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MESOZOIC AND TERTIARY STRATIGRAPHY, WESTERN ELLESMERE ISLAND AND AXEL HEIBERG ISLAND, DISTRICT OF FRANKLIN

(Preliminary Account)

E. T. Tozer

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CONTENTS

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INTRODUCTION

During the past 10 years it has been shown that an unusually thick sequence of Mesozoic and Tertiary rocks was deposited in the Sverdrup Basin, situated in the northwestern part of the Arctic Archipelago. The eastern part of this basin lies within Axel Heiberg Island and western Ellesmere Islands.

The literature on the Mesozoic and Tertiary rocks of Ellesmere and Axel Heiberg Islands is already quite extensive. Reference to pioneer work by Schei, Kittl, Nathorst, Heer, Bentham and Troelsen will be found in Fortier et al. (1963)[1]. More recent publications include accounts of the Triassic stratigraphy and palaeontology (Tozer, 1961), and Jurassic palaeontology (Frebold, 1957, 1960, 1961). The structural relations of the Mesozoic and Tertiary rocks of Ellesmere and Axel Heiberg Islands have been discussed by Thorsteinsson and Tozer (1957, 1960). Observations made in 1955 during "Operation Franklin", by Y.O. Fortier, B.F. Glenister, N.J. McMillan, E.F. Roots, J.G. Souther, R. Thorsteinsson and the writer, are recorded in GSC Memoir 320 (Fortier et al., 1963). A general summary of the Mesozoic and Tertiary stratigraphy was prepared in 1959 (Tozer, 1960).

In 1961 and 1962 a Geological Survey party comprising R. Thorsteinsson, J.W. Kerr, H.P. Trettin and the writer mapped most of the previously unstudied parts of western Ellesmere Island, north of Baumann Fiord, and Axel Heiberg Island. In the course of this work the writer assumed principal responsibility for the stratigraphy of the Mesozoic and Tertiary rocks. This account however, incorporates observations made by all members of the party. It also includes observations made by R. Thorsteinsson and the writer in 1956 and 1957. A preliminary geological map of Axel Heiberg Island, based on all this work, and on work done by Fricker (1962) and E.W. Hoen, has been published (Tozer and Trettin, 1963). Maps of western Ellesmere Island are in preparation. Dr. Roland Bechsel, of Queen's University and a member of the Jacobsen-McGill University Expedition in 1962, kindly provided information on the geology of western Axel Heiberg Island and Dr. Geoffrey Hattersley-Smith, of the Defence Research Board, has courteously made available observations and specimens obtained in northern Ellesmere Island in 1961.

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

This paper is a preliminary report on results of the recent study of Mesozoic and Tertiary rocks. It is supplementary to the geological maps published and in preparation. Data gathered in 1961 and 1962 were incorporated in a summary account of the geology of northern Canada (Douglas et al., 1963). That account summarizes much of the available data on the variations in thickness of the Mesozoic formations and includes provisional isopach maps for the Mesozoic rocks. In this report no attempt has been made to provide a complete summary of all known data for western Ellesmere Island and Axel Heiberg Island. However it is hoped that this report, read in conjunction with the published accounts of Fortier et al. (1963), Douglas et al. (1963) and Tozer (1961), will provide an up-to-date summary of the Mesozoic and Tertiary geology of these islands.

In 1960 and 1961, Dr. Peter Fricker, a member of the Jacobsen-McGill Arctic Research Expedition to Axel Heiberg Island, made detailed studies of the Mesozoic stratigraphy in the vicinity of Expedition Fiord and Thompson Glacier. A preliminary map and report have been published (Fricker, 1961, 1962).

Fossil and age determinations recorded in this report have been made by the following officers of the Geological Survey: Jurassic fossils by H. Frebold; Upper Jurassic <u>Buchia</u> species and Cretaceous fossils by J.A. Jeletzky; Tertiary plant microfossils by D.C. McGregor; and Triassic fossils by the writer. Dr. G.E. Rouse of the University of British Columbia has also identified Tertiary plant microfossils.

TRIASSIC

Triassic formation names and correlations are summarized on Table I.

