____ (1859): Geological Account of the Arctic Archipelago; Appendix IV in M'Clintock, 1859.

Heer, O. (1868): Enhaltend die in Nordgronland, auf der Melville Insel, im Banksland, in Island und in Spitzbergen entdeckten fossilien Pflanzen; Flora Fossilis Arctica, vol. 1, Zurich.

Jeletzky, J. A. (1954): in Macdonald, 1954, pp. 235-238.

Jenness, J. L. (1952): Erosive Forces in the Physiography of Western Arctic Canada; Geog. Review, vol. 42, No. 2, pp. 238-252.

Koch, L. (1929): The Geology of the South Coast of Washington Land; Medd. om Grønland, bd. 73, No. 1.

_____ (1933): The Geology of Inglefield Land; Medd. om Grønland, bd. 73, No. 2.

Konig, C. D. E. (1824): Rock specimens; in Parry, W. E., Supplement to the Appendix of Captain Parry's voyage for the Discovery of a Northwest Passage, in the years 1819-1820; pp. ccxlvii-cclvii.

Macdonald, S. D. (1954): Report on Biological Investigations at Mould Bay, Prince Patrick Island, N. W. T., in 1952; Nat. Mus., Canada, Bull. 132, pp. 214-238.

Mecham, G. F. (1855): Travelling Journal of Lieut. G. F. Mecham; in Further Papers Relative to the Recent Arctic Expeditions in Search of Sir John Franklin and the Crews of H.M.S. "Erebus" and "Terror"; London, for H. M. Stationery Office; pp. 499-540.

M'Clintock, F. L. (1855): Travelling Journal of Commander F. L. M'Clintock; ibid., pp. 540-587.

_____ (1857): Reminiscences of Arctic Ice Travel in Search of Sir John Franklin and his Companions; Jour. Roy. Soc. Dublin, vol. 1, pp. 183-280.

_____ (1859): A Narrative of the Discovery of the Fate of Sir John Franklin and His Companions; John Murray, London.

McMillan, J. G. (1910): Geological Report, in Bernier, 1910, pp. 383-500.

Rae, R. W. (1951): Climate of the Canadian Arctic Archipelago; Dept. of Transport, Canada, 90 pp.

Schei, P. (1904): Preliminary Account of the Geological Investigations during the second Norwegian Polar Expedition in the "Fram"; Appendix 1 in Sverdrup, 1904.

Spath, L. F. (1932): The Invertebrate Fauna of the Bathonian-Callovian Deposits of Jameson Land (East Greenland); Medd. om Grønland, bd. 87, No. 7.

_____ (1936): The Upper Jurassic Invertebrate Faunas of Cape Leslie, Milne Land, II (Upper Kimmeridgian and Portlandian); Medd. om Grønland, bd. 99, No. 3.

_____ (1947): Additional Observations on the Invertebrates (Chiefly Ammonites) of the Jurassic and Cretaceous of East Greenland, I, the Hectoroceras fauna of Southwest Jameson Land; Medd. om Grønland, bd. 132, No. 3.

Stefansson, V. (1921): The Friendly Arctic; MacMillan, New York.

Sverdrup, O. (1904): New Land, Four Years in the Arctic Regions, vol. 2, Longmans Green, London.

Thorsteinsson, R., and Fortier, Y. O. (1954): Report of Progress on the Geology of Cornwallis Island, Arctic Archipelago, Northwest Territories; Geol. Surv., Canada, Paper 53-24.

Troelsen, J. C. (1950): Contributions to the Geology of Northwest Greenland, Ellesmere Island and Axel Heiberg Island; Medd. om Grønland, bd. 149, No. 7.

Troelsen, J. C. (1952): Geological Investigations in Ellesmere Island; Arctic, vol. 5, pp. 199-210.

Washburn, A. L. (1947): Reconnaissance Geology of Portions of Victoria Island and Adjacent Regions, Arctic Canada; Geol. Soc. Amer., Mem. 22.

PHYSICAL FEATURES

Physiography

The physiography of the area studied suggests that stream action, coupled with mass wasting, has been largely responsible for its present configuration. As noted by Jenness (1952) 'splash erosion' is practically non-existent in the western Arctic as little rain falls. Incisive stream erosion, brought about by the annual period of torrential run-off during the spring thaw, is very active. Mass wasting, particularly by solifluction and rockfall, is the most important agent of denudation on the sides of valleys. There is little denudation on the flat highland surfaces, and in consequence peneplain remnants are conspicuous.

Prince Patrick Island

Prince Patrick Island may be described as a peneplain, in part elevated and dissected, which slopes to the northwest. The southeast coast is indented by three prominent narrow bays, Walker Inlet, Mould Bay, and Intrepid Inlet. The peninsulas between these bays are dissected peneplain remnants, with elevations up to about 700 feet, developed in Palaeozoic and Mesozoic sedimentary rocks. On the peninsula between Mould Bay and Intrepid Inlet are prominent north-south escarpments that define cuestas facing the west. These express topographically the north-south strike imposed by post-Lower Cretaceous normal faulting. The sandstones of the Melville Island formation produce fault line scarps and the Mould Bay formation provides resistant beds that form escarpments where they overlie the relatively incompetent Wilkie Point strata. To the northwest the Palaeozoic and Mesozoic formations pass beneath the unconsolidated sands and gravels of the Beaufort formation. Near the contact between the Beaufort and earlier formations, hills cut in the two formations reach the same elevations; in other words the northwest sloping gradient of the peneplain is not interrupted at this geological boundary. The terrain formed by the Beaufort formation appears to extend to the west coast of the island and to slope gradually to sea-level. The many consequent streams that drain this region exhibit a remarkably dentritic pattern. The north and west coast of the island is said by M'Clintock (1855), Mecham (1855), and Stefansson (1921) to be so low that in spring when snow-covered it is difficult to distinguish between land and sea. Streams draining the southeast

side of the island that head in the Beaufort terrain and thence flow over Palaeozoic and Mesozoic sedimentary rocks commonly show superposed gorges where they traverse the relatively resistant Palaeozoic sandstones. The creek flowing into the west side of Mould Bay 1 mile south of its head is a good example.

Eglinton Island

Eglinton Island also represents a dissected peneplain, the remnants of which form the striking, flat-topped hills described by Mecham (1855). The elevations of these hills apparently lie between 400 and 500 feet. Stream valleys have a V-shaped profile at their heads but the lower reaches meander over the low country that lies to seaward of the hills. The bedrock of Eglinton Island is probably entirely of Mesozoic age and consists of soft sediments that are readily eroded. 'Badland' topography has developed in the northern part of the island where vegetation is almost entirely lacking.

Western Melville Island

The west side of Melville Island constitutes a dissected plateau deeply indented by three long inlets, from north to south, Marie, Ibbett, and Purchase Bays. The position of Ibbett Bay is probably related to the nature of the bedrock, for it lies between resistant Lower Palaeozoic argillites and carbonate rocks on the north and scarp-forming sandstones within the Melville Island formation on the south. The stratigraphic interval between these beds elsewhere comprises incompetent sandstones and siltstones in which wide valleys have formed in the Canrobert Hills. The site of Marie and Purchase Bays may also be controlled by the nature of the bedrock. The former apparently lies close to the Palaeozoic-Mesozoic contact and the mouth of Purchase Bay is situated on the axis of a syncline. The peninsula north of Marie Bay was not visited, but a study of air photographs and flights over the area show that it represents a well-dissected plateau cut mainly in northerly dipping Mesozoic sedimentary rocks. These Mesozoic formations form east-west trending cuestas, the most prominent of which lies about 6 miles north of Marie Heights and is probably formed by sandstones of the Mould Bay formation. In the Canrobert Hills, between Marie and Ibbett Bays, elevations reach about 1,800 feet. The bedrock consists of Ordovician, Silurian, and Devonian sedimentary rocks that have been folded to form east-west trending structures. Dissection is more pronounced than to the south of Ibbett Bay. The Ordovician and Silurian strata are more resistant than the overlying Devonian rocks, and in consequence form prominent ridges aligned east-west. Between Ibbett Bay and Cape Russell elevations probably reach 2,000 feet within 20 miles of the coast. Recent charts give an elevation of approximately 3,500 feet for the Blue Hills, which lie

east of the head of Purchase Bay. The plateau of western Melville, south of Ibbett Bay, has not suffered much dissection; streams that drain it have canyons of V-shaped profile and the coasts are formed of steep cliffs.

