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SUMMARY ACCOUNT OF STRUCTURAL HISTORY OF THE CANADIAN ARCTIC ARCHIPELAGO SINCE PRECAMBRIAN TIME

R. Thorsteinsson and E. T. Tozer

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Geol. & Petrol. Potentialities of N. Canada

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SUMMARY ACCOUNT OF STRUCTURAL HISTORY OF THE CANADIAN ARCTIC ARCHIPELAGO SINCE PRECAMBRIAN TIME[1]

INTRODUCTION AND SOURCES OF INFORMATION

Several provinces characterized by distinct structural features can be recognized within the Archipelago, and the first part of this paper is devoted to a suggested subdivision of the island area into such provinces. Then follows a summary of the structural history of these main provinces. Tertiary earth-movements have left their mark on more than one province; accordingly these movements are considered with respect to the region as a whole, rather than for each province.

The breakdown into structural provinces should be regarded as provisional. Although reconnaissance mapping is virtually complete west of the 105th meridian, much of the country to the east has not been studied at all. Areas not known in any detail that should yield important data on the structural history include, particularly, Grinnell Peninsula on Devon Island and much of Ellesmere Island.

In compiling this summary the writers have made use of all published work, and unpublished data obtained by members of the Geological Survey. A survey of the early work, with a full bibliography, has been furnished by Fortier, McNair, and Thorsteinsson (1954)[2], but no introduction to this subject would be complete without individual references to the following authors who pioneered geological studies in the Archipelago: Reverend Samuel Haughton (1859), who, from collections made by the Franklin Search Expeditions in the middle of the last century, made the first geological map of the islands; H.W. Feilden and C.E. De Rance (1878), who studied the geology of northern Ellesmere Island; Per Schei (1903), who established the Palaeozoic succession of southern Ellesmere Island, and first discovered folded Mesozoic rocks in Eureka Sound; R. Bentham (1936, 1941), who contributed to our knowledge of eastern and southeastern Ellesmere Island; and J.C. Troelsen (1950, 1952), who first recognized the important sub-Pennsylvanian unconformity and made other contributions to the geology of Ellesmere Island.

Recent published works of members of the Geological Survey include papers by Blackadar (1954, 1956), Christie (1957), Fortier (1957), Fortier and Morley (1956), Fortier and Thorsteinsson (1953), Heywood (1955, 1957), McLaren (1959), Thorsteinsson (1959), Thorsteinsson and Tozer (1957, 1959), and Tozer (1956). Much new structural data

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[1] This report is one of several summary papers prepared by officers of the Geological Survey of Canada and presented at the First International Symposium on Arctic Geology, Calgary, Alberta, 1960. Preliminary publication is by arrangement with the organizing committee of the symposium.

[2] Dates or names and dates in parentheses refer to publications listed in the References.

was gathered in 1955 by members of "Operation Franklin", a Geological Survey field project led by Y.O. Fortier. Preliminary maps covering the area investigated in 1955 have been published[1] and a summary of the geology of the Archipelago prepared by Fortier (1957) incorporates some results of this field work. Relevant work by members of this operation is acknowledged in the text by reference to their individual reports which will soon appear in one volume as Geological Survey Memoir 320. Unpublished data obtained after 1955 has also been used. The following have contributed information: R.L. Christie (northern Ellesmere Island, 1957, 1958); and R.L. Christie, J.G. Fyles, and the present writers (Banks, Victoria, and Stefansson islands, 1959). In 1956 and 1957 the writers studied parts of Ellesmere and Axel Heiberg islands and results of this work have also been used.

STRUCTURAL PROVINCES OF THE ARCHIPELAGO

The Canadian Arctic Archipelago can be divided into seven structural provinces (see Fig. 1). From southeast to northwest these are:

1. A probable Tertiary Volcanic province, evidently similar to that of West Greenland. This province covers a small area in southeastern Baffin Island. Little is known about the area except that relatively young volcanic and sedimentary rocks occur (McMillan, 1910; Kidd, 1953). The writers have no new information on this area.

2. The Canadian Shield. The structure of the Shield is beyond the scope of this paper. However, cratonic arches that expose Precambrian rocks extend north from the Shield proper into the Arctic Lowlands. These arches have been tectonically active in Palaeozoic and probably also later times, and their tectonic movements are discussed below. Metamorphic rocks of possible Precambrian age are brought to the surface on northern Ellesmere Island (Blackadar, 1954; Christie, 1957).

3. The Arctic Lowlands—the region of thin, generally horizontal or gently dipping Lower Palaeozoic rocks that overlie the Canadian Shield. To the north, towards the Franklinian geosyncline, the rocks of the Arctic Lowlands thicken, and at several levels, change in facies. Cretaceous and Tertiary rocks are exposed and are preserved on the westernmost part of the Arctic Lowlands, on Banks Island. Two, and possibly three, essentially linear cratonic arches penetrate the Lowlands as salients of Shield rocks. The presence of these arches led Fortier, McNair, and Thorsteinsson (1954) to hypothesize the presence of a number of cratonic and miogeosynclinal basins within the Lowlands.

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[1]These maps are listed in the References under "Geological Survey of Canada".

4. The Franklinian geosyncline, originally recognized by Schuchert (1923), lies north and east of the Lowlands. It was a region of profound subsidence from the Cambrian (possibly also the late Precambrian) to the Upper Devonian, and is now the site of a complex orogenic system. Within the Archipelago the exposed part of the Franklinian geosyncline extends as a reverse "L", trending easterly through the Parry Islands and then northeasterly through Ellesmere Island. Exposures also occur on the north tip of Axel Heiberg Island. A northwestern eugeosynclinal belt and a miogeosyncline to the south and east are recognized. The Franklinian geosyncline thus appears to be a sinuous mirror image of the Appalachian geosyncline. Schuchert (1923, p. 215) has suggested that the Franklinian geosyncline extends south and west to join the western Cordillera. Koch (1935, p. 133 etc.) suggested that the eastern extension is to be found in North Greenland. These connections are possible but are not proven. Two phases of Palaeozoic earth-movements have left their mark in the Franklinian geosyncline. The first period, apparently limited in extent, took place near the Siluro-Devonian boundary and in this paper will be termed the "Early Palaeozoic movements". The second period, between the Upper Devonian and the Middle Pennsylvanian will be called the "Mid-Palaeozoic movements".

5. The Sverdrup Basin, situated west and north of the exposed part of the Franklinian geosyncline, was a site of heavy sedimentation from the Middle Pennsylvanian to the early Tertiary. A profound angular unconformity separates the beds in this basin from those of the folded lower Palaeozoic rocks. The axis of this basin strikes northeasterly from Sabine Peninsula to northwestern Ellesmere Island and coincides approximately with the regional strike of the Palaeozoic structures imposed on the Franklinian geosyncline. Sections on the axis of the basin are thicker than those of the margins. The east, south and southwest margins of this basin are exposed; the northwest margin is mainly covered by the Beaufort sediments of the Arctic Coastal Plain. The available data suggests that the beds in the basin become thinner towards the northwest, and the regional dip in this northwestern part is apparently to the southeast. The basin may therefore be regarded as a major synclinorium, striking northeast. Tectonism affected the margins of the basin between the Middle Pennsylvanian and the Permian. This period of movement will be termed the "Late Palaeozoic movements". Sedimentation within the basin ceased in early Tertiary time and was followed by widespread Tertiary folding, thrust faulting and diapirism.