<u>Bjorne Formation</u>

The Bjorne Formation (Tozer, 1961, p. 9; Fortier et al., 1963, pp. 78, 367) is now known to extend as far northeast as the head of Tanquary Fiord. Until recently no diagnostic fossils were known, but in 1962 R. Thorsteinsson collected specimens of <u>Otoceras</u> of Lower Scythian age from near the base in a section near the head of Trold Fiord. The specimens are apparently lost but Thorsteinsson's determination was confirmed by the writer in the field. The interpretation of this formation as a sandy, and locally conglomeratic equivalent of the Lower Triassic Blind Fiord Formation (Tozer, 1961, pp. 10-11) is thus well established, although, as noted below, it is possible that equivalents of the Bjorne occur in the lower part of the Blaa Mountain Formation of northwest Ellesmere Island and northern

Axel Heiberg Island. In the foothills of "Sawtooth Range"[1] the Bjorne attains a thickness of about 4,000 feet. Towards the northeast, near the mouth of Tanquary Fiord the thickness is reduced to about 1,500 feet. At the head of Tanquary Fiord the thickness is still further reduced but no accurate measurements have been made.

Blind Fiord Formation

A considerable amount of new data is now available regarding the Lower Triassic Blind Fiord Formation, which consists mainly of siltstone and fine-grained sandstone (Tozer, 1961, p. 11; Fortier et al., 1963, pp. 75, 384, 431, 507). New fossil collections have been obtained and they will be described in a report now being prepared. The recent work necessitates some modification of the description of the boundary between the Blind Fiord and Blaa Mountain Formations. Formerly (Tozer, 1961, p. 8) the abrupt nature of this boundary was emphasized and it was suggested that the contact corresponds with the Lower-Middle Triassic boundary. The new evidence indicates that this is only true in some sections and that in others the lithological change takes place at a lower level, within the Lower Triassic. This may be illustrated by describing the position of the Blind Fiord - Blaa Mountain contact with respect to the position of the late Lower Triassic *Posidonia aranea* zone (Tozer, 1961, p. 32).

On Raanes Peninsula, at the type section of the Blind Fiord Formation, the Blind Fiord - Blaa Mountain contact (Tozer, 1961, pl. I) occurs above the *Posidonia aranea* zone. In a section 24 miles northeast of Bear Corner, *Posidonia aranea* and *Keyserlingites* cf. *robustus* (Mojsisovics)(GSC loc. 51599, 51600) were collected 700 feet below the contact.

Eight miles north of Whitsunday Bay, eastern Axel Heiberg Island, *Posidonia aranea* was obtained by geologists of Round Valley Oil Company about 200 feet below the Blind Fiord - Blaa Mountain contact.

In the Blaa Mountain area, northern Ellesmere Island, the contact is very abrupt and conspicuous (Tozer, 1961, pl. III B). Ten miles northwest of Blaa Mountain, *Ptychites* cf. *trochlaeformis* (Lindstrom) of Anisian age (GSC loc. 47533), was obtained by Thorsteinsson from the Lower Shale Member of the Blaa Mountain Formation, about 150 feet above the Blind Fiord - Blaa Mountain contact. Alignment of this contact with the Lower-Middle Triassic boundary is probable but cannot be established because the *Posidonia aranea* zone has not been found.

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[1] This name is in local use for the range that extends across Fosheim Peninsula from Cape With, in Canyon Fiord, to the entrance of Vesle Fiord.

In the section 5 miles northwest of the entrance to Hare Fiord (Tozer, 1961, p. 12, pl. II) Posidonia aranea is now known to occur about 200 feet below the contact, and Anisian fossils (Sturia etc., GSC loc. 51676, 51677) occur 250 feet above. In this section, however, there is considerable black shale below the contact, and the typical, massive-weathering, Blind Fiord siltstones are confined to the lower part of the formation.

In all the sections mentioned above the contact is approximately, and perhaps exactly, aligned with the Lower-Middle Triassic boundary.