Glaciation

There is no geomorphological evidence to suggest that continental glaciers crossed Viscount Melville Sound and penetrated to these islands. The lithology of the Beaufort formation may indicate that continental glaciation extended to this area but the evidence is decidedly inconclusive (See page 25).

Prince Patrick Island

At the head of Mould Bay there is evidence of glaciation, and glacial striae, aligned parallel to the axis of the valleys, are found at elevations up to 300 feet in each of the wide valleys at the head of the bay. Erratics of Devonian sandstone and of igneous rocks, presumably derived from pebbles and boulders associated with the Beaufort formation, are common in these valleys up to an elevation of about 250 feet. The lakes in the region of the west arm of the bay are the largest on the island, the small one east of Landing Lake being in a basin excavated in bedrock. These features are attributed to the action of a small local ice-cap that developed subsequent to the establishment of the main drainage system of the island.

Eglinton Island

No evidence of local glaciation has been seen on Eglinton Island.

Melville Island

No striae or erratics were seen on the west coast of Melville Island. McMillan (1910, p. 461), however, described striae on the shore of Liddon Gulf, which he suggests may have resulted from local glaciation. The width, steeply sloping sides, and abruptly truncated heads of Ibbett and Purchase Bays suggest that they represent stream-cut valleys that have been enlarged by tongues extending from an ice-cap similar to that present on Devon Island today. Air photographs show several permanent snowfields in southwestern Melville Island that probably represent the remains of such an ice-cap.

Emergence Features

Emerged strand lines, so conspicuous in many parts of the Arctic Archipelago, have not been recognized on Prince Patrick Island. No physiographic features to suggest emergence were seen on Eglinton Island, but on the east coast, 6 miles south of Gardiner Point, shells of Hiatella arctica (Linne)[1], which lives in the Arctic Ocean today, were found up to an elevation of 60 feet above sea-level. No emergence features were seen on the west coast of Melville Island, although they have been described on the south and east coasts (See Washburn, 1947).

[1]Identified by Miss F. J. E. Wagner, Geological Survey of Canada.

STRATIGRAPHY

General Statement

The consolidated sediments within the area investigated range in age from Lower Ordovician, and perhaps earlier, to Lower Cretaceous (?). Ordovician, Silurian, and Devonian rocks have been recognized on the west coast of Melville Island between Capes Russell and De Bray and Mesozoic rocks are probably present north of Marie Bay. Upper Jurassic or Lower Cretaceous rocks are present on northern Eglinton Island. Devonian, Jurassic, and Lower Cretaceous (?) rocks, together with younger unconsolidated sediments, occur on Prince Patrick Island.

The Lower Palaeozoic is represented by about 4,000 feet of carbonate and fine-grained clastic rocks in the Canrobert Hills, on the west coast of Melville Island. The lowest beds, the Canrobert formation, comprise thin-bedded dolomites and edgewise conglomerates from which no fossils are known. They are succeeded, probably conformably, by about 3,500 feet of black shales and argillites (the Ibbett Bay formation), which contain graptolite faunas ranging in age from Lower Ordovician (Arenig) to Silurian (Ludlow).

The Lower Palaeozoic sediments are overlain, in structural conformity, by the Melville Island formation, which is composed principally of sandstone. Thin interbedded calcareous strata in the lower part carry marine Devonian fossils and beds higher in the section poorly preserved vertebrate and plant fossils of probable Devonian age. These upper beds also include thin coal seams. The thickness of the Melville Island sedimentary rocks, which were probably derived from the north, apparently exceeds 11,000 feet.

On Prince Patrick Island the Melville Island formation is overlain unconformably by the Jurassic Wilkie Point formation, which reaches a thickness of more than 500 feet and consists predominantly of sandstone. Marine fossils of Lower, Middle, and perhaps Upper Jurassic age occur in the lower part of the formation. The higher beds, which include thin coal seams, are probably of non-marine origin.

The Wilkie Point beds are overlain by sandstones referred to as the Mould Bay formation. Locally the Mould Bay and Wilkie Point formations are conformable, but the latter is transgressive and in places rests directly on the Melville Island formation. The Mould Bay formation, which is about 400 feet thick, contains a marine fauna of Upper Jurassic or Lower Cretaceous age in the lower part. The higher beds contain coal seams and are of non-marine deposition.

The Mould Bay formation is overlain, apparently conformably, by the Landing Lake formation, which comprises at least 130 feet of grey clay shale with limestone concretions and indeterminate marine shells. On the basis of its stratigraphic position the Landing Lake formation is provisionally referred to the Lower Cretaceous.

The Palaeozoic and Mesozoic formations of Prince Patrick Island are overlain unconformably by the unconsolidated sands and gravels of the Beaufort formation, the age and mode of origin of which are open to question. This formation reaches a thickness of at least 250 feet and contains abundant fragments of unaltered fossil wood.

Table of Formations

Period	Formation and approximate thickness (feet)	Lithology
Tertiary and/or Quaternary	Beaufort (7) 250+	Sand, gravel
	Unconformity	
Cretaceous (?)	Landing Lake (6) 130+	Shale
Upper Jurassic and/or Lower Cretaceous	Mould Bay (5) 400±	Sandstone, shale, coal

Local unconformity and overlap

Jurassic	Wilkie Point 500+	(4)	Sand, sandstone, phosphatic nodules, coal

Angular unconformity

Devonian	Melville Island 11,000+	(3)	Sandstone, siltstone, shale; coal
Ordovician and Silurian	Ibbett Bay 3,500+	(2)	Shale
Ordovician and/or earlier	Canrobert 600+	(1)	Dolomite, edgewise conglomerate

Ordovician and/or earlier

Canrobert Formation

The lowest beds exposed in the anticline north of Ibbett Bay on Melville Island comprise about 600 feet of dark grey, yellowish grey weathering, thin-bedded, silty dolomites interbedded with clastic carbonate rocks that include calcarenites and edgewise conglomerate. These rocks are referred to as the Canrobert formation. Most of the detritus in the calcarenites is carbonate material but small grains of quartz are also present as a minor constituent. Carbonate slabs up to 6 inches long occur in the edgewise conglomerates. The base of this formation has not been seen.

No fossils were seen in these rocks, however, but they are presumably of Lower Ordovician (Tremadoc) age or earlier, for the overlying Ibbett Bay formation contains graptolites of Lower Ordovician (Arenig) age. Lithologically these beds seem to resemble the Lower Ordovician Cass Fjord formation of northwest Greenland and Bache Peninsula, Ellesmere Island, described by Koch (1929, 1933) and Troelsen (1950).

Ordovician and Silurian

Ibbett Bay Formation

Ordovician and Silurian shales and argillites that lie between the Canrobert and Melville Island formations are named the Ibbett Bay formation. The formation has been recognized only in the Canrobert Hills of Melville Island. The type section is exposed on the north limb of the anticline immediately north of Ibbett Bay.

The Ibbett Bay formation comprises black, thin-bedded, graptolitic shale and black, grey weathering argillite. Grey and black chert radiolarian occurs interbedded with black shale in the middle of the formation. Beds near the base include calcareous sandstone. The contact with the underlying Canrobert formation has not been seen but the two formations are evidently structurally conformable. The thickness of the Ibbett Bay formation is estimated to be about 3,500 feet east of Blackley Haven.

Graptolites are abundant in the Ibbett Bay formation and, except for one undetermined, inarticulate brachiopod, were the only macrofossils seen. The collections were submitted to R. Thorsteinsson, who is responsible for the following determinations and correlations.

Beds near the base of the formation 4 miles northeast of Nisbet Point have yielded Didymograptus sp. nov. aff. D. nicholsoni var. planus Elles and Wood. Thorsteinsson states that this species permits a correlation with the Arenig series (Lower Ordovician) of Great Britain. Collections made from talus nearby include: a lot with Tetragraptus (Etagraptus) cf. approximatus Nicholson; a lot with Tetragraptus cf. serra (Brongniart), Didymograptus cf. extensus Hall, and Glyptograptus cf. dentatus (Brongniart); and a third lot with Goniograptus cf. macer T. S. Hall, Tetragraptus cf. quadribrachiatus (Hall), and indeterminable dichograptids. All three lots are dated as Arenig by Thorsteinsson.

Middle Ordovician (Caradocian) graptolites were also collected in talus. Climacograptus bicornis (Hall) cf. var. tricornis Lapworth, a lower Caradocian species, was collected on the south side of Blackley Haven and Orthograptus quadrimucronatus (Hall), which occurs at the top of this series in Great Britain, was collected about 1 mile inland, 1 1/2 miles north of Blackley Haven.

A collection from the cherty beds north of Blackley Haven, which probably lie in the middle of the formation, contains Climacograptus cf. latus Elles and Wood, Orthograptus sp. indet., and Dicellograptus ? sp. Thorsteinsson suggests that this represents an Ashgillian (Upper Ordovician) fauna.

A talus collection made in a small creek flowing into Ibbett Bay 2 1/2 miles east of Nisbet Point has: Petalograptus palmeus Barrande, Glyptograptus tamariscus Nicholson, Climacograptus sp.,

Monograptus regularis Tornquist, and M. turriculatus (Barrande). These species range between the zones of Monograptus gregarius and M. turriculatus, which are in the middle of the Llandovery series (Silurian) of Great Britain.

Graptolites collected in talus from beds about 800 feet from the top of the formation 2 miles east of the southeast corner of Blackley Haven include Stomatograptus grandis (Suess), Cyrtograptus cf. centrifugus Boucek, Monograptus priodon Bronn, M. cf. vomerinus (Nicholson), and M. convolutus coppingeri Etheridge. Thorsteinsson states that this collection includes representatives of several zones in the upper part of the Llandovery series. S. grandis and C. centrifugus characterize respectively the penultimate and uppermost zones of the Llandovery in Bohemia and on Little Cornwallis Island M. convolutus coppingeri occurs below S. grandis but above M. turriculatus (i.e., in a lower zone of the upper part of the Llandovery).

Monograptus bohemicus (Barrande) was collected in situ about 200 feet from the top of the formation in the same section as the preceding collection. This species ranges from the zone of M. nilssoni to that of M. tumescens, in the Lower Ludlow in Great Britain.

From the foregoing it is evident that the Ibbett Bay formation represents a graptolitic facies ranging in age from Lower Ordovician (Arenig) to the upper part of the Silurian (Ludlow). The lithological uniformity of the formation, coupled with the presence of several faunas of intermediate age, suggests that it represents continuous sedimentation throughout most of Ordovician and Silurian time. The recent discovery by Thorsteinsson and Fortier (1954) of a thick Upper Ordovician and Silurian graptolitic formation on the north half of Cornwallis Island, some 400 miles to the east, suggests that a belt of graptolitic Lower Palaeozoic rocks may extend throughout the length of the Parry Islands.

Devonian

Melville Island Formation

The term Melville Island is applied to a thick sequence of mainly fine-grained, clastic rocks, overlying the Ibbett Bay formation, that occurs on Melville and Prince Patrick Island. The top of the formation has not been seen, for it represents the youngest Palaeozoic unit recognized within the area, being separated from the overlying Mesozoic rocks by an unconformity. About 11,000 feet of beds are present on the west coast of Melville Island between the Canrobert Hills and Stevens Head and this section may be considered typical.

The lowest beds of the formation have only been seen in the Canrobert Hills. The contact with the underlying Ibbett Bay

formation has not been observed but the stratigraphic interval covered does not amount to more than 100 feet and the two formations are structurally conformable. These beds comprise thin-bedded, olive-grey, micaceous siltstone and sandstone and dark grey, yellowish brown weathering sandstone, some of which show ripple-marks. Thin beds of grey silty shale with dusky red clay ironstone concretions and thin, impure, fossiliferous lenticular limestones with black phosphatic pebbles are present in the upper part. Fossils from these limestones identified by D. J. McLaren include Atrypa sp., "Martinia" sp., Nuculana sp. and other pelecypods and Dechenella sp. These beds have been closely folded and consequently the thickness is not easily estimated; it probably amounts to about 3,500 feet.

About 7,500 feet of beds are exposed between Ibbett and Purchase Bays. Their relationship to the basal beds exposed in the Canrobert Hills has not yet been determined, for the covered interval of Ibbett Bay intervenes. The absence of horizon markers precludes a precise correlation between the beds north and south of Ibbett Bay, but it is probable that the highest beds in the Canrobert Hills do not range as high as the lowest south of the bay. The lower 3,000 feet comprise light grey and brown, fine-grained, in part micaceous sandstones with thin dusky red weathering, calcareous sandstones that carry marine fossils. Fossils are particularly abundant immediately south of Ibbett Bay. They have been identified by McLaren and include: Alveolites ex gr. suborbicularis Lamarck, Uralophyllum sp., Zonodigonophyllum sp., Productella 2 spp., Anatrypa sp., Atrypa ex gr. independensis Webster, "Martinia" richardsoni Meek, Plectospirifer cf. fongi Grabau, Cyrtina sp., Nuculana sp., Myalina sp., Goniophora sp., and Dechenella (D.) cf. verneuili (Barrande). The beds with marine fossils are succeeded transitionally by rather similar beds that differ in that thick-bedded, yellow-brown weathering, grey, frequently crossbedded sandstone and olive-green sandstone become increasingly common. Intraformational conglomerates and thin coal seams also appear in the section and dusky red, clay ironstone concretions are common. Ripple-marks are frequent and the foreset dip of the crossbedded sandstones is mostly to the south. No marine fossils were found in these beds, but fragmentary plant remains were collected.

South of Purchase Bay, which conceals the beds overlying those exposed at Stevens Head, essentially similar strata reappear, but again owing to the absence of horizon markers the relationship between the beds north and south of the bay cannot be determined. Lithologically they resemble particularly the upper beds exposed between Ibbett and Purchase Bays and they include thin coal seams. Fossiliferous beds are also present. At Kelly Point Lingula melvillensis Lambe and Estheria canadensis Lambe were collected, and 2 1/2 miles south of the point fragmentary vertebrate fossils, identified as fragments of placoderms by Wann Langston, together with Schizophoria sp. were collected.

On Prince Patrick Island beds referred to the Melville Island formation occur on the peninsulas between Intrepid and Walker Inlets. Exposures are extensive but many are covered with talus derived from the thick-bedded sandstones. About 7,300 feet of beds are exposed on the west side of Mould Bay between the scarp south of Landing Lake and the prominent cliffs opposite the weather station. The base of the formation has not been seen and is probably not exposed on Prince Patrick Island. The lower 1,800 feet consist of thin-bedded, olive-grey sandstones and siltstones, in part micaceous, with subordinate grey shale containing dusky red, clay ironstone concretions. Some beds carry marine fossils together with poorly preserved plant fragments. From a collection made in a calcareous sandstone near the base of this section, 1/2 mile south of Landing Lake, McLaren has determined Schizophoria sp. and Allanaria ? sp., and from a collection made about 1,000 feet higher in the section, he determined Cyrtospirifer sp. and Atrypa sp. The succeeding 5,500 feet comprise olive-green and light grey to white sandstones. The latter are mostly thick bedded, contain up to 40 per cent kaolinized feldspar, and are commonly cemented by pods of hematite. Micaceous siltstones and thin beds of small-pebble conglomerate, carbonaceous shale, and coal are also present. Many of the sandstones contain plant fragments, some of which, from beds about 4,300 feet above the base, were determined by W. L. Fry as Bothrodendron sp. L. and H. and an axis similar to those associated with Archaeopteris.

Thin-bedded sedimentary rocks with fossiliferous bands, similar to those occurring in the lower part of the section described above, outcrop extensively at the north end of Mould Bay and between the bay and Landing Lake. Immediately east of Landing Lake Cyrtospirifer ex gr. verneuili (Murchison) and Atrypa ex gr. devoniana Webster, determined by McLaren, were collected. Lower beds in this area have provided several faunules that are apparently not widely separated stratigraphically. McLaren has determined the following species from these beds: Schizophoria cf. athabaskensis Warren, Allanaria cf. allani (Warren), and a large productellid in one faunule; and Eleutherokomma cf. leducensis Crickmay from another. A third carries Alveolites sp., Thamnopora sp., and Synaptophyllum aff. arundinaceum (Billings). In similar beds on the east side of Mould Bay, 5 miles north of the weather station, Eleutherokomma sp. occurs with fossil wood, determined by Fry as Callixylon sp.

Most of the strata exposed inland, between Mould Bay and Walker Inlet and on the east shore of the latter, are similar to the beds in the upper part of the section on the west side of Mould Bay.

Regarding the marine faunas from the Melville Island formation, McLaren states: "Three distinct faunas appear to be represented among the collections, representing Middle and Upper Devonian horizons.

"The fauna from Prince Patrick Island, typified by Cyrtospirifer and Atrypa, is of Upper Devonian (Frasnian-Senecan) age. The faunules from Prince Patrick Island collected from beds below those with Cyrtospirifer include one typified by Schizophoria, Allanaria and productellids and another with Eleutherokomma. These assemblages seem to represent a distinct fauna. Allanaria and Eleutherokomma have not been recognized in the same faunule but I believe that they are of approximately equivalent age. According to Tozer the field evidence supports this conclusion. The genera Allanaria and Eleutherokomma occur widely in western and northern Canada everywhere below beds with Cyrtospirifer. They typify a faunal stage of earliest Upper and possibly late Middle Devonian age. Eleutherokomma appears to range higher than Allanaria but much of their range overlaps. Faunas with a somewhat similar general aspect occur in the Waterways formation of northern Alberta and the Flume formation of the Rocky Mountains, although no correlation is positively indicated.

"The third fauna, typified by that from the beds immediately south of Ibbett Bay on Melville Island, is characterized by digonophyllid corals, Anatrypa, Plectospirifer, "Martinia" richardsoni Meek (which appears to belong to an undescribed genus), and Dechenella cf. verneuili (Barrande), which suggest a Middle Devonian (Givetian) age. The collections from the Canrobert Hills may be confidently correlated with this horizon. "Martinia" richardsoni was first described from Fort Good Hope on the Mackenzie River and has been reported in beds associated with Stringocephalus sp. Plectospirifer has not been reported from the Devonian of northern Canada previously, but "Spirifer" compactus Meek, from Lockhart River, may belong to the genus although it is not conspecific with the form in these collections.

"The faunules collected between Purchase Bay and Cape Russell, containing Lingula, Schizophoria and Estheria, cannot be definitely correlated with any of the above faunas."

The placoderm fragments collected 2 1/2 miles south of Kelly Point almost certainly indicate an Upper Devonian age for these beds according to Wann Langston.

Regarding Bothrodendron sp. and other plant fragments from the beds on Prince Patrick Island above those carrying marine Upper Devonian fossils Fry states: "The plant fragments lack elemental diagnostic features and the generic identifications must be regarded as tentative. The plants most closely resemble Devonian form genera but there is nothing to eliminate the possibility of this collection representing an unusual florule of higher stratigraphic level."

The lithological uniformity and monotony of the Melville Island formation makes stratigraphic comparison between Prince Patrick and Melville Islands difficult, nevertheless, in both areas

the formation seems to be divisible into two, as yet poorly defined, units: a lower part consisting of thin-bedded, drab-coloured, fine-grained, clastic rocks with beds carrying marine fossils, and an upper part characterized by relatively thick-bedded, green and light grey sandstones with much carbonaceous material and interbedded coal seams. Much of this upper part evidently was deposited under non-marine conditions, and the predominant direction of foreset dip may be interpreted as suggesting that the sediment was derived from the north. As noted above, on Prince Patrick Island the marine faunas in the thin-bedded unit are all of Upper Devonian age, whereas on Melville Island the marine fauna collected below the coal-bearing beds is of Middle Devonian age. Further collecting will probably reveal marine Upper Devonian faunas below the coal beds on Melville Island also.

The crossbedded sandstone and shaly sandstone described by McMillan (1910, p. 401 et seq.) from the Dundas peninsula on the south coast of Melville Island are almost certainly referable to this formation. It was in this area that McMillan collected Lingula melvillensis and Estheria canadensis. The sediments described by McMillan farther east, between Winter Harbour and Bridport Inlet, may also represent the same formation, in fact much or all of the "Carboniferous sandstones" of Haughton (1859, p. 383), which are apparently widely distributed in the Parry Islands, probably represent the same unit as the Melville Island formation. As shown above, there is no evidence on Prince Patrick and western Melville Islands to suggest that these beds range higher than the Devonian.

The upper plant-and vertebrate-bearing beds of the Melville Island formation seem to be about the same age, and resemble in facies, "Series E" of the Devonian of southwestern Ellesmere Island, described by Schei (1904), but the limestones and shales of "Series D", with abundant marine fossils, which underlie "Series E" are apparently quite unlike the lower Melville Island beds.

Jurassic

Wilkie Point Formation

Sandstone and sand, with interbedded, thin, dusky red weathering, hard bands, rest unconformably upon the Melville Island formation and are here designated the Wilkie Point formation. Marine fossils of Jurassic age are present in the lower part of the formation. These beds were first discovered by M'Clintock (1857) and the fossils he collected were described by Haughton (1857).

The Wilkie Point formation has been examined only on Prince Patrick Island, but air reconnaissance and photographs show that it is also present on Melville Island. The best exposures known form cliffs on the east side of Intrepid Inlet, 11 miles north of Cape Canning, and the section there is considered typical.

On Prince Patrick Island the Wilkie Point formation outcrops over most of the peninsula for which the beds are named and occurs as outliers between Intrepid Inlet and Mould Bay. West of Mould Bay the formation has only been recognized around Landing Lake, for south of the lake, between Mould Bay and Walker Inlet, the Wilkie Point beds are not present and the succeeding Mould Bay formation rests directly on Palaeozoic rocks.

The unconformity between the Wilkie Point and Melville Island formations is clearly displayed between Intrepid Inlet and Mould Bay. Outliers of Wilkie Point beds rest on the northeasterly dipping Melville Island formation east of Disappointment Point and on sandstones of the same formation dipping to the southwest 1 mile north of the weather station. In each case the angle of discordance is about 10 degrees (See Figure 1, page 32). The contact between the formations is not exposed, but north of the weather station a small patch of brown, fossiliferous, conglomeratic sandstone, overlain by distintegrated red sandstone, rests upon the Melville Island formation and the concealed interval does not exceed 10 feet.

The following section was measured on the east side of Intrepid Inlet between 11 and 12 miles north of Cape Canning. The lower beds are well exposed on the coast and the higher units may be seen a short distance inland. Fossil and age determinations are by H. Frebold.

		Thickness (in feet)	
		Unit	Total from base
	Wilkie Point formation (in part)		
8	Sandstone and sand: light grey to white, very fine grained, mainly massive but in part crossbedded; weathers to castellated forms	130	560
7	Sandstone and sand: yellowish orange, medium grained, with reddish brown, hard bands; much fossil wood	180	430
6	Sandstone and sand: light grey, fine grained, with dusky red, fossiliferous, hard bands and grey phosphatic nodules; Inoceramus cf. retrorsus Keys., Ammonite gen. nov., ichthyosaur vertebrae (Bathonian-Callovian)	70	250

		Thickness (in feet)	
		Unit	Total from base
5	Sandstone and sand: light grey, fine grained; lenticular 6-inch conglomerate of fragments of underlying sandstone at base	50	180
4	Sandstone: pale reddish brown, fine grained, calcareous; lower contact indefinite; Ludwigia (Lioceras) opalina Rein (Lower Bajocian)	5	130
3	Sandstone and sand: soft, light grey, fine grained	98	125
2	Sandstone: pale reddish brown, fine grained; "Harpoceras" aff. m'clintocki (Haughton) (Toarcian) ...	2	27
1	Sandstone, soft, light grey, fine grained	25	25
	Covered interval to sea-level	100	

The covered interval at the base of the section probably represents soft sediments referable to the Wilkie Point formation. No sign was seen of the hard Devonian sandstones that underlie the Wilkie Point beds on the west side of Intrepid Inlet. Beds probably equivalent to unit 7 in the above section contain a 3-foot coal seam on the west side of Intrepid Inlet 4 miles north of Salmon Point.

The upper lithological units distinguished in this section may also be recognized on the Manson Point peninsula. The light grey to white, fine-grained sandstone (unit 8), which constitutes a very distinctive bed at the top of the formation, is about 150 feet thick 4 miles northeast of the weather station where it is underlain by yellow sands with hard bands and fossil wood, the equivalent of unit 7. The lower beds, which carry marine fossils, are widely distributed but the exposures are generally completely disintegrated by frost action. They comprise soft grey sandstone and sand, with reddish brown and dusky red hard bands and grey phosphatic nodules.

The total thickness of the Wilkie Point formation on the Manson Point peninsula is not easily estimated as the attitude of the beds in the lower part of the section can rarely be determined. However, it probably does not exceed 500 feet, which is less than the total exposed thickness north of Cape Canning. This is probably

accounted for by the attenuation of the lower beds, for the upper units (7 and 8 in the measured section) seem to maintain a constant thickness throughout the area. Possibly this thinning may be due in part to an unconformity, for north of Cape Canning there is evidence of a non-sequence, in the form of an intraformational conglomerate, between the beds referred to the Bajocian and Bathonian-Callovian stages.

The Wilkie Point formation has not been examined on Melville Island. However, the light colour and absence of vegetation that characterize the soft sandstones at the top of the formation makes it possible to trace these beds, and, therefore, the Wilkie Point-Mould Bay contact (See page 3), on air photographs. On this evidence the Wilkie Point formation may be recognized on Melville Island.

Marine fossils are abundant in the lower part of the Wilkie Point formation, but the upper beds are in part, and perhaps entirely, of non-marine deposition. The faunas have been examined by H. Frebold, who has made the following identifications. Dactylioceras cf. commune Sow. was obtained from the conglomeratic beds at or near the base of the formation 1 mile north of the weather station. Phosphatic nodules collected on the surface of disintegrated outcrops representing beds not more than 100 feet above the base, 3 3/4 miles northeast of the weather station, have yielded "Harpoceras" sp. indet. and Coeloceras sp. nov. Nodules from the small, fault-bounded outcrop immediately east of Landing Lake contain Coeloceras sp. nov., "Harpoceras" aff. m'clintocki (Haughton), and pelecypods. Fossils collected from talus on the disintegrated outcrops at Wilkie Point include "Harpoceras" m'clintocki (Haughton), Ludwigia (Lioceras) opalina Rein., "Monotis" septentrionalis Haughton, Goniomya sp., and other pelecypods. From the measured section (See page 19) north of Cape Canning three faunas were collected in situ, characterized, in ascending order, by: "Harpoceras", Ludwigia, and a new ammonite genus. Beds 3 miles south 30 degrees east of the weather station, which underlie sandstone with fossil wood similar to those on Intrepid Inlet above the beds with the new ammonite genus, have Arctocephalites sp. and belemnoids in situ. Talus collections at this locality have Arctocephalites (Cranocephalites) cf. vulgaris Spath, A. (C.) cf. vulgaris var. robusta Spath, A. sp., Cylindroteuthis sp., Pecten sp., and Inoceramus sp.

Regarding these faunas Dr. Frebold states: "The Jurassic collections made on Prince Patrick Island prove clearly the presence of three stages, i.e. the Toarcian, the Lower Bajocian, and the "Bathonian-Callovian".

"The lowermost Jurassic horizon on Prince Patrick Island is characterized by the Dactylioceras fauna which has been found locally close to the contact with the underlying Devonian rocks. This fauna is of Toarcian age.

"The collections from east of Landing Lake and northeast of the weather station, representing assemblages of Coeloceras, and "Harpoceras" and from unit 2 of the measured section of "Harpoceras" are probably younger than the Dactylioceras fauna. They may represent zones of different ages or may be facial equivalents of one another.

"Toarcian may also be represented by part of the talus collection from Point Wilkie, in which both the typical "Harpoceras" m'clintocki (Haughton) and the Lower Bajocian Ludwigia (Lioceras) opalina Rein. were found. As Tozer, in the measured section on the east side of Intrepid Inlet, found Ludwigia opalina in a horizon 100 feet higher than the horizon with "Harpoceras" aff. m'clintocki (Haughton), it seems possible that the Wilkie Point collection contains fossils from both the Toarcian and the Lower Bajocian.

"Toarcian is known from both Spitsbergen and East Greenland and it is remarkable that the lithological facies of some of the beds on Prince Patrick Island is the same as Spitsbergen (phosphatic nodules). A connection of the Toarcian sea of Spitsbergen with that of Prince Patrick Island postulated by me in 1929 (Frebold, 1929) is evident.

"Lower Bajocian is represented by the collection from unit 4 of the type section and part of the collection from Wilkie Point, which contain Ludwigia (Lioceras) opalina Rein. This species is the index fossil of the lowermost Bajocian zone. It is remarkable that this ammonite has not been reported from other Arctic regions. The collection from Wilkie Point also contains "Harpoceras" m'clintocki (Haughton) but as this collection is from talus it may have come from a horizon below that with Ludwigia opalina.

"Beds of Upper Bathonian or Callovian age are indicated by; 1. a fauna characterized by representatives of Arctocephalites (Cranocephalites) from 3 miles southeast of the weather station, which is well known in other Arctic regions, particularly East Greenland and 2. a fauna consisting of various species of a new ammonite genus and Inoceramus cf. retrorsus Keys. from unit 6 of the type section.

"Spath (1932) determined the age of the Greenland Arctocephalites beds as Upper Bathonian, but Arkell (1946) is of the opinion that they belong in the Lower Callovian. Donovan (1953) points out that the exact age of the Greenland beds is open to question and considers both Bathonian and Callovian as possible. The field investigations in Prince Patrick Island do not help to decide this question. Therefore both Upper Bathonian and Lower Callovian are considered as possible ages. As to the horizon of Inoceramus cf. retrorsus Keys. and the new ammonite genus, it can be stated that I. retrorsus is found both in some so-called Upper Bathonian and Lower Callovian beds of Arctic regions. As the ammonites found

in these Prince Patrick Island beds are new, conclusions based upon them can only be hypothetical. The new genus resembles, to a certain degree, both Arctocephalites and some forms of Cadoceras but is easily distinguished from both of them by cosmoceratoid young whorls. The new genus was not found in association with known ammonites. Its relative stratigraphic position to the Arctocephalites beds therefore remains unknown."

The strata containing fossil wood and thin coal seams, and evidently of non-marine deposition, that overlie the marine Bathonian-Callovian beds are presumably of Upper Jurassic age for they are succeeded by the uppermost Jurassic or lowermost Cretaceous Mould Bay formation.

Upper Jurassic and/or Lower Cretaceous

Mould Bay formation

The term Mould Bay is proposed for a formation composed predominantly of sandstone, which rests upon the Wilkie Point and Melville Island formations. Although no complete section is known, most of the beds are exposed on Prince Patrick Island in the belt of outcrop extending east from the scarp 5 miles north 10 degrees east of the Mould Bay weather station. This section is considered typical.

On Prince Patrick Island the Mould Bay formation has been recognized on the peninsulas between Intrepid and Walker Inlets. Examination of air photographs suggests that the formation also forms a wide belt of outcrop extending from the northern part of Intrepid Inlet east to Fitzwilliam Strait.

Over most of the Manson Point peninsula, on Prince Patrick Island, the Mould Bay formation rests with sharp, apparently conformable contact on the white, fine-grained sandstone of the upper part of the Wilkie Point formation. To the west, between Mould Bay and Walker Inlet, the Mould Bay formation rests directly upon the Melville Island formation. Poor outcrops, lying geographically between the above localities, 3 miles south of the weather station, apparently show rocks of the Mould Bay formation resting on beds low in the Wilkie Point formation. It is, therefore, concluded that the Mould Bay beds overlap, and locally rest unconformably upon, the Wilkie Point formation.

The Mould Bay formation may be divided into two members. The lower member comprises 20 feet of poorly exposed, black, clay shale followed by about 170 feet of soft, light grey, quartz sandstone containing irregular beds of hard, light brown weathering sandstone with a calcareous cement. Some of the hard sandstones show ripple-marks and crossbedding. Nodules of dusky

red, clay ironstone, which are mostly fossiliferous, are common. Well-rounded pebbles and cobbles up to 1 foot across, composed of green sandstone and black greywacke, occur scattered throughout the sandstone. The basal clay shale is not present west of Mould Bay.

Marine fossils are abundant in many beds of the lower member, particularly curved, tubular, scaphopod-like shells, which occur in great profusion.

The upper member consists of soft grey, medium to very coarse-grained, quartz sandstone. Beds, commonly about 1 foot thick, of dark greenish grey, dusky red weathering, clay ironstone with abundant plant fragments are interbedded with the sandstone. Coal seams also occur and one 7 miles north 15 degrees east of the weather station is 5 feet thick with the base not exposed. Owing to the discontinuity of exposures the thickness of the upper member is not easily determined, but is probably not less than 200 feet and not more than 300 feet. Accordingly, the total thickness of the formation is about 400 feet.

On Eglinton Island rocks typical of the upper member of the Mould Bay formation have been recognized 7 miles south of Gardiner Point. About 180 feet of flat-lying soft grey sandstone with clay ironstone bands and a 3-foot coal seam are present.

The Mould Bay formation has not been examined on Melville Island, but examination of air photographs suggests that the northern part of the peninsula north of Marie Bay is composed of beds of this formation (See pages 3, 21).

Fossils collected from the Mould Bay formation by S. D. Macdonald of the National Museum have been examined by J. A. Jeletzky (1954, pp. 235-238) who states that the predominantly pelecypod fauna is allied to the East Greenland Portlandian (Upper Jurassic) and Infravalanginian (lowermost Cretaceous) faunas of Milne Land and southwest Jameson Land (Spath, 1936, 1947) respectively. After having briefly examined specimens of Aucella collected from the same, and some additional, localities as those of Macdonald, Jeletzky informs the writer that he now favours an uppermost Jurassic (Purbeckian or Upper Tithonian) age for this fauna, with the reservation that some of the Aucella lots may be of lowermost Cretaceous age. Jeletzky also says that the Mould Bay fauna appears to be older than the Aucella faunas recently collected from Ellef Ringnes Island and near Eureka, Ellesmere Island, both of which are definitely of Lower Cretaceous age.

Vertebrate fossils collected from the lower member of the Mould Bay formation have been identified by Wann Langston, of the National Museum of Canada. They include plesiosaur vertebrae and phalanges from the scarp 4 1/2 miles north 10 degrees east of

the weather station and the right humerus of an ichthyosaur of Opthalmosaurus (= Baptanodon) type obtained from the same beds 6 miles northeast of the station. Langston notes that the ichthyosaur is representative of a group that occurs in Jurassic rocks in Europe and the Middle Jurassic to Upper Cretaceous of North America. The plesiosaur bones are said to be possibly of the polycotylid type, and Polycotylidae are elsewhere known only in the Upper Cretaceous.

Among the poorly preserved plant remains from the non-marine upper member W. L. Fry has determined Nilssonia cf. N. nigracollensis Wieland. Fry states that although these specimens are similar to a species common in Lower Cretaceous floras, this record does not permit a precise age determination.

Lower Cretaceous (?)

Landing Lake formation

The Landing Lake formation consists of grey clay shales, which overlie the Mould Bay formation and which represent the youngest Mesozoic formation recognized within the area. The lower contact has not been seen but the two formations are structurally conformable. The best exposures, which may be considered typical, occur 4 miles southwest of Landing Lake. They comprise about 130 feet of grey clay shales that contain large concretionary masses of yellow weathering limestone and many fragments of silicified wood. The shale is very soft and friable and most outcrops are deeply weathered. Rocks and fossil wood, typical of the Landing Lake formation, were seen on the west coast of Eglinton Island early in the season when most of the land was snow covered. Mecham (1855, p. 501) records the occurrence of petrified wood on the south coast of Eglinton that may have been derived from this formation.

The only fossils seen in the Landing Lake formation other than fossil wood were poorly preserved pelecypods, which include pectenoids that indicate a marine environment of deposition. The fact that this formation overlies the uppermost Jurassic or lowermost Cretaceous Mould Bay formation suggests that it may be of Lower Cretaceous age.

Tertiary and/or Quaternary

Beaufort Formation

Unconsolidated sands and gravels rest unconformably upon the Palaeozoic and Mesozoic formations of Prince Patrick Island. These beds are named the Beaufort formation as sediments of this type are apparently widely distributed on the northwest side of the Arctic Archipelago, facing the Beaufort Sea and Arctic Ocean.

The best exposures seen are west and northwest of the head of Mould Bay, and the beds in this area may be considered typical.

Streams draining the Beauford terrain show a remarkably dendritic pattern and the interstram areas constitute flat-topped, vegetation-free ridges with rounded margins. These distinctive characters show well on air photographs and make it possible to recognize the formation in untraversed areas. The Beaufort formation has been examined on both sides of Intrepid Inlet, on the Manson Point peninsula, and between Walker Inlet and Mould Bay. Study of air photographs leads to the conclusion that all Prince Patrick Island west of a line joining Wolley Bay and Cape Leopold M'Clintock is underlain by this formation.

The formation evidently rests on a surface of moderate relief. Southwest of Landing Lake the base is at an elevation of 360 feet and within half a mile bedded sands, without an exposed base, were found down to an elevation of 240 feet. In this area 250 feet of beds are present, the maximum thickness observed. On the Manson Point peninsula the sands and gravels are about 70 feet thick with the base at an elevation of 530 feet, the highest occurrence of the formation seen. The Beaufort formation caps some of the highest hills on Prince Patrick Island and there can be no doubt that its deposition preceded the establishment of the present drainage system. This is confirmed by the presence of superposed streams (See page 7).

The sediments of the Beaufort formation comprise unconsolidated bedded and crossbedded quartz sands with thin seams of gravel. Pebbles in the gravel are well rounded and rarely exceed 2 inches in length. Bedding can only rarely be determined, owing to solifluction and slumping. The most striking characteristic of the formation is that it contains much fossil wood in a completely unlithified and uncarbonized condition. The wood occurs in fragments ranging in size from a few inches to several feet. The largest log seen was about 14 inches in diameter and at least 6 feet long. Most smaller fragments occur in well-defined beds and large logs are commonly seen protruding from banks of talus. South of Landing Lake wood was seen throughout about 200 feet of sediment. There is no evidence to suggest that the wood grew in situ, for all fragments seen were rounded and worn and in all respects resemble driftwood. The occurrence of wood answering this description was noted by Mecham (1855, pp. 518, 522-523) at Cape Manning and west of Walker Inlet. M'Clintock (1855, p. 571) described the occurrence of decayed wood on the north coast of the island. These occurrences support the inferred extension of the Beaufort formation to the west and north parts of the island.

The surface of the land where the Beaufort formation is present is covered with well-rounded pebbles and boulders that reach 3-foot dimensions. An examination of these pebbles at two localities showed that about half the material was derived from rocks similar to the Melville Island formation, the remaining half

comprising exotic rock types, including pink and brown quartzite, conglomerate, Palaeozoic limestone, purple rhyolite, diabase, red granite, and gneiss. Among the exotic rock types pink and brown quartzite are most abundant. The nature of these rocks suggests that they were derived from the south, for pink and brown quartzites are common rock types in the Precambrian of southwestern Victoria Island and granite and gneiss occur on the mainland shores of Coronation and Queen Maude Gulfs (Washburn, 1947, pp. 6, 14-15). The association of these pebbles with the underlying bedded sands and gravels might be interpreted as indicating that they are derived from a coarse phase of the Beaufort formation, but the fabric of this coarse material and its relation to the bedded sands has not been determined owing to the widespread solifluction. No large boulders have been seen in the bedded deposits. It, therefore, cannot be established that the two are genetically related.

No fossils other than wood were found in the Beaufort formation. The wood collected by Mecham was said by Heer (1868, p. 23) to have a microscopic structure similar to that of Pinus strobus, a living species; however, he referred the beds from which it came to the Miocene. Wood collected by the writer has been identified as Picea sp. (spruce) and Pinus sp. (a 5-needle pine) by J. D. Hale of the Forestry Products Laboratory, Ottawa. W. L. Fry states that fossil wood is rarely useful in stratigraphic correlation and Heer's Miocene dating is probably not justified; furthermore, the new identifications do not assist in determining the age of these beds[1].

The typical bedded sediments of the Beaufort formation probably represent a fluvial or deltaic deposit. If the coarse material is part of the formation possibly the whole represents glacio-fluvial material deposited by an ice-sheet that moved from the south, in which case the driftwood was perhaps driven onto the resulting outwash fan from the Arctic Ocean.

If the coarse material is not genetically related to the underlying Beaufort sands, they might represent a Tertiary or interglacial deltaic formation, the interbedded wood having been transported by streams. In this case the origin of the coarse material is problematical, particularly as it has no determinable fabric. There is no geomorphological evidence to suggest that it might represent ground moraine, but any such features may have been obliterated by the planation that followed the deposition of the Beaufort formation and its veneer of boulders. Ice-rafting seems an inadequate agent to account for the situation of the coarse exotic material, for it is not found in areas where the bedded sands are absent. If the boulders associated with the Beaufort formation represent a glacial deposit, the ice advance responsible preceded the development of the local glacier at the head of Mould Bay (See page 9).

---

[1] Since this report was prepared radiocarbon age determinations of two samples of wood by the Yale Geochronometric Laboratory have given dates of $> 25,300$ years and $> 31,840$ years. The Beaufort formation therefore appears to be at least as old as 'early' Wisconsin and may be much older.

Although the age and mode of origin of this formation must be considered open to question, beds of this type are evidently widely distributed on the northwest side of the Arctic Archipelago. The occurrence of petrified and unaltered wood in unconsolidated deposits on the west coast of Banks Island has been known for many years through Armstrong's (1857, p. 383 et seq.) description. Air photographs of the west coast of Brock and Borden Islands and the west side of the Isachsen peninsula on Ellef Ringnes Island show terrain very similar to that on the west side of Prince Patrick Island, suggesting the northern continuation of the Beaufort formation. The contemporaneity of the various deposits cannot yet be established, but their apparent geographic continuity along the east shores of the Beaufort Sea and Arctic Ocean suggests that they may have had a similar origin.

STRUCTURAL GEOLOGY

The original interpretation of the western Arctic Archipelago as a stable shield overlain by essentially flat-lying sedimentary rocks has been shown by Fortier and Thorsteinsson (1953) to be incorrect. In the Canrobert Hills of Melville Island the Ordovician, Silurian, and Devonian formations have been deformed into a series of symmetrical folds trending approximately east. These folded rocks constitute the west end of the Parry Island Fold Belt of Fortier and Thorsteinsson (1953). The Lower Palaeozoic rocks are relatively competent and have not been internally deformed, but the overlying micaceous siltstones of the lower part of the Melville Island formation have been folded less competently than the underlying beds and in places the rocks are cleaved.

Between Ibbett Bay and Cape Russell the folding in the Melville Island formation is of low amplitude and the beds are flat-lying over considerable areas. From a structural standpoint this area may be placed in the Melville Basin (Fortier, McNair, and Thorsteinsson, 1954).

The Melville Island formation on Prince Patrick Island has been folded and at the head of Mould Bay is a northwesterly trending anticline. Elsewhere on Prince Patrick Island the cover of Mesozoic and Beaufort formations combined with post Lower Cretaceous normal faulting has made the analysis of pre-Jurassic structures difficult.

The Palaeozoic and Mesozoic formations of Prince Patrick Island between Intrepid and Walker Inlets have been affected by normal faulting, most of the faults being nearly straight and trending north. Along the axis of the Manson Point peninsula they are arranged en échelon. The faults mapped do not persist for more than about 10 miles and the maximum displacement determined is about 1,000 feet. The sediments of the Beaufort formation are not affected by this faulting.

The Jurassic strata of the Wilkie Point peninsula dip northeasterly at about 30 feet to the mile and structurally this area is part of the Arctic Coastal Plain (Fortier, McNair, and Thorsteinsson, 1954).

On the traversed part of Eglinton Island are exposed flat-lying beds of the Mould Bay formation, and the Landing Lake beds on the west coast are apparently also structurally undeformed. The available information and an examination of air photographs suggest that the whole of Eglinton Island is composed of relatively undisturbed Mesozoic sediments that are probably not older than the Mould Bay formation. Eglinton Island, therefore, seems to constitute an outlier of Mesozoic strata lying between Melville and Prince Patrick Islands, on both of which Palaeozoic formations outcrop.

Within the area the Mesozoic rocks are in places tilted as a consequence of normal faulting, but they have evidently not been subjected to compressive orogenic forces as in the Eureka Sound area to the east.

On Prince Patrick Island the Wilkie Point beds rest unconformably upon the Melville Island formation, the angle of discordance reaching about 10 degrees. The orogenic movement responsible for the deformation of the Palaeozoic rocks, therefore, took place between the Upper Devonian and the Lower Jurassic. It is inferred that the deformation of the Parry Island Fold Belt on the west coast of Melville Island took place during the same interval, for air reconnaissance and photographs permit the tracing of the Jurassic and Cretaceous (?) formations of Prince Patrick Island across Fitzwilliam Strait to Melville Island. The Mesozoic formations are seen to outcrop, dipping gently to the north, on the peninsula north of Marie Bay, where they represent the continuation of the Coastal Plain structural province recognized on Prince Patrick Island. At the head of the bay Jurassic beds lie north of the folded Palaeozoic rocks and the relationship of the Mesozoic to the Palaeozoic is apparently that of unconformity, as on Prince Patrick Island.

The relation between the post-Devonian, pre-Jurassic fold belt of Melville Island and the post-Silurian, pre-Pennsylvanian belt of Canyon Fiord, Ellesmere Island (Troelsen, 1952, p. 207), cannot yet be determined for neither are, as yet, precisely dated. If they represent contemporary structures, which is not improbable, the deformation is presumably post-Devonian but pre-Pennsylvanian, in which case the fold belt would represent the result of an early Variscide orogenic phase.

ECONOMIC GEOLOGY

Coal

Coal occurs in the Melville Island, Wilkie Point, and Mould Bay formations.

W. J. Montgomery of the Division of Fuels, Mines Branch, has made the following analyses of 5 samples, the stratigraphic position and localities of which are:

1. Melville Island formation, coal from disintegrated outcrop, 3 miles south of Mould Bay weather station, Prince Patrick Island.

2. Melville Island formation, coal from disintegrated outcrop in creek flowing into Kellett Strait at Stevens Head, Melville Island.

3. Wilkie Point formation, from 3-foot seam, 4 miles north of Salmon Point, Prince Patrick Island.

4. Mould Bay formation, from 3-foot seam, 7 miles south of Gardiner Point, Eglinton Island.

5. Mould Bay formation, from seam 5 feet thick without base exposed, 6 miles north-northeast of Mould Bay weather station, Prince Patrick Island.

Analyses of Coal

Sample	1			2			3			4			5		
	As received	Dry	At capacity moisture	As received	Dry	At capacity moisture	As received	Dry	At capacity moisture	As received	Dry	At capacity moisture	As received	Dry	At capacity moisture
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Proximate analysis															
Moisture	2.94	0.00	4.20	2.36	0.00	4.70	10.50	0.00	9.40	9.80	0.00	19.50	4.49	0.00	12.00
Ash	35.81	36.89	35.40	8.29	8.49	8.10	11.38	12.72	11.50	16.10	17.85	14.40	24.63	25.79	22.70
Volatile matter	39.10	40.28	38.60	42.78	43.81	41.80	46.80	52.29	47.40	51.91	57.55	46.3	41.55	43.50	38.30
Fixed carbon (by difference)	22.15	22.83	21.80	46.57	47.70	45.40	31.32	34.99	31.70	22.19	24.60	19.80	29.33	30.71	27.00
Ultimate analysis															
Sulphur			0.60			1.30			0.70			0.40			0.40
Calorific value															
B.T.U./lb. gross	7985			12690			9375			7815			8145		
B.T.U./lb. dry	8330			13315			10350			9710			9255		
Moist mineral matter free B.T.U./lb.	13078			13951			10746			9282			10857		
Rank (A.S.T.M. D.388-38 designation)	High volatile B bituminous			High volatile B bituminous			Subbituminous B			Subbituminous C			Subbituminous B		

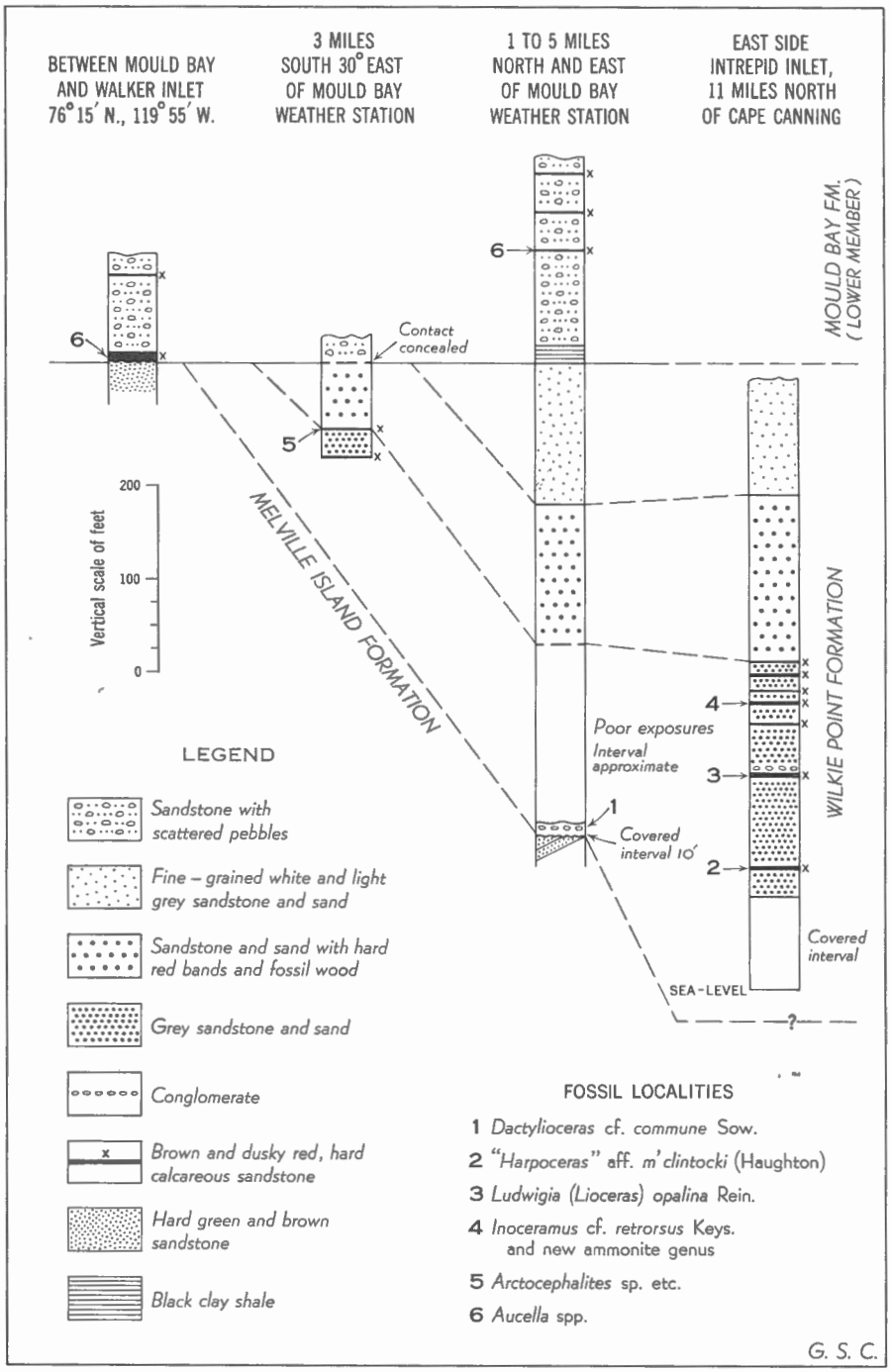

Figure 1. Columnar sections showing relation between Melville Island, Wilkie Point, and Mould Bay formations, Prince Patrick Island

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1956