6. The Prince Patrick uplift. This structural province includes southern Prince Patrick Island and a small part of northern Banks Island. It constitutes an isolated area of Devonian rocks that have experienced Tertiary faulting. This uplifted area may reflect the presence of a buried cratonic arch, as shown below.

7. The Arctic Coastal Plain, a narrow strip of late Tertiary or Pleistocene sediments (Beaufort formation), extending from Banks Island to Meighen Island. The Beaufort formation rests

unconformably upon all older formations, and apparently dips gently towards the northwest. On Prince Patrick Island there is some evidence to suggest that the Beaufort beds have been dislocated by faults.

HISTORY OF THE ARCTIC LOWLANDS AND THE CRATONIC ARCHES

The name Arctic Lowlands is given to the terrain where a thin cover of essentially undisturbed Palaeozoic and younger rocks overlies the Precambrian basement. The Lowlands lie between the Canadian Shield, or craton, and the Franklinian geosyncline. They are the counterpart of the Interior Lowlands of continental North America. The Lowlands, together with the Shield, form the "Central Stable Region" of North America (King, 1959, p. 10). Palaeozoic rocks form the surface of most of the Lowlands. Mesozoic and Tertiary rocks are presumed in the westernmost part, on Banks Island. The presence, within the Lowlands, of the Minto and Boothia cratonic arches, first recognized by Fortier, McNair and Thorsteinsson (1954), makes the contact between the Shield and the Lowlands highly irregular. This contact contrasts remarkably with that between the Shield and the Lowlands of Hudson Bay and the Western Interior. These arches have their counterpart in structural features such as the Frontenac-Adirondack axis. Fortier et al. (1954) have also tentatively recognized several basins within the Lowlands. At the time that these structures (Victoria Strait, Foxe, Wollaston, Melville and Jones-Lancaster basins) were named, Fortier and his co-authors stressed that it was not known whether these basins were crustal depressions with thickened sections, or whether they were essentially crustal downwarps, younger in age than the Palaeozoic sediments involved. As a rule, the relief in the Lowlands is not great, and the Palaeozoic beds are generally horizontal or gently dipping. Consequently it is difficult to measure thicknesses from surface data, and the true character of these basins is still uncertain. It is known that the various Palaeozoic formations thicken to the north, towards the Franklinian geosyncline. Variations in thickness across the Lowlands, in an east-west direction, have not yet been demonstrated. Aeromagnetic data obtained by the Geological Survey suggests that the basement is covered by at least 10,000 feet of sedimentary rock on the west coast of Devon Island, and on Dundas Peninsula, Melville Island (Gregory, Bower and Morley, in press). This figure may include late-Precambrian sedimentary rocks.

In this paper the structural history of the Lowlands will be reviewed in chronological sequence. The sedimentary record is relatively meagre and consequently there is not much data available.

For the Cambrian we have little information. Cambrian rocks occur at Dundas Harbour, Devon Island (Kurtz, McNair and Wales, 1952) and Bache Peninsula, eastern Ellesmere Island (Bentham, 1936; Poulsen, 1946; Troelsen, 1950), but no certain Cambrian rocks are known in the Lowlands south of Parry Channel. The basal Palaeozoic beds north of Minto Inlet, Victoria Island, include oolitic hematite with inarticulate brachiopods, and according to A.W. Norris of the

Geological Survey, they may be of Upper Cambrian age. However, from the available data it seems reasonable to conclude that if Cambrian deposits were laid down they were thin, and are now discontinuous.

Lower Ordovician rocks (with Arenigian graptolites) have recently been discovered by Blackadar (1958) in the northern part of Foxe Basin (Jens Munk Island). This is at present a unique occurrence, and its situation, in Foxe Basin, may indicate that the basin was a negative subsiding area in contrast to the remainder of the Lowlands in Early Ordovician time. Middle or Upper Ordovician rocks, mainly carbonates, with the "Arctic Fauna" are widespread in the Lowlands, and they occur as a nearly continuous sheet throughout the area, broken only by the cratonic arches and Precambrian inliers. There is no evidence that the Ordovician carbonates change in facies or thickness on approaching the arches, but as already mentioned, it is difficult to calculate thicknesses from the surface data available in the Lowlands. The quiescent and uniform conditions suggested by this more or less continuous layer of rock probably continued in Silurian time, with widespread carbonate sedimentation in the Lowlands. On western Somerset Island and eastern Prince of Wales Island, adjacent to the northerly trending Boothia Arch, there are red sandstones and conglomerates with ostracoderms of Upper Silurian or Lower Devonian age (Thorsteinsson and Tozer, Mem. 320 in press). Boulders in the conglomerates are mainly Precambrian rock, but Ordovician or Silurian fossiliferous limestone also occurs. The strata adjacent to the arch are moderately deformed. On Somerset Island the structure adjacent to the arch is synclinal, with the Peel Sound formation conformably overlying the Silurian Read Bay formation. On eastern Prince of Wales Island, north-trending faults dislocate the Palaeozoic succession. It appears that the Peel Sound formation is a syntectonic deposit, that dates with a fair degree of accuracy, a prominent period of elevation for the Boothia Arch. As noted below, these movements were not confined to the Lowlands, but also affected parts of the Franklinian geosyncline, namely the Cornwallis fold belt. The same strike is revealed in Tertiary structures within the Sverdrup Basin.

Following the time of deposition of the Peel Sound beds, younger formations are of very limited distribution in the Lowlands and there is little evidence from them to construct the structural history.

The Minto Arch, which trends northeasterly through southeastern Victoria Island, is not apparently flanked by deposits analogous to the Peel Sound formation, and the adjacent Palaeozoic rocks dip at low angles. To the southeast it is flanked by nearly flat-lying Ordovician dolomite. To the northwest it is bordered by the Prince Albert homocline which comprises a sequence of Ordovician to Upper Devonian rocks, gently inclined to the northwest. Around Prince of Wales Strait there are some dip reversals in isolated outcrops, but they do not seem to seriously affect the northwesterly dip. Parts of this presumably homoclinal sequence are completely concealed by Pleistocene deposits and the rocks at the Siluro-Devonian boundary are not exposed. Consequently the stratigraphic interval represented near the Boothia Arch by the Peel Sound formation is not exposed north of the Minto structure, so the absence of this formation cannot be proven from the exposures. However, there is no evidence in the sedimentary record that the Minto Arch experienced a sudden uplift at any time. Middle and Upper Devonian rocks are inclined on the Prince Albert homocline, consequently it seems reasonable to infer that positive movement has affected the Minto Arch since the Devonian. The strike of the Lower Cretaceous and Tertiary rocks of Banks Island appears to be unrelated to the trend of the Prince Albert homocline (Fig. 2). It thus seems probable that the main period of movement along the Minto axis took place before the Lower Cretaceous.

The so-called Wellington Arch of southern Victoria Island (Fortier, McNair and Thorsteinsson, 1954, p. 2079) probably differs from the Boothia and Minto structures. Recent field work by the Geological Survey has shown that the Precambrian rocks of Wellington Bay are less extensive than formerly believed, and that many of the Precambrian outcrops are small inliers surrounded by Ordovician dolomite. This "arch" seems best regarded as an exhumed range of sub-Ordovician hills rather than a tectonically positive area.