In the vicinity of Otto Fiord, and in northern Axel Heiberg Island, a different situation prevails. At the mouth of Otto Fiord, contrary to the previous interpretation (Tozer, 1960, p. 12), the Posidonia aranea zone occurs about 300 feet above typical Blind Fiord siltstones in a black shale sequence inseparable from the Lower Shale Member of the Blaa Mountain Formation. In northern Axel Heiberg Island, 1 mile south of the small lake on the divide between Lightfoot and Bukken Rivers, Posidonia aranea again occurs in the Lower Shale Member of the Blaa Mountain Formation (GSC loc. 51712). In another section, 16 miles northwest of the head of Stang Bay, the Arctoceras zone, which is older than the Posidonia aranea zone, occurs in the upper 10 feet of the Blind Fiord Formation, beneath black shale of the Lower Shale Member (GSC loc. 47560). It is therefore well established that the Blind Fiord - Blaa Mountain contact lies within the Lower Triassic at Otto Fiord and in northern Axel Heiberg Island.

Schei Point Formation

In 1961 and 1962, relatively detailed studies of the Schei Point Formation were made in certain areas and they permit some revision of descriptions given previously (Tozer, 1961, pp. 13-16; Fortier et al., 1963, pp. 78, 368). The type section on Bjorne Peninsula is 600 feet thick. The previously given figure of 800 feet, based on work done in 1955, is incorrect; it was calculated from a graphic measurement that failed to take some small faults into account. This section, which is on the southwest limb of the Goose Point anticline, northwestern Bjorne Peninsula, is given below.

Unit		Thickness (feet) Unit	Total from Base
Overlying beds: Sand and sandstone of Heiberg Formation, separated from underlying Schei Point Formation by covered interval of about 50 feet.			
	Schei Point Formation		
11	Sandstone, grey, very calcareous, with layers of brachiopod coquina.	15	600
10	Covered interval.	15	585
9	Siltstone, grey, very calcareous, with Halobia and Sirenites (Karnian), GSC loc. 26127.	1.5	570
8	Covered interval, talus of calcareous siltstone.	12	568.5
7	Siltstone, grey, very calcareous, with Halobia and Sirenites (Karnian), GSC loc. 26128.	1.5	556.5
6	Covered interval.	215	555
5	Sandstone, grey, very calcareous, with layers of pelecypod coquina.	35	340
4	Mainly covered, talus of calcareous siltstone with grey phosphatic nodules and Nathorstites (Ladinian), GSC loc. 26111, 51617.	65	305
3	Siltstone, grey, calcareous, with grey phosphatic nodules, Daonella frami Kittl, Longobardites sp., Ptychites nanuk Tozer, Protrachyceras sp., (Anisian or Ladinian). GSC loc. 26110, 51616, etc. (Tozer, 1961, pp. 33-34).	2	240
2	Covered interval.	183	238
1	Mainly covered, some small exposures of grey shale.	55	55
Underlying beds: Bjorne Formation.			

Although exposures are very discontinuous, the type section nevertheless illustrates the dominant features of the formation that are characteristic over an extensive area, namely the occurrence of a resistant member of calcareous sandstone in the middle of the formation and another at the top. The lower resistant member is unit 5 in the type section (above) and the upper part of unit 4 in the Vesle Fiord section (Tozer, 1961, p. 16). The upper resistant member is unit 11 in the type section, and unit 6 ("Gryphaea bed") at Vesle Fiord (Tozer, 1961, p. 16). These two members are easily recognized in all complete Schei Point sections between Bjorne Peninsula and the north shore of Greely Fiord, i.e. for a distance of about 200 miles. In the foothills of "Sawtooth Range", on Fosheim Peninsula, the Gryphaea bed is now known to be 100 feet thick. As already described, the Schei Point Formation attains a thickness of 1,500 feet on Fosheim Peninsula. Between Canyon and Greely Fiords the thickness is reduced to 800 feet, but the section is nevertheless complete, with beds of Anisian, Ladinian and Karnian age, and the Gryphaea bed, 73 feet thick, at the top. Northeast of the head of Trold Fiord the thickness of the Schei Point Formation is reduced to 175 feet but this section is incomplete, and equivalent only to units 1-5 in the type section, with the Isachsen Formation disconformably above.

North of Greely Fiord, e.g. on the coast between Borup and Tanquary Fiords some normal, complete, Schei Point sections occur but they have not been studied in detail.

Within Tanquary Fiord, in the section on the west side, 10 miles north of the fiord entrance; in another section on the cliffs above McKinley Bay; and also 3 miles southeast of the head of the fiord, a different situation prevails. In these sections the Gryphaea bed, up to 100 feet thick, and commonly forming a distinctive orange-brown bluff or cliff, rests directly upon the Bjorne sandstone. The greater part of the Schei Point Formation, equivalent to units 1-10 in the type section, and units 1-5 at Vesle Fiord (Tozer, 1961, p. 16) is missing in these sections. These sections are of considerable interest because they show that the Karnian Gryphaea bed of the Schei Point Formation assumes a transgressive role in the northeastern part of the Sverdrup Basin. It will be recalled that a somewhat similar situation prevails on Prince Patrick Island (Tozer, 1960, p. 18), on the southwestern margin of the basin.

Blaa Mountain Formation

In GSC Memoir 316 (Tozer, 1961, p. 20) it was shown that the Blaa Mountain Formation of the type area and of Nansen Sound is divisible into five members, named, in ascending order, the "Lower Shale", "Lower Calcareous", "Middle Shale", "Upper Calcareous" and "Upper Shale". These subdivisions have now been recognized over an extensive area. It should be emphasized, however, that these members are in no sense time-stratigraphic units. In particular, both the lower and upper boundaries of the Lower Shale Member are now known to be markedly time-transgressive. Formerly only Middle Triassic faunas were known from this member, but, as noted in the description of the Blind Fiord Formation, it is now known that beds of late Lower Triassic age occur in the Lower Shale Member of the Otto Fiord area and northern Axel Heiberg Island. In northwestern Axel Heiberg Island, between Camp Five Creek and the head of Bunde Fiord, specimens of Halobia, of Karnian age (GSC loc. 47627) were obtained from talus of the upper part of the Lower Shale Member. This member thus spans latest Lower Triassic, Middle Triassic, and early Upper Triassic time in northwestern Axel Heiberg Island.

Raanes Peninsula

Relatively detailed studies were made on parts of Raanes Peninsula. Formerly (Tozer, 1961, p. 22) a threefold division for the Blaa Mountain Formation of this area was proposed. These divisions were the Lower Member (mainly black shale), the Middle Member (mainly calcareous siltstone) and the Upper Member (mainly shale, with many gabbro sills). The description of the Upper Member was based on a brief examination of the sea cliffs on the west coast of the peninsula, between Cape Chase and Trappers Cove. This examination failed to reveal any substantial calcareous unit within the beds above the Middle Member.

In 1961 and 1962 several sections of the Blaa Mountain Formation were examined in central Raanes Peninsula. These sections reveal a calcareous unit, of Karnian age, in the upper part of the formation. The discovery of this upper calcareous unit permits the recognition of five members in the Blaa Mountain Formation of central Raanes Peninsula, and nomenclature similar to that used in the type section may be applied.

The lithology and thickness of these members is as follows:

Overlying beds: Heiberg Formation.

Blaa Mountain Formation

Upper Shale Member. Grey, weakly to non-calcareous shale, with numerous dusky-red ironstone concretions, with Halobia. 200 feet thick on west side of valley west of Blind Fiord.

Upper Calcareous Member. This member is divisible into three distinct units, in descending order:

c. "Oxytoma beds". Grey calcareous siltstone, weathers orange and yellow. Halobia and Oxytoma common (GSC loc. 51614, 51621). 50 feet thick on west side of valley west of Blind Fiord; 90 feet thick, 6 miles northeast of head of Trappers Cove.

b. Grey calcareous shale with small grey nodules. 310 feet thick on west side of valley west of Blind Fiord; 335 feet thick, 6 miles northeast of head of Trappers Cove.

a. Grey calcareous siltstone and shale with Halobia and Sirenites (GSC loc. 51613, 51620, 51718). 115 feet on west side of valley west of Blind Fiord; 152 feet thick, 6 miles northeast of head of Trappers Cove.

This member has not been recognized on the west coast of Raanes Peninsula where it is possibly replaced by shale (Tozer, 1961, p. 22).

Middle Shale Member. Mainly grey, non-calcareous shale, in part with dusky-red nodules with Halobia (Karnian). 8 miles northeast of Trappers Cove this member comprises 1,700 feet of intermittently exposed shale, intruded by nine gabbro sills, 480 feet thick in aggregate thickness. The thickness of this member increases from east to west.

Lower Calcareous Member (=Middle Member, Tozer, 1961, p. 22). Grey calcareous siltstone and very fine grained sandstone, weathers brown. Grey phosphatic nodules in lower part. Halobia sp., of Karnian age, occurs in the upper beds, 7 miles northwest of head of Blind Fiord (GSC loc. 51611). Nathorstites (Ladinian) occurs near the middle in the section northwest of Blind Fiord (Tozer, 1961, pl. I). Thickness: 750 feet west of Blind Fiord; 520 feet 5 1/2 miles east of Trappers Cove; about 500 feet at Cape Chase, where it is now known that a complete section is present (cf. Tozer, 1961, p. 22).

Lower Shale Member. Dark grey and black, calcareous, in part silty, shale. Yellow-weathering siltstone beds in upper part. Daonella frami Kittl (Anisian or Ladinian) is widely distributed in the upper part (Tozer, 1961, p. 22, pl. I). Poorly preserved ammonoids, probably of Anisian age, occur in the lower beds of some sections. Thickness: 800 feet west of Trappers Cove; 660 feet west of mouth of Willow River; 460 feet south of Hat Island.

When these members are traced towards the northeast part of Raanes Peninsula, south of Hat and Gretha Islands, the Lower and Middle Shale Members become progressively thinner but they nevertheless have recognizable equivalents in the Schei Point Formation. The Lower Calcareous Member merges with the resistant member in the middle of the Schei Point Formation and the Upper Calcareous Member passes laterally into the *Gryphaea* bed, at the top of that formation. The Upper Shale Member apparently disappears entirely, but equivalents might be present in the thin (50 feet or so) covered interval that commonly occurs between the *Gryphaea* bed and the first exposures of typical, lower Heiberg sandstone.

Fosheim Peninsula

No complete sections of the Blaa Mountain Formation are exposed on Fosheim Peninsula. The Lower Shale Member overlies the Blind Fiord Formation at Mount Lockwood, where it is 350 feet thick with the *Daonella frami* bed 125 feet above the base (GSC loc. 51716). The Lower Shale Member is followed by approximately 300 feet of the Lower Calcareous Member at this locality. The section on Black Top Ridge includes the upper part of the Middle Shale Member, the Upper Calcareous Member, about 200 feet thick, and the Upper Shale Member, which includes about 300 feet of shale intruded by gabbro sills.

Exposures in the core of the Fosheim structure, opposite Depot Point on Axel Heiberg Island, are mainly calcareous siltstone and fine-grained sandstone, of Upper Karnian age.

Northern Ellesmere Island

The section west of Hare Fiord has been described by Tozer (1961, p. 20). On the east limb of the Blaa Mountain anticline, near the head of the small fiord east of Blaa Mountain, the thicknesses of the five members in feet are as follows: Lower Shale, 600; Lower Calcareous, 385; Middle Shale, 2,800 sedimentary rock, five gabbro sills, in aggregate 425; Upper Calcareous, 200; and Upper Shale, 35. Considerable sandstone is interbedded with the shales of the Middle Shale Member. The thickness of the Upper Shale Member was obtained from the section 3 miles northwest of the head of the small fiord. Towards the shore of Greely Fiord the thickness increases considerably and several gabbro sills intrude this member.

Twenty miles northeast the thickness of the Blaa Mountain Formation is greatly reduced, as shown by the following section, measured north of the head of Oobloyah Bay (west arm of Borup Fiord).

Unit		Thickness (feet) Unit	Total from Base
Overlying beds: Heiberg Formation.			
	<u>Blaa Mountain Formation</u>		
18	Shale, bluish grey, non-calcareous, with red ironstone nodules (=Upper Shale Member).	55	990
17	Covered interval.	35	935
16	Sandstone, grey, very calcareous, weathers brown, with many shells of <u>Gryphaea</u> and other pelecypods (GSC loc. 51700) (=Upper Calcareous Member and <u>Gryphaea</u> bed of Schei Point Formation).	65	900
15	Covered interval, talus from overlying beds.	45	835
14	Shale, non-calcareous, with dusky-red ironstone nodules and thin siltstone beds. Lower part of unit is mainly grey; upper part is green and red.	190	790
13	Sandstone, grey, very calcareous; weathers brown.	20	600
12	Sandstone, grey, very calcareous; weathers brown; some shale interbedded.	45	580
11	Shale, grey, non-calcareous, poorly exposed.	35	535
10	Sandstone, grey, very calcareous, many bioclastic layers; weathers brown.	40	500
9	Covered, talus of overlying sandstone.	30	460
8	Shale, grey, non-calcareous.	18	430
7	Sandstone, grey, very calcareous; weathers brown; bioclastic layers.	7	412

Unit		Thickness (feet) Unit	Total from Base
6	Shale, grey, non-calcareous, poorly exposed.	30	405
5	Sandstone, grey, very calcareous, brown-weathering.	2	375
4	Shale, grey, non-calcareous, with red ironstone nodules.	38	373
	(Units 4-14 evidently represent the Middle Shale Member)		
3	Covered.	105	335
2	Siltstone and sandstone, grey, very calcareous, weathers yellow and brown, spiriferid brachiopods (GSC loc. 51697) (=Lower Calcareous Member).	15	230
1	Shale, dark grey and black, non-calcareous in basal 25 feet, calcareous above. Upper 15 feet contains beds of yellow-weathering calcareous siltstone up to 10 inches thick. Daonella sp. indet. (Middle Triassic) occurs 140 feet above base. Unit includes 5-foot covered interval at base (=Lower Shale Member).	215	215

Underlying beds: Sandstone of Bjorne lithology. The underlying sequence comprises alternations of Bjorne and Blind Fiord rock types.

A further 20 miles to the northeast an even more attenuated development occurs, as shown by the following section, measured near the north end of the pass connecting the valleys at the heads of Hare Fiord and Esayoo Bay (east arm of Borup Fiord).

Unit		Thickness (feet) Unit	Total from Base
Overlying beds: Heiberg Formation.			
4	Mainly covered; some grey, non-calcareous shale and talus of thin-bedded green sandstone. (Interval probably includes equivalents of Upper Shale Member and basal part of Heiberg Formation).	215	458
	Blaa Mountain Formation		
3	Sandstone, grey, very calcareous, weathers brown, with numerous shells of Gryphaea, Plicatula and other pelecypods (GSC loc. 51685, 51686) (=Upper Calcareous Member and Gryphaea bed of Schei Point Formation).	90	243
2	Sandstone and shale interbedded, poorly exposed.	103	153
1	Shale, dark grey to black, non-calcareous with grey nodules; some talus of yellow-weathering calcareous siltstone on upper beds (=Lower Shale Member).	50	50
Underlying beds: Sandstone of Bjorne lithology. The underlying sequence comprises alternations of Bjorne and Blind Fiord rock types.			

In this section the Upper Calcareous Member, or Gryphaea bed, lies within 160 feet of the Blind Fiord equivalent. In the Nansen Sound area this stratigraphic interval is more than 4,000 feet thick. Presumably there is a disconformity at the base of the Upper Calcareous Member and this section illustrates the partial truncation of the equivalents of the Lower Shale, Lower Calcareous, and Middle Shale Members. This truncation is complete in Tanquary Fiord, 20 miles to the east of the section given above. There the Gryphaea bed rests directly on the Bjorne Formation and there are no beds of Blaa Mountain lithology.

Eastern Axel Heiberg Island

Apart from the section at Buchanan Lake, studied by J.G. Souther (Fortier et al., 1963, p. 431) and the writer (Tozer, 1961, p. 19), little detailed work has been done on the Blaa Mountain Formation of eastern Axel Heiberg Island. The Blaa Mountain sequence appears to be mainly shale, and very thick, all the way along the range that extends from Whitsunday Bay to Buchanan Lake. Daonella frami of Anisian or Ladinian age, not found at Buchanan Lake, occurs about 400 feet above the base in a section 8 miles north of Whitsunday Bay. In this section some thin beds of baked calcareous shale, adjacent to a gabbro sill, occur about 900 feet above the base, but the Lower Calcareous Member, so prominent on Raanes Peninsula is absent, as at Buchanan Lake (Tozer, 1961, p. 19).

The Blaa Mountain beds of Schei Peninsula, and the Mokka Fiord and Depot Point anticlines have not been studied in detail. In these areas the upper Blaa Mountain beds include considerable calcareous siltstone and fine-grained sandstone. No Middle Triassic rocks are known to be exposed.

Southwestern Axel Heiberg Island

The Blaa Mountain exposures in southwestern Axel Heiberg Island are on the northeast flank of the gypsum diapir 14 miles northeast of Cape Levvel, on the south side of Strand Fiord. About 800 feet of Blaa Mountain beds occur immediately northeast of the gypsum intrusion. The dominant lithology is dark grey, non-calcareous shale, with some siltstone and thin beds of calcareous shale. Daonella cf. frami (GSC loc. 51633), of Anisian or Ladinian age, occurs about 125 feet above the base of the section; Halobia sp. of Karnian age, 235 feet above the base (GSC loc. 51637); Juvavites sp. and Proclydonautilus cf. spirolobus Dittmar (GSC loc. 51632), also Karnian, and probably Upper Karnian, about 600 feet above the base. Daonella thus occurs about 700 feet below the Heiberg Formation. In the Eureka Sound area this interval is much greater: probably about 7,000 feet at Buchanan Lake; 3,000 feet at Blaa Mountain; and 3,600 feet on Raanes Peninsula. Clearly much of the Triassic sequence shows marked attenuation between Eureka Sound and the west side of Axel Heiberg Island, and this has influenced the writer in preparing provisional isopach maps for the Triassic of the Sverdrup Basin (Douglas et al., 1963, fig. 15).

Northwestern Axel Heiberg Island

A section of Triassic beds immediately southwest of Aurland Fiord was examined briefly. Here the combined thickness of the Blind Fiord and Blaa Mountain Formations is probably not more than 2,500 feet. The Lower Shale Member, with Daonella, has been recognized and it is overlain by poorly exposed beds of non-calcareous shale and calcareous siltstone. The sequence thickens rapidly towards the southeast. Northeast of Bukken Fiord the Blaa Mountain Formation is about 3,500 feet thick with recognizable equivalents of the Lower Shale, Lower Calcareous, Middle Shale and Upper Calcareous Members. An interesting unit of light-coloured calcareous sandstone and grit, with Gryphaea, Plicatula, "Myophoria" and other pelecypods occurs at the cape marking the south side of the entrance to Bunde Fiord (discovered by R. Thorsteinsson in 1957); 7 miles southeast of Cape Northwest (discovered by R.H. Janes, Thorsteinsson's assistant, in 1957); and 5 miles east of Bad Weather Cape at the entrance to Li Fiord. The thickness has not been accurately measured but at each locality it is about 100 feet. This sandstone apparently occupies a stratigraphic position near the top of the Blaa Mountain Formation, i.e. it seems to occupy the same position as the Upper Calcareous Member and the Gryphaea bed of the Schei Point Formation. Somewhat similar rocks occur in the Schei Point Formation of Borden Island (Thorsteinsson and Tozer, 1959; Tozer, 1961, p. 16; Thorsteinsson and Tozer, in press). This distinctive unit is apparently absent in the Triassic sections northeast of Cape Levvel, southwest of Aurland Fiord, northeast of Bukken Fiord, and south of Upper Bunde Fiord. Relatively coarse-grained sandstones of this type are also apparently absent in the Blaa Mountain Formation of northeastern Axel Heiberg Island. The occurrence of coarse-grained sandstone, with a shallow-water fauna, in the Upper Triassic of western Axel Heiberg Island is of considerable palaeogeographic interest. Formerly (Tozer, 1960, p. 15), it was stressed that most of the clastic sediment in the Sverdrup Basin appears to have been derived from the south and east. The occurrence of Upper Triassic sandstone in northwestern Axel Heiberg Island, similar in facies, and apparently contemporary with the Triassic sands of Borden Island suggests that a shoal area, and source of sediment, lay on the northwestern edge of the Sverdrup Basin in Karnian time. This shoal area was probably only intermittently close to the strand line, for the greater part of the Triassic section is devoid of these shallow-water deposits. This may be seen at Bad Weather Cape: the section is unfortunately largely masked by gabbro talus but typical Blind Fiord and Blaa Mountain siltstones and shales overlie the Permian chert and it is only near the top of the Blaa Mountain section that the shallow-water deposits occur.

Northeastern Axel Heiberg Island

Several partial sections in this area have been described by N.J. McMillan (Fortier et al., 1963, pp. 508, 509). In a section 16 miles northwest of Stang Bay the writer recognized the Lower Shale, Lower Calcareous, Middle Shale and Upper Calcareous Members but no accurate measurements were made. In this area, as in northern Axel Heiberg Island generally, and in northwestern Ellesmere Island (Tozer, 1961, p. 20), considerable sandstone is interbedded with the shales of the Middle Shale Member. McMillan's subdivision into three members, designated "A", "B", and "C", was not based on an examination of the whole sequence. Apparently none of his sections reached the Upper Calcareous Member. McMillan's Member "A" represents the lower part of the Lower Shale Member; Members "B" and "C" include the upper part of the Lower Shale Member, the Lower Calcareous Member, and the Middle Shale Member. McMillan's failure to segregate the Lower Calcareous Member is understandable. In northern Axel Heiberg Island this member consists of at least two distinct units of yellow-weathering calcareous siltstone and fine-grained sandstone with shale, in part non-calcareous, interbedded. The boundary between the Lower Calcareous and Middle Shale Members is thus not well defined on northern Axel Heiberg Island and future work may result in adoption of a new subdivision.

Heiberg Formation

The Heiberg Formation (Fortier et al., 1963, pp. 79, 369, 432, 451, 476, 510; Tozer, 1961, p. 23) is widely distributed, and essentially uniform, on Axel Heiberg and western Ellesmere Islands. Data on distribution and thickness have been summarized by Douglas et al. (1963, fig. 16). Northeast of the head of Trold Fiord the Heiberg Formation is progressively cut out by the sub-Isachsen unconformity and the same thing happens between "Sawtooth Range", on Fosheim Peninsula, and the head of Vesle Fiord. As mentioned previously (Fortier et al., 1963, p. 81; Tozer, 1961, pp. 25-26), it is possible that the upper Heiberg beds are of lowermost Jurassic age.

JURASSIC AND LOWER CRETACEOUS

Between the Heiberg Formation and the Lower Cretaceous Isachsen Formation there lies a sequence of alternating sandstone and shale, in part marine, in part non-marine. In ascending order the following units are recognized: (1) Borden Island Formation, Lower Jurassic marine sand and sandstone; (2) Savik Formation, Lower, Middle and Upper Jurassic marine shale, with a tongue of marine sandstone (Jaeger Member) intercalated on Ellesmere Island, eastern and southern Axel Heiberg Island; (3) Awingak Formation, Upper Jurassic alternating sandstone and shale, marine and non-marine; and (4) Deer Bay Formation, Upper Jurassic and lowermost Cretaceous marine shale, with a sandstone member in the middle on southern Axel Heiberg Island. In the northwestern part of the area, north of West Cape Fiord on Axel Heiberg Island, the Awingak Formation cannot be recognized and is apparently absent. Here an essentially homogeneous shale formation occupies the interval between the

Heiberg and Isachsen Formations. Jurassic and Lower Cretaceous formation names and correlations are summarized in Table II. A provisional isopach map for the beds between the Heiberg and Isachsen Formations has been published (Douglas et al., 1963, fig. 17).

Borden Island Formation

This formation has been named by Thorsteinsson and Tozer (in press) to accommodate the sand and sandstone of Lower Jurassic age exposed on Borden and Melville Islands. In the preliminary report on the Western Queen Elizabeth Islands these rocks were referred to as Map-unit 15 (Thorsteinsson and Tozer, 1959). Poorly preserved ammonites from these beds have been described by Frebold (1960, pp. 6, 8, 13) as Arietites, s. lato., and dated as Sinemurian. The occurrence of similar beds in the Eureka Sound area has already been mentioned by Tozer (1961, p. 26).

Beds assigned to the Borden Island Formation are known from the following localities: northern Ellesmere Island, in the valley northeast of Blaa Mountain; throughout the Eureka area, Fosheim Peninsula; north of Mount Bridgman, near the shore of Canyon Fiord; in the foothills of "Sawtooth Range"; and throughout much or all of eastern Axel Heiberg Island.

The beds consist of grey sand, in part yellow-weathering, with dark dusky-red beds of hard ferruginous sandstone, commonly about 1 foot thick, and spherical sandstone concretions, about 4 to 6 inches in diameter. Fossil wood, poorly preserved crustacean remