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DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 59-1

WESTERN QUEEN ELIZABETH ISLANDS, DISTRICT OF FRANKLIN, NORTHWEST TERRITORIES

78, 79, 88, 89, 99 parts of

(Descriptive Notes)

PETROLOGICAL SCIENCES DIVISION

By

R. Thorsteinsson and E. T. Tozer

OTTAWA

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WESTERN QUEEN ELIZABETH ISLANDS, DISTRICT OF FRANKLIN, NORTHWEST TERRITORIES

ACCESSIBILITY

Mould Bay weather station is the only settlement within this part of the Archipelago. At Mould Bay there is an airstrip that is serviceable in the spring and sometimes in the summer. Ski-wheel aircraft have landed on lakes and suitable sea ice as late as the middle of June. Such landings have been made at Landing Lake, Prince Patrick Island, and at Tingmisut Lake and Bridport inlet on Melville Island. Canso aircraft have landed in Walker Inlet, near CapeRussell and in Liddon Gulf. However, drifting ice makes conditions for water landings unpredictable in summer. In the Summer of 1958 a Piper Super Cub with low-pressure tires landed on unprepared terrain at 250 points within the area (7)[1]. Ships have reached parts of the east coast of Melville Island, between Towson Point and Nelson Griffiths Point. They have also reached much of the south coast, east of Liddon Gulf. Summer ice conditions are generally unfavourable to navigation and have prevented ships from reaching any other parts of the area.

RELIEF AND TOPOGRAPHY

Topographically, most of the area may be described as a dissected plateau. The Arctic Coastal Plain of western Prince Patrick, western Brock, and northern Borden Islands is an exception, and there the land rises gently to the southeast and south from an exceptionally low coast. The highest part of Prince Patrick Island is between Walker and Intrepid Inlets, with elevations up to about 700 feet. The central plateau of Eglinton Island reaches about 800 feet. Western Melville Island is higher, with maximum elevations of about 2,000 feet in the Canrobert Hills, 2,700 feet east of Purchase Bay, 3,000 feet north of Murray Inlet, and 1,000 feet on Dundas Peninsula. Maximum elevations on Melville Island east of the 111th meridian probably do not exceed 1,000 feet. The uplands of Brock, Borden and Mackenzie King Islands generally do not exceed 450 feet. A few isolated hills on Mackenzie King Island (e.g. Leffingwell Crags) rise to about 525 feet.

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[1] Numbers in parentheses are those of references given at the end of these notes.

STRATIGRAPHY

The Canrobert formation is the oldest in the area and the oldest exposed in the Parry Islands Fold Belt. Lower Ordovician (Arenig) graptolites occur in the top beds but the underlying beds are unfossiliferous and of uncertain age. Marked facies differences characterize much of the Ordovician-Silurian sequence, with three different types developing as follows: 1. In the Canrobert Hills the Ibbett Bay formation (map-unit 2) is composed of graptolitic shale, argillite, chert, and minor dolomite, ranging in age from Arenig (Lower Ordovician) to Upper Ludlow (highest Silurian). 2. West of Raglan Range, a thick carbonate sequence (map-unit 5) underlies 300 feet of graptolitic shale (not mapped separately) of Upper Ludlow age. 3. On Middle Island and south of McCormick Inlet the sequence resembles that of northern Cornwallis Island (5), with the Cape Phillips formation (map-unit 4) (Ashgill-Upper Ludlow) lying upon the Cornwallis formation (map-unit 3). The Cape Phillips formation at McCormick Inlet includes beds younger than any in the type section, on Cornwallis Island. The exposed lower Palaeozoic carbonate rocks are mainly fine-grained to aphanitic limestone and dolomite with minor bioclastic rock. Porosity is low to negligible.

The Melville Island formation (Devonian) has been divided into 3 map-units 6, 7, and 8. In eastern Melville Island these units are distinct, but to the west they are not so recognizable, particularly the boundary between units 6 and 7 which becomes indistinct in western Melville Island. Marine Middle Devonian fossils occur in map-unit 6 and Upper Devonian fossils in unit 8. The exposed Devonian rocks of Melville Island consist, almost exclusively, of terrigenous clastic material and include much non-marine sediment[1].

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[1] Since this preliminary map was prepared, D. J. McLaren, of the Geological Survey, has identified Middle Devonian corals from the beds mapped as unit 5 in the section east of Weatherall Bay. It follows that in this area Middle Devonian limestone and dolomite, probably at least 1,500 feet thick, occurs beneath map unit 6. The section east of Weatherall Bay is therefore essentially similar to some sections on Bathurst Island (1, p. 428). This Middle Devonian carbonate formation does not occur in the sections near Ibbett Bay and Raglan Range, in western Melville Island. In southern Melville Island the base of map-unit 6 is not exposed; consequently it is not known whether or not Middle Devonian carbonates occur in this part of the island. In view of the foregoing,

The Canyon Fiord beds (map-unit 9) resemble the typical beds of Ellesmere Island. Middle Pennsylvanian fusilinids and brachiopods occur in the lower beds. The formation is apparently confined to the margin of the Sverdrup Basin.

The Permian rocks of Sabine Peninsula (map-unit 11) are thick and varied, with up to about 2,000 feet of calcareous sandstone, glauconitic sandstone, and chert. In northwestern Melville Island the Permian section is reduced to between 50 and 200 feet of glauconitic sandstone. The Permian rocks of Sabine Peninsula include older rocks than occur to the west.

Both the Pennsylvanian and Permian rocks probably change in facies beneath northern Sabine Peninsula, for the gypsum in the piercement bodies (map-unit 10) is of Pennsylvanian or possibly Permian age (7, p. 22). Porous Permian or Pennsylvanian limestone occurs as upthrust masses in the central dome of Sabine Peninsula and probably forms a subsurface layer in this area.

The Bjorne formation (map-unit 12) and the Schei Point formation (map-unit 13) represent the sandstone and calcareous siltstone Triassic facies that characterizes the margin of the Sverdrup Basin (9). The Heiberg formation (map-unit 14) outcrops only on Brock Island. On Melville and Prince Patrick Islands the Heiberg beds were either not deposited or were removed prior to Jurassic deposition.

A new formation (map-unit 15), probably of Sinemurian (early Lower Jurassic) age, occurs on Borden Island. Possible equivalents occur north of Marie Bay, Melville Island but they have not been mapped separately. On Prince Patrick Island map-unit 15 does not outcrop and the succeeding Wilkie Point formation rests directly upon the Devonian.

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it is probable that map-unit 6, of western Melville Island, includes beds older than those placed in unit 6 in eastern Melville Island.

This new data does not indicate that all the rocks mapped as unit 5 around Weatherall Bay are of Devonian age. Immediately east of Tingmisut Lake the beds placed in unit 5 contain Silurian fossils. The carbonate rocks that form the prominent cliff on the south side of Weatherall Bay may be Silurian or Devonian in age, or include strata of both ages. The relationship of the Devonian carbonates east of Weatherall Bay to the Silurian limestones and dolomites east of Tingmisut Lake is not known.

The Wilkie Point formation of Prince Patrick Island (map-unit 16) has already been described (2,8). The beds on Melville Island are essentially similar to those on Prince Patrick Island. The section on Borden and Mackenzie King Islands is somewhat different, for the lower Wilkie Point beds include shale (not present on Prince Patrick Island) and the upper, non-marine, beds of Prince Patrick and Melville Islands apparently do not occur.

The Mould Bay formation (map-unit 17) is now restricted to include only the lower, marine, member of the type section (8, p. 23). The upper, non-marine, beds are now mapped as the Isachsen formation. On the south margin of the Sverdrup Basin (i.e. southern Prince Patrick Island and Melville Island) the Mould Bay beds are mainly sand and sandstone, with, in some sections a shale member at the base. On Mackenzie King Island there are three members: a lower shale; a middle sandstone; and an upper shale. This section illustrates both faunally and lithologically, the correlation with the Deer Bay formation of Ellef Ringnes Island. Upper Jurassic and Lower Cretaceous fossils (including Buchia spp.) occur in the Mould Bay formation.

The Isachsen formation (map-unit 18) is fairly uniform throughout the area, but is much thinner than in sections on the Ringnes Islands and western Axel Heiberg Island. The Isachsen formation is irregularly indurated. The hard facies forms buttes and crags, such as the Leffingwell Crags; the soft facies forms badlands. The Christopher formation (map-unit 19) contains more sandstone and siltstone than at the type locality. Albian (late Lower Cretaceous) fossils occur at one locality. The Landing Lake formation of Prince Patrick Island (8, p.25) is now included in the Christopher formation. The Hassel (map-unit 21), Kanguk (map-unit 22), and Eureka Sound (map-unit 24) formations of Sabine Peninsula have been identified by their stratigraphic position and their similarity to beds on Ellef Ringnes and Axel Heiberg Islands (1, 3). In this area these formations have not provided diagnostic fossils. The beds mapped as 'Eureka Sound' in south central Melville Island may, in fact, be older than the typical Eureka Sound formation. The Cretaceous rocks of Eglinton Island (map-unit 20) probably include equivalents of the Christopher formation, and possibly also the Hassel and Kanguk formations. The age and origin of the Beaufort formation (map-unit 25) (8, p.25) is still uncertain. This formation extends as an unconformable blanket across the northwestern part of the area.

IGNEOUS ROCKS

A gabbro dyke cuts the Pennsylvanian and Permian rocks at Tingmisut Lake. Gabbro masses, in the form of ring dykes, but probably representing upthrust sills, occur in the piercement structures of Sabine Peninsula. No other igneous rocks are exposed but, in view of the foregoing, they might be encountered in the subsurface of Sabine Peninsula.

STRUCTURE

The area may be divided into seven provinces of distinct structural regime (see inset map).

In the Parry Island Fold Belt the Ordovician, Silurian, and Devonian rocks form a conformable sequence. These rocks were folded prior to Pennsylvanian deposition. The folds are mainly symmetrical and the deformation is more intense in the north than in the south. Some beds overturned both to the north and south occur in the Canrobert Hills. On Dundas Peninsula the folds die out entirely and the beds there are placed in the Melville Basin structural province.

The Pennsylvanian Canyon Fiord formation was deposited upon the eroded surface of the older, folded, rocks. Between the Canrobert Hills and Raglan Range the Canyon Fiord rocks are folded along the same axes as the unconformably underlying strata. Two periods of folding are thus indicated in this part of the Parry Island Fold Belt. The first folding took place between the Upper Devonian and the Middle Pennsylvanian; the second between the Middle Pennsylvanian and the Permian.

In northwestern Melville Island an angular unconformity separates the Permian and Pennsylvanian rocks, but on Sabine Peninsula the Permian and Pennsylvanian rocks are structurally conformable.

The section from the Permian to the Eureka Sound formation is essentially conformable. Within the Sverdrup Basin it is probably completely conformable. On the margins of the basin several formations are transgressive and overstep the older beds. The Schei Point formation is transgressive near Salmon Point, Prince Patrick Island. Map-unit 15 is transgressive on Borden Island, having overstepped the Heiberg formation. The Wilkie Point formation is transgressive on Prince Patrick Island. The Mould Bay formation is transgressive on southern Prince Patrick Island. The beds in southern Melville Island, tentatively placed in the Eureka Sound formation, evidently represent a transgressive deposit. If these beds do represent the Eureka Sound forma-

tion, the situation is analogous to that on Ellesmere Island (6, p. 23).

Much of the map-area lies within the western part of the Sverdrup Basin structural province. In this area the Sverdrup Basin may be described as the western part of a large, northeasterly plunging synclinorium that probably extends towards Ellef Ringnes Island. Dips are low in this part of the synclinorium, generally less than 5 degrees. The pattern of the synclinorium may be envisaged by considering the outcrop pattern of the Wilkie Point formation; this is apparently roughly parabolic. Starting on Sabine Peninsula, it extends west from Sherard Bay to Long Point and Wilkie Point and then swings northeast to Mackenzie King Island and southern Borden Island. On Sabine Peninsula and northwestern Melville Island the beds dip north and represent the south limb of the synclinorium. The tip of Sabine Peninsula has the youngest Mesozoic (and Tertiary ?) rocks in the Sverdrup Basin sequence. This area probably lies at, or near the axis of the synclinorium. The outliers of Hassel and Kanguk beds exposed on central Sabine Peninsula are nearly or quite horizontal. No evidence has been found to indicate a reversal of dip on Sabine Peninsula.

The Mesozoic rocks of eastern Prince Patrick Island dip regionally to the northeast and evidently lie near the southern part of the 'nose' of the synclinorium. This regional dip is interrupted by gentle northwest-trending undulations around Moore Bay. Brock, Borden, and Mackenzie King Islands exhibit a southeasterly regional dip, with some north- and northwest-trending folds. These islands evidently lie on the northwest limb of the synclinorium.

Eglinton Island evidently represents a graben in which a substantial patch of gently dipping Mesozoic rocks have been preserved. These beds dip gently southwest. Structurally, Eglinton Island seems to be unrelated to the synclinorium described above.

Normal faulting has affected parts of the area, notably the Prince Patrick horst and the Blue Hills fault belt, but also the Weatherall Bay region and Borden Island. On the Prince Patrick horst these faults have preserved several outliers of Mesozoic rocks. This faulting probably took place in Tertiary time. Two remarkable lineaments occur in the Beaufort formation on the Arctic Coastal Plain of northwestern Prince Patrick Island. On the ground they appear to mark nothing but boundaries between areas of slightly different vegetation. However, in view of their linear and arcuate nature it seems probable that they reflect a recent tectonic event.

GLACIAL GEOLOGY

On southern Melville Island isolated hills and sinuous ridges of glacial till form conspicuous land forms on Dundas Peninsula and in the country north of Bridport Inlet and Skene Bay. Besides numerous boulders, obviously derived from local formations, the till contains gneisses, schists, quartzite and igneous rocks evidently derived from lands south of Viscount Melville Sound. This is the first clear evidence that glaciers crossed Viscount Melville Sound and extended into the Queen Elizabeth Islands.

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