The northern parts of the Lowlands, adjacent to the Franklinian geosyncline, in general exhibit homoclinal sections dipping towards the geosyncline. This is true on Devon Island and southern and eastern Ellesmere Island, and the monocline on Stefansson Island is probably part of an analogous structure. The youngest beds in these homoclines are Upper Devonian.

From the Upper Devonian to the Lower Cretaceous we have no record of sedimentation in any part of the Lowlands, and for the greater part of the area we have no record between the Silurian and the Pleistocene. For much of this time-interval the Lowlands were probably subjected to erosion, and contributed sediment to the Sverdrup Basin. However on Banks Island there are Mesozoic and Tertiary rocks that record some structural events, discussed on p. 14 under the heading Tertiary Earth-Movements. The evidence from Banks and Prince Patrick islands suggests that a northerly trending structural elevation, now largely buried, but active in Mesozoic and Tertiary times, may extend north from Nelson Head on southern Banks Island to Cape Crozier on northern Banks Island and southern Prince Patrick Island. The occurrence of exposed Precambrian rocks at Nelson Head suggests that this (largely hypothetical) structure, like the Minto and Boothia arches, has a Precambrian foundation.

The history of the Lowland arches may be summarized as follows. It would appear that two and probably three cratonic arches have been active since Precambrian time. The eastern, or Boothia Arch was particularly active in late Silurian or early Devonian time; the central Minto Arch seems to have been active since the Devonian, but before the Cretaceous; the western, and mainly concealed arch, appears to have moved in Mesozoic and Tertiary time.

THE FRANKLINIAN GEOSYNCLINE

The Franklinian geosyncline extends east and northeast through the northern islands of the Arctic Archipelago, and is generally held to continue east to North Greenland (see Fig. 2). As far as the writers can determine from the literature, no fossiliferous Lower Palaeozoic rocks have been described from North Greenland, consequently the extension of the Franklinian geosyncline towards that area cannot be proved at present. Except for a limited area around Cornwallis Island the Franklinian geosyncline appears to have been the site of more or less uninterrupted and heavy deposition from Cambrian to Upper Devonian times, but it should be noted that Devonian rocks are known only in the southern part. Two belts may be recognized within the geosyncline: a miogeosyncline to the south and east which is adjacent to the Arctic Lowlands and is traceable for about 900 miles from Melville Island through Bathurst Island, Grinnell Peninsula on Devon Island and then northeast through almost the entire length of Ellesmere Island; and a eugeosynclinal belt that is exposed only in northern Ellesmere and Axel Heiberg islands. In northern Ellesmere Island much of the eugeosynclinal belt is covered by later rocks, mainly Pennsylvanian and Permian; towards the southwest this cover becomes increasingly continuous, and southwest from the northern tip of Axel Heiberg Island there are no exposures of this belt. Presumably the folded eugeosynclinal rocks constitute the basement underlying the Sverdrup Basin.

The southern and southeastern limits of Palaeozoic folding and faulting are considered to mark the boundary between the miogeosyncline and the Arctic Lowlands. There is no sharp boundary between the disturbed part of the miogeosyncline and the Lowlands as there is, for example, between the Plains and the Foothills belt in Alberta. The boundary between the eugeosyncline and the miogeosyncline (see Fig. 1) is drawn where clastic rocks, as opposed to carbonates and shale, dominate the Lower Palaeozoic sequence. The clastic rocks are generally unfossiliferous and many of the eugeosynclinal formations are of uncertain age; however, some of these thick, clastic units have yielded Ordovician and Silurian fossils. If volcanic rocks be considered the diagnostic character of the eugeosyncline, the boundary must be moved to the northwest, for definite Lower Palaeozoic volcanics are known only in northern Axel Heiberg Island and along the north coast of Ellesmere Island. Gneisses, acid and basic intrusives occur on the north coast of Ellesmere Island (Blackadar, 1954, Christie, 1957). Biotite from a specimen of gneissic rock obtained by Blackadar in Markham Inlet has recently been dated by R.K. Wanless of the Geological Survey as 545 million years old. This indicates either a late Precambrian or a lower Palaeozoic age for the metamorphism of these rocks. If they are Precambrian, the rocks may represent a sub-geosynclinal basement.

Representative thicknesses of the stratigraphic column in various parts of the Franklinian geosyncline are as follows:

1. Western Melville Island; Lower Ordovician to Upper Devonian, about 16,000 feet (Tozer, 1956; Thorsteinsson and Tozer, 1959).

2. Cornwallis Island; Middle Ordovician to Upper Silurian, more than 20,000 feet (Thorsteinsson, 1959).

3. Okse Bay area, southern Ellesmere Island; Devonian (probably only Middle and Upper Devonian), 17,000 feet (McLaren, 1959, and Mem. 320 in press).

4. Northern Axel Heiberg and northwestern Ellesmere islands; about 60,000 feet of altered sedimentary rocks and lavas occur; the only fossils present are Silurian (Thorsteinsson, Mem. 320 in press).

PALAEOZOIC DEFORMATION OF THE MIOGEOSYNCLINE

Two periods of earth-movements have been detected within the Franklinian miogeosyncline. The first period, here referred to as the Early Palaeozoic movements, took place at about the time of the Siluro-Devonian boundary; in European terms these movements are essentially Caledonian. The later period, here called the Mid-Palaeozoic movements, was between the Upper Devonian and the Middle Pennsylvanian, and is therefore essentially of early Variscan age.

Early Palaeozoic Movements

Early Palaeozoic movements affected a limited part of the Franklinian miogeosyncline and produced north-trending structures that have been studied on Cornwallis Island (Thorsteinsson, 1959) and eastern Bathurst Island (Thorsteinsson and Glenister, Mem. 320 in press). Examination of air photographs has revealed the presence of similarly trending structures on the Grinnell Peninsula of Devon Island, to the north of Cornwallis Island. These are probably related to the Cornwallis structures. From Grinnell Peninsula the northerly extension of this belt of folding, which has been named the Cornwallis fold belt (Thorsteinsson, 1959), is hidden beneath the waters of Belcher Channel. Folding within the Cornwallis belt is generally moderate. Synclines are broad and shallow and are separated by more closely folded anticlines. No thrust faults have been recognized. Normal faults are present in the Cornwallis fold belt and some of these appear to be genetically related to the folded structures in that they trend parallel to the axes of anticlines. Others that displace Tertiary[1] and Devonian

[1] Thorsteinsson (1959, p. 110) proposed the name Intrepid Bay formation for non-marine clastic sediments preserved on the downthrown side of a normal fault at Intrepid Bay in southwestern Cornwallis Island. Superficially similar beds (also mapped as Intrepid Bay by Thorsteinsson) occur in another downfaulted block on Rookery Creek, some 20 miles from the beds at Intrepid Bay. Plant microfossils from these beds have been studied by N.W. Radforth of McMaster University and by D.C. McGregor of the Geological Survey. In 1954 Radforth dated a sample from the Rookery Creek beds as Middle Pennsylvanian; P.A. Hacquebard of the Geological Survey has recently examined the report and plates prepared by Radforth and believes that the microfossils from Rookery Creek are Upper Devonian, not Pennsylvanian. In 1958 a coal sample was obtained by Thorsteinsson from the beds at Intrepid Bay; microfossils from this sample have been dated as early Tertiary by McGregor. It thus appears that the two outcrops represent different formations; the Intrepid Bay beds presumably represent the Eureka Sound formation (Tertiary) and the Rookery Creek beds are evidently the Okse Bay formation (Upper Devonian).

formations are clearly younger structures and are discussed below.

The best documented dating for the deformation of the Cornwallis fold belt has been obtained from the Driftwood Bay area, eastern Bathurst Island (Thorsteinsson and Glenister, Mem. 320 in press). In this area Devonian formations rest with angular unconformity upon Ordovician and Silurian rocks. The youngest fossiliferous beds beneath the unconformity are Upper Silurian graptolitic shales. The oldest fossiliferous beds above the unconformity represent the Blue Fiord formation, dated as Middle Devonian by McLaren.

In other parts of the miogeosyncline—e.g. on Melville Island (Tozer, 1956; Thorsteinsson and Tozer, 1959), central Bathurst Island (McLaren, Mem. 320 in press), and southern Ellesmere Island (Greiner, Mem. 320 in press; McLaren, op. cit.)--the Silurian and Devonian rocks are structurally conformable. However, this boundary may mark a period of regression within the Archipelago because no certain Lower Devonian rocks are known.

As already mentioned, the Boothia Arch, south of Parry Channel and roughly on strike with the Cornwallis fold belt, evidently experienced movement at the time of the folding described above. There thus seems to be no doubt that the Cornwallis folds are related to basement movements.

Mid-Palaeozoic Movements

The Cornwallis fold belt interrupts the continuity of the southern part of the Franklinian geosyncline. To the west lie the folded structures of Bathurst and Melville islands that have been named the Parry Islands fold belt (Fortier and Thorsteinsson, 1953), and to the east and northeast are the deformed rocks of Devon and Ellesmere Islands. This, the main part of the Franklinian miogeosyncline, suffered deformation between the Upper Devonian and the Middle Pennsylvanian, and it may be that the eugeosynclinal belt was deformed during this same interval (see below). Presumably this period of deformation is correlative with either the Bretonic or Sudetic phase of the Variscan orogeny (Stille, 1924).

Regular folds, with long parallel axes characterize the Parry Islands fold belt. Overturning of beds is rare and known only in the Canrobert Hills on Melville Island. The intensity of the folding increases to the north, and the south limbs of anticlines are commonly steepest. It thus appears that the deformative forces acted from north to south.

Around Weatherall Bay, eastern Melville Island, the oldest formation of the Sverdrup Basin (Canyon Fiord formation) with Middle Pennsylvanian fusulinids rests with angular unconformity upon

Upper Devonian beds (Thorsteinsson and Tozer, 1959). This area provides the most accurate dating for the Parry Islands folding.

Moderately folded structures strike easterly to northeasterly through northwestern Devon Island and southern Ellesmere Island. The continuity of these structures with those of the Parry Islands belt is broken by the northerly salient of the Cornwallis fold belt. On Devon Island, at the Douro Range, a prominent north-dipping thrust fault marks the southern edge of the deformed Palaeozoic rocks (Thorsteinsson, Mem. 320 in press), but in this area there is some doubt as to the age of the structures; some may be Tertiary. However, folded Devonian rocks have been described by McLaren (Mem. 320 in press), between Okse Bay and Eids Fiord, north of the Schei syncline of southern Ellesmere Island, and also on the east coast of Grinnell Peninsula. The Devonian rocks of southern Ellesmere Island, like those of Melville Island in the Parry Islands belt, are overlain unconformably by Pennsylvanian strata. There is thus no doubt that the Palaeozoic folds of the Parry Islands and southern Ellesmere Island are essentially contemporary structures.

Northeast from the Eids Fiord area, folded and faulted Ordovician and Silurian rocks have been described from several parts of Ellesmere Island, e.g. between Trold and Vendome fiords (Norris, Mem. 320 in press), and at Cape Baird (Troelsen, 1950).

At two localities on Ellesmere Island, namely at the head of Trold Fiord (Tozer, Mem. 320 in press) and Canyon Fiord (Troelsen, 1952), Middle Pennsylvanian rocks rest unconformably upon Ordovician and Silurian strata, so there is no doubt that post-Silurian pre-Middle Pennsylvanian movements extended along the axis of Ellesmere Island. However as no Devonian rocks are known to be involved in these central Ellesmere folds the Palaeozoic structures could be older than those of southern Ellesmere Island and the Parry Islands. It should also be mentioned that throughout much of eastern Ellesmere Island it is difficult to distinguish between Tertiary and Palaeozoic structures. In some areas, e.g. Canyon and Trold fiords, the Tertiary movements have been superimposed upon the Palaeozoic structures, and in others, e.g. at the head of Bay Fiord, the Tertiary movements have dislocated rocks that were not tectonically disturbed in Palaeozoic time (Thorsteinsson and Tozer, 1957).

HISTORY OF THE EUGEOSYNCLINE

Recent investigations of the eugeosynclinal rocks of northern Ellesmere Island have been conducted by Blackadar (1954), Christie (1957, and unpublished work) and Thorsteinsson (unpublished work). However, the geology of this complex area is far from fully understood because it is large, much of it is ice-covered, the degree of deformation is intense, and much of the rock has been metamorphosed. Nevertheless, the observations that have been made on northern Axel Heiberg and Ellesmere islands do permit some generalizations. The most common rock types in this area are greywacke, impure sandstone, volcanic flows and pyroclastics, conglomerate, impure limestone, shale and siltstone; metamorphosed equivalents of these rock types also occur. In general the metamorphic rank increases across the eugeosynclinal belt, from the southeast to the northwest. Christie (1957) has described volcanic rocks within an Ordovician formation in M'Clintock Fiord, northern Ellesmere Island. Thorsteinsson has discovered basic lavas overlying altered Palaeozoic sedimentary rocks at Svartevaeg at the northern tip of Axel Heiberg Island, and at Emma Fiord, northwestern Ellesmere Island. At Emma Fiord poorly preserved Middle Silurian graptolites occur in the rocks beneath the conformably overlying lavas, and this sequence is overlain unconformably by Middle Pennsylvanian limestone. There is thus no doubt that Palaeozoic volcanic rocks occur in this area. Their exact age is not known but they are not older than Silurian, and not younger than Middle Pennsylvanian. Formations such as the Bourne group and the M'Clintock group, described by Christie (1957) on the north coast of Ellesmere Island, may also be Palaeozoic volcanics. Bedded rocks within the eugeosynclinal belt strike northeasterly on northern Ellesmere Island, and northerly on Axel Heiberg Island. Middle Pennsylvanian and Permian rocks are widely distributed throughout northern Ellesmere and Axel Heiberg islands, and rest with profound unconformity upon the eugeosynclinal rocks. The age of the Palaeozoic deformation of the eugeosynclinal belt cannot be dated more closely than post-Middle Silurian, pre-Middle Pennsylvanian. Thus the movements could have been contemporaneous with either the Early Palaeozoic or the Mid-Palaeozoic tectonism that affected the miogeosyncline.

As the Early Palaeozoic phase affected only a limited part of the miogeosyncline it seems most reasonable to infer that the eugeosynclinal movements were related to the widespread Mid-Palaeozoic phase. However, this dating is not offered without some misgivings. In the sedimentary record of the miogeosynclinal belt of Melville, Bathurst, Devon and southeastern Ellesmere islands, there is evidence, in the form of thick Devonian clastic formations, of tectonic activity—, possibly orogenic—somewhere north of the miogeosyncline. Starting in the Middle Devonian, clastic rocks (mainly quartzose clastics) become increasingly common, and by the Upper Devonian, the mainly non-marine Okse Bay formation and its equivalents, locally at least 10,000 feet thick, extended from southern Ellesmere Island, through the Parry Islands to northeastern Banks Island. These rocks seem to be of northern provenance. If tectonic activity in the eugeosyncline produced the landmass that shed these clastics, the activity presumably started in the Middle Devonian. This would indicate a phase of Palaeozoic tectonism within the Archipelago that took place between the Early and Mid-Palaeozoic movements. This phase, if it existed, has not yet been recognized in situ, unless it produced the folded rocks of northern Ellesmere and Axel Heiberg islands.

DEVELOPMENT OF THE SVERDRUP BASIN

The youngest beds in any part of the Franklinian geosyncline are of Upper Devonian age. The next dated rocks in the Archipelago are Middle Pennsylvanian, and from Melville Island to northern Ellesmere Island they rest with profound angular unconformity*

* Miss & Lower Penn. non-marine beds now known in basal part of Sverdrup sequence. Christie, Mem 331, p. 40

upon folded rocks of the geosyncline. Rocks of uppermost Devonian, Mississippian and Lower Pennsylvanian ages are unknown in the Archipelago. The Middle Pennsylvanian rocks mark the start of a long period of essentially uninterrupted sedimentation* which, in parts of the Archipelago, continued until early Tertiary time. This great column of sediment was deposited in a gradually subsiding depression, apparently superimposed on the deformed rocks of the Franklinian geosyncline. This sediment-filled depression has been named the Sverdrup Basin. From the available data it would appear that the axis of this basin extends from northern Sabine Peninsula on Melville Island, northeasterly through the Ringnes Islands and Axel Heiberg Island to northern Ellesmere Island. Exposures within any one area along this axis (some 400 miles long) reveal only a part of this Pennsylvanian-Tertiary sequence. However, the data from several partial sections near the axis suggest that in this axial area an essentially complete, structurally conformable sequence occurs from the Middle Pennsylvanian to the early Tertiary. The critical sections that lead to this conclusion, revealing the sequence from the bottom up, are as follows:

1. South of Svartevaeg, the northern tip of Axel Heiberg Island, the eugeosynclinal rocks of the Franklinian geosyncline are overlain unconformably by a conformable sequence from the Middle Pennsylvanian (limestones with <u>Profusulinella</u>) to the Permian (Thorsteinsson, unpublished work.)

2. Near Buchanan Lake, eastern Axel Heiberg Island, Souther (Mem. 320 in press) and Tozer have studied a structurally conformable section from the Permian, through the Triassic and Jurassic to the Isachsen formation (Lower Cretaceous).

3. In the Strand Fiord area, western Axel Heiberg Island, Souther (Mem. 320 in press) and the writers have studied sections from the Upper Triassic (Karnian part of the Blaa Mountain formation), through the Jurassic and Cretaceous, to the early Tertiary (Eureka Sound formation).

These three sections occur along, or near the axis of the basin. Taken together, they support the contention that an essentially continuous sequence is present within the basin. Evaporites of Pennsylvanian or Permian age (see below) form piercement structures along the axial part of the basin. Their presence provides good evidence that Permian and Pennsylvanian rocks occur beneath the axial part. The maximum thickness of sediment that accumulated in any one area along the axis is probably at least 40,000 feet. Detailed information on the variations in thickness of the various formations is rather limited. Much of the available data is summarized in Figure 3, which is a diagrammatic section across the basin showing the supposed relations prior to the Tertiary earth-movements. In an attempt to give a third dimension to this picture of thickness variations, a tentative isopach map for the Isachsen formation (Lower Cretaceous) is also presented (see fig. 4). This map reveals what is presently known; equally important it reveals some gaps in our knowledge of the character of the basin due to lack of exposures. This is particularly true of the northwestern part of the basin where exposures of all older rocks are concealed by the unconformable blanket of Beaufort beds forming the

* There are unconformities on margins of Sverdrup Basin, e.g. between Penn & Perm. Christie, Mem. 331, p. 40

Arctic Coastal Plain. Nevertheless, the thin Mesozoic sections on Mackenzie King Island suggest that the beds in the Sverdrup Basin become thinner toward the northwest. The Isachsen isopachs reveal that heaviest sedimentation took place on the west coast of Axel Heiberg Island. In Triassic time the axis was probably farther east, because the Heiberg formation (Upper Triassic) appears to be thickest at Buchanan Lake in eastern Axel Heiberg Island, with thinner sections to the northwest on Fosheim Peninsula, Ellesmere Island, and also to the southwest at Strand Fiord where the Isachsen formation is thickest. The thickness of sections of the Blind Fiord formation (Lower Triassic) provide some confirmation for placing the axis of Triassic sedimentation near eastern Axel Heiberg Island, and also for a thinning to the northwest. This is shown by a thickness of 4,500 feet at Buchanan Lake, as opposed to a thickness of 1,500 feet at Bunde Fiord in northwestern Axel Heiberg Island (Thorsteinsson, unpublished work). Very little data is available on variations in thickness of the Permian and Pennsylvanian formations, and the thickness shown in Figure 3 is little more than a guess.

On the margins of the Sverdrup Basin, unlike the axis, the Pennsylvanian-Tertiary time-interval was not one of continuous sedimentation. The first break recorded lies between the Pennsylvanian and the Permian. At two, and probably three localities, there is an angular unconformity between Pennsylvanian and Permian rocks. These localities are: (1) western Melville Island, where the Canyon Fiord formation, containing Middle Pennsylvanian fossils, was folded along the same axes as the underlying Lower Palaeozoic rocks, and locally removed, prior to deposition of the Permian Assistance formation. This relationship is particularly well displayed between Raglan Range and the Canrobert Hills (Thorsteinsson and Tozer, 1959); (2) at the head of Trold Fiord, central Ellesmere Island, where Tozer (Mem. 320 in press) has shown that about 1,800 feet of Canyon Fiord rocks are overstepped completely by the Assistance formation within a distance of 3 miles. In this area it appears probable that the Canyon Fiord rocks were faulted against Ordovician limestones prior to deposition of the Permian Assistance beds; (3) Feilden Peninsula, northern Ellesmere Island, where the relationships are not quite clear. According to Blackadar (1954), the Cape Rawson beds are locally overlain by red beds of the "Guide Hill Group", which contain caninoid corals. Nearby, limestones with Permian fossils (Feilden group) apparently rest directly upon Cape Rawson beds, without any intervening red strata. The writers suggest that the Guide Hill group may represent the Canyon Fiord formation and that the geology of this area may be comparable with that of Trold Fiord and western Melville Island.

Following the Permian there are no marked angular unconformities on the margins of the Sverdrup Basin. However, on the south, southwest, and west margins of this basin, several formations are transgressive. Sections on these margins (e.g. on Melville, Prince Patrick, Borden and Mackenzie King islands) reveal sections that are very fragmentary and incomplete compared with those of the basin proper. This is discussed in detail elsewhere (Tozer, Paper in press), but the overstep shown in this area may be appreciated from an examination of Figure 3.

To the east of the Sverdrup Basin, the Eureka Sound formation (mainly or entirely Early Tertiary) is transgressive (Thorsteinsson and Tozer, 1957, p. 25, Fig. 15). Recent work by the writers, together with R.L. Christie and J.G. Fyles, has shown that on Banks Island there are coal measures, probably correlative with the Eureka Sound formation, resting directly and transgressively (but without angular unconformity) upon the Christopher formation (Lower Cretaceous).

TERTIARY EARTH-MOVEMENTS

FOLDING AND RELATED MOVEMENTS

Extent and Strike of Tertiary Compressive Movements

In Tertiary (probably early Tertiary) time, folding and thrust faulting took place throughout much of the Queen Elizabeth Islands, and at the same time the Permo-Pennsylvanian evaporites were intruded to form piercement domes and diapirs along the axis of the Sverdrup Basin. The principal fold axes, faults and piercement domes are shown on the tectonic map (Fig. 2). From an examination of this map it will be seen that these Tertiary movements affected much of Ellesmere Island and nearly all of Axel Heiberg Island. These islands show the effects of the more intense movements. Cornwall Island and the Ringnes Islands also show Tertiary folds, but farther west, in the western Queen Elizabeth Islands, compressive Tertiary structures are of low amplitude. Many of the Tertiary structures are demonstrably superimposed upon the older, Palaeozoic structures but it is also apparent that the Tertiary movements were not confined to the area of older movements. This is illustrated by structure-sections at Irene Bay at the head of Bay Fiord, Ellesmere Island (Thorsteinsson and Tozer, 1957). These sections show that the Tertiary movements left their mark in areas that escaped Palaeozoic tectonism. On Ellesmere Island, where the strike of the Palaeozoic structures is visible in many places, the grain of the later, Tertiary structures in general follows that of the Mid-Palaeozoic movements. This strike is essentially northerly to northeasterly. On Axel Heiberg Island the principal Tertiary structures strike north-south. This strike conforms with that of the eugeosynclinal rocks of Svartevaeg on northern Axel Heiberg Island which were folded in the Palaeozoic. In the remaining part of Axel Heiberg Island there are no exposures of the Palaeozoic structures, consequently it is not known whether or not they have influenced the Tertiary strike. This also applies to the folds of Ellef Ringnes and Mackenzie King islands which are far removed from areas where older structures are exposed. Cornwall and Amund Ringnes islands seem to reflect the northerly strike shown by the early Palaeozoic structures of the Boothia Arch, Cornwallis Island and Grinnell Peninsula.

The country around Lake Hazen deserves special mention in connection with the Tertiary earth-movements. This area is a conspicuous plateau bounded by the United States Range to the northwest and by the Victoria and Albert Mountains to the southeast.

Christie (unpublished work) has shown that the United States Range was deformed by the Tertiary movements; the same is probably true of the Victoria and Albert Mountains, which lie on strike with known Tertiary structures in Canyon and Bay fiords, to the south. It appears that the Lake Hazen Plateau constitutes a rigid block, folded in Palaeozoic time, but unaffected by the Tertiary movements that flank it on both sides (Thorsteinsson and Tozer, 1957).

Nature of Structures

The Tertiary anticlines of southern Axel Heiberg Island characteristically have long axes, flat crests, and steeply inclined limbs; they appear to represent the "boxfolds" of DeSitter (1956, p. 189). In west-central Axel Heiberg Island the folds have short, plunging axes, and anticlines commonly have diapiric cores. In this area the mobile layer of Permo-Pennsylvanian evaporites has evidently controlled the pattern of the folds, and this is evidently also true on Ellef Ringnes and Amund Ringnes islands.

Faults are associated with the compressive structures in some areas. Particularly prominent faults have been recognized on eastern Axel Heiberg Island, Fosheim Peninsula on western Ellesmere Island, Irene Bay in central Ellesmere Island, north of Lake Hazen in northern Ellesmere Island, and at Copes Bay in eastern Ellesmere Island (see Fig. 2). All these faults are probably high-angle thrusts. The fault at Copes Bay is demonstrably a thrust and the others are probably of similar origin, but this is not easy to prove. The southwest side of Douro Range, Devon Island, is also faulted and this fault is probably also a thrust. The age of this fault is uncertain; it is tentatively shown as Tertiary on Figure 3, mainly on the grounds of its marked topographic expression. The Palaeozoic structures are in general, planed off, topographically, unlike the Tertiary features which form prominent ranges. On this admittedly inconclusive evidence it is suggested that the Douro fault moved in Tertiary time. Needless to say, it is not improbable that this fault originated in the Palaeozoic and has moved on occasions since then.

Diapirs and Piercement Domes

Diapirs and piercement domes are characteristic of the axial part of the Sverdrup Basin. In this discussion the more or less circular structures will be called domes; ovoid or tear-shaped masses will be termed diapirs. Brown (1951) first drew attention to the prominent circular structures, but Heywood (1955, 1957) was the first to study them and recognize their nature. In 1955 these structures were studied by several members of "Operation Franklin", and since then this work has been continued by the writers. The following generalizations may now be made. The outcropping rock forming both the piercement domes and the diapirs is mainly gypsum and anhydrite; no halite has ever been seen but it may be present at depth. Masses of gabbro, volcanic rock, and fossiliferous limestone commonly occur embedded in the evaporites. All of the fossils collected so far are Permian or Pennsylvanian. The internal structural relations within the piercement bodies are complex, with highly contorted bedding and much brecciation. Up to the present time no stratigraphic breakdown of a diapiric mass has been made. Circular or subcircular piercement domes occur throughout the entire belt, e.g. on Sabine Peninsula, Melville Island, near Isachsen, Ellef Ringnes Island, and near South Fiord, Axel Heiberg Island. A near-circular mass occurs north of Mokka Fiord, on the east coast of Axel Heiberg Island. The circular domes of Sabine Peninsula and Ellef Ringnes Island appear to be situated, from a regional point of view, in synclinal depressions. Oval to tear-shaped diapirs are commonly on the axes of anticlines, for example the Dumbells domes of Ellef Ringnes Island, the Amund Ringnes diapir on the axis of the Cornwall anticline, the numerous diapiric cores of anticlines in the Strand Fiord area on western Axel Heiberg Island and the Fair Cape diapir at the entrance to Gibs Fiord on eastern Axel Heiberg Island. Adjacent to most domes and diapirs the strata are steeply inclined and commonly vertical. The Sabine Peninsula domes may be an exception for it appears that the surrounding beds are nearly horizontal. However exposures are poor around these domes and there may be a narrow belt of highly deformed strata in the concealed interval immediately adjacent to the intrusive evaporites. On the other hand, the Sabine Peninsula domes are in contact with very incompetent sands (Tertiary Eureka Sound formation) at the surface, unlike the domes to the northeast which are in contact with Lower Cretaceous or older formations. Perhaps these Tertiary sands were too incompetent to accept warping.

On eastern Axel Heiberg Island a line of gypsum intrusions lies east of a prominent fault; these intrusions occur north of Whitsunday Bay, and at the east end of Buchanan Lake (Souther, Mem. 320 in press). Immediately north of Mokka Fiord, adjacent to the same fault, gypsum occurs along the fault plane. It would appear that these masses of evaporite have been intruded along a fault plane. Gypsum also occurs along a fault plane on the east side of Hare Fiord, about 12 miles from its mouth.

The fossils collected by members of "Operation Franklin" suggested that the evaporites were Permian or Pennsylvanian; this was confirmed by the writers in 1956 when bedded evaporites were found in the Permo-Pennsylvanian sequences of Hare, Borup and Canyon fiords, Ellesmere Island. In the Hare Fiord area Middle Pennsylvanian limestone occurs beneath the evaporite sequence. Between Hare and Borup fiords, on the axis of the (faulted) Blaa Mountain anticline, the bedded evaporites can be traced continuously from where they are in situ, to where they have been thrust up to intrude the Triassic rocks. The evaporites of the Sverdrup Basin thus lie near the base of the sequence that fills the basin, similar to the salt deposits of the Hannoverian salt-dome region of Germany. In such a position evaporites are particularly susceptible to diapirism.

Age of Tertiary Folding and Diapirism

On Ellesmere, Axel Heiberg, Ellef Ringnes and Melville islands, the Eureka Sound formation, partly and perhaps wholly of early Tertiary (Palaeocene-Eocene) age, is involved in the Tertiary structures. The movements therefore took place at some time during the Tertiary period. On eastern Axel Heiberg Island structurally disturbed conglomerates occur east of the prominent fault that extends south from Buchanan Lake. Near the head of Mokka Fiord these conglomerates are composed mainly of boulders and cobbles of gabbro. They are steeply inclined, and they overlie, conformably, typical coal measures of the Eureka Sound formation. The gabbro in these conglomerates is similar to the rock that forms sills in the Triassic shales and sandstones that form the fault-line scarp. These conglomerates may be syntectonic fanglomerates formed at the foot of this fault scarp during an early stage of the Tertiary orogeny. On Axel Heiberg and Ellesmere islands no definite late Tertiary deposits are known to overlie the rocks folded during this Tertiary orogeny. The Beaufort formation of the Arctic Coastal Plain is apparently younger than the main Tertiary folding, but this formation is of uncertain age and does not assist in dating the Tertiary movements. The diapirs and piercement domes intrude and warp the entire section within the Sverdrup Basin. The intrusion of these evaporite masses is therefore related to the Tertiary orogeny.

NORMAL FAULTS

Normal faults are found in many parts of the Archipelago. In several areas (e.g. at Intrepid Bay, Cornwallis Island) these faults displace Tertiary strata. On southern Prince Patrick Island they displace Jurassic and Cretaceous rocks. It is probable that most of these faults are relatively young structures, probably younger than the Tertiary compressive structures. Location of the more important faults is given in Figure 2.

The most notable feature related to these faults is the Prince Patrick uplift, which brings up Devonian rocks on the southwest margin of the Sverdrup Basin. The uplift is a structural elevation and is the locus of north-trending normal faults. The Devonian rocks exposed in the uplift are overlain unconformably by various Mesozoic formations. These Mesozoic formations show overstep from the northeast towards the southwest, and this brings progressively younger formations into direct contact with the Devonian rocks (see Fig. 3). From northeast to southwest the Devonian is overlain directly by, first the Schei Point formation (Triassic), then the Wilkie Point formation (Jurassic), and finally by the Mould Bay formation (uppermost Jurassic and lowermost Cretaceous) (Tozer, 1956; Thorsteinsson and Tozer, 1959). It would thus appear that the Prince Patrick uplift experienced positive movement in Mesozoic time. Pre-Mesozoic deformation of the Devonian rocks was not severe. It has resulted in angular discordance between the Devonian and Mesozoic rocks, but is not known to exceed 12 degrees and is commonly less. The Devonian rocks of the uplift do not reveal any clear trace of the east-west Mid-Palaeozoic fold structures which are well developed in the Canrobert Hills some 40 miles to the east.

Immediately east of the Prince Patrick uplift lies Eglinton Island, with a southwesterly dipping homocline of Mesozoic rocks. Eglinton Island seems to be a graben depressed between the Prince Patrick uplift on the west, and the Parry Islands fold belt to the east.

The northern and western boundaries of the uplift are concealed beneath the Beaufort formation. To the south it is concealed by the waters of M'Clure Strait. South of this strait, on northern Banks Island, the Cape Crozier anticline apparently represents the southern extension of the uplift. This anticline exposes more or less undisturbed Devonian rocks, overlain directly by the Christopher formation (Lower Cretaceous). Still farther south, in line with the Prince Patrick uplift and the Cape Crozier anticline, is the Proterozoic area of Nelson Head, Banks Island. These Proterozoic rocks are overlain by Lower Cretaceous (Isachsen and Christopher formations) and Tertiary beds. East of Nelson Head the Proterozoic rocks are in fault contact with Tertiary beds. There are also small downfaulted outliers of Lower Cretaceous beds resting on the Proterozoic rocks of Nelson Head. The Christopher formation of these outliers is much thinner than in Masik Valley, 30 miles to the north. There is thus no doubt that the Nelson Head inlier has moved positively in Tertiary time, and probably also at the time of deposition of the Christopher formation.

The Nelson Head Proterozoic area, the Cape Crozier anticline and the Prince Patrick uplift may be related structures. All three appear to have been active in Tertiary time, and probably also in the Mesozoic. All three are characterized by north-trending structures and lie on strike with one another. However, a structural connection between these areas cannot be demonstrated at the surface because the country between Nelson Head and Cape Crozier is covered by Cretaceous, Tertiary and Pleistocene deposits, and that between Cape Crozier and Prince Patrick Island by the waters of M'Clure Strait. Nevertheless it is possible that Nelson Head, the Cape Crozier anticline, and the Prince Patrick uplift represent culminations on a deep-seated north-trending structural elevation analogous to the Minto and Boothia arches.

Southwestern Melville Island is another area where faults are prominently developed (see Fig. 2). At the surface these faults involve only Devonian rocks, so they could be relatively old structures. Despite the fact that these Devonian rocks are relatively homogeneous, the faults have prominent topographic expression, suggesting that they have moved in relatively recent time. They, like the faults of the Prince Patrick uplift, are probably Tertiary structures.

Casual inspection of a map of the Canadian Arctic Archipelago is sufficient to reveal the presence of several remarkably linear stretches of coast. Viewed from the air or the ground the imposing sea cliffs commonly found on these coasts coupled with their linear nature, seem to suggest that these coasts represent fault-line scarps. Conspicuous stretches of such coast include: (1) parts of the south coast of Devon Island, (2) the east coast of Somerset Island, facing Prince Regent Inlet, (3) much of the west coast of Melville Island, (4) the east and west coasts of Eglinton Island, and (5) stretches of the north side of M'Clure Strait, from Cape Manning to Cape Hay. It seems likely that Tertiary faulting is responsible for the linear nature of the coastal areas. Besides the physiographic evidence suggesting faulting between Eglinton and Melville Islands, the structural and stratigraphic evidence mentioned above also supports this hypothesis.

Before concluding the discussion of Tertiary faulting, mention should be made of two remarkable linear features on the Arctic Coastal Plain of northwestern Prince Patrick Island (see Fig. 2). This plain is formed by the Beaufort formation, of uncertain age, but probably Pliocene or Pleistocene. These linear features, on the ground, mark the boundary between areas of slightly different vegetation. However their linear nature suggests that they represent faults. If so, the movement must have been of relatively recent date, not older than late Tertiary or Pleistocene.

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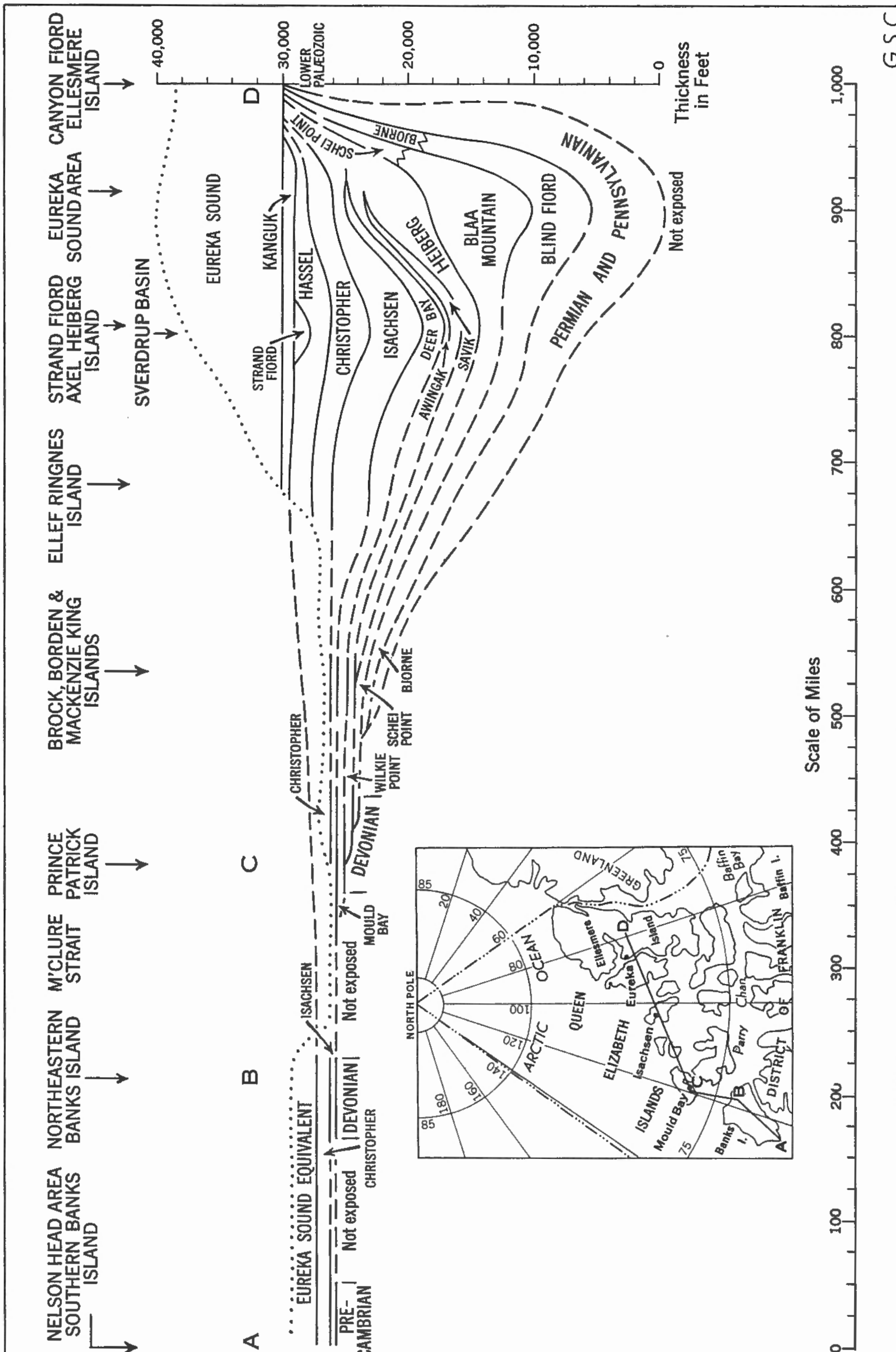

Figure 3. Section across Sverdrup Basin

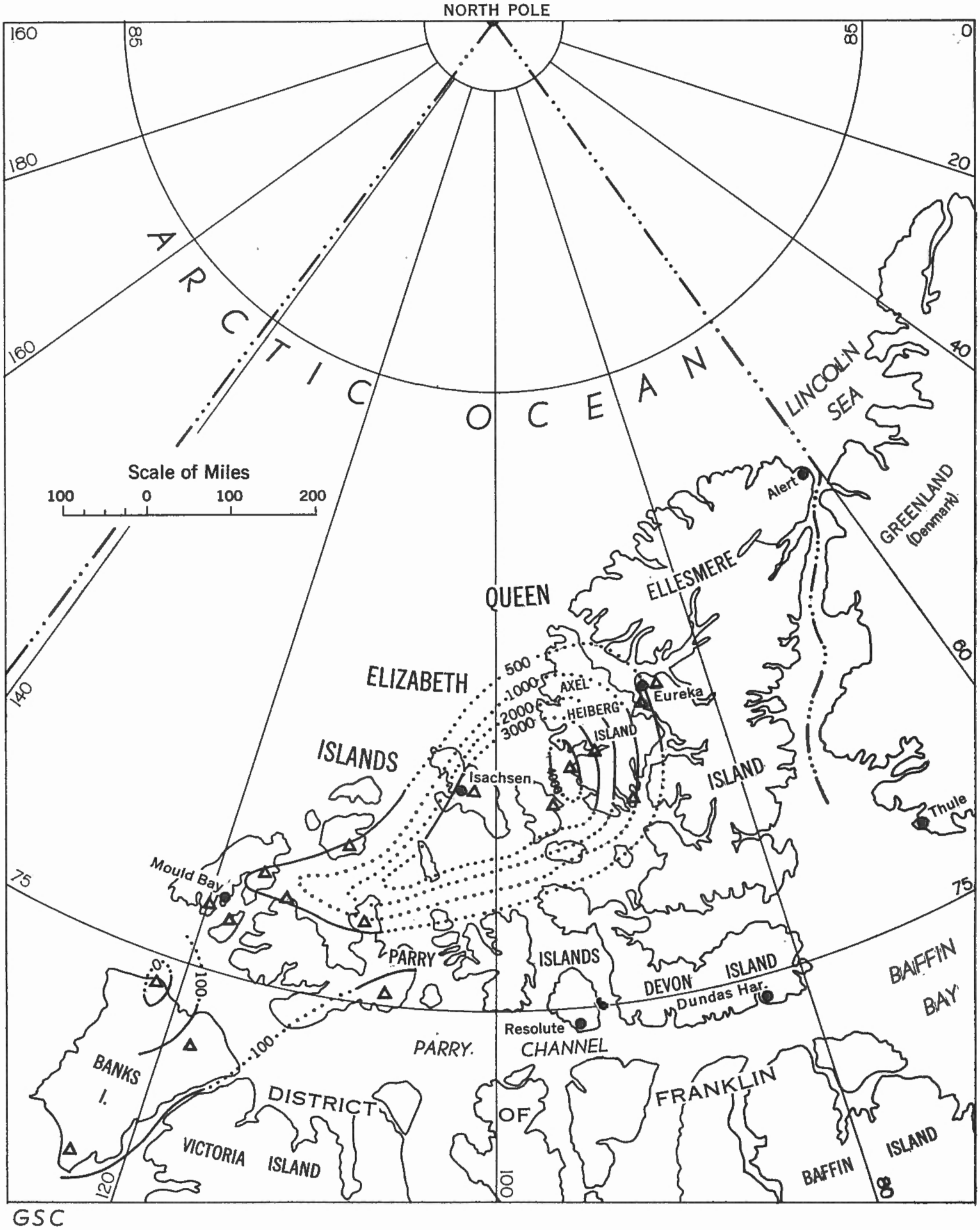

Figure 4. Tentative isopach map of Isachsen formation (Lower Cretaceous).
Solid lines are approximate isopachs. Dotted lines are conjectural.
Triangles are control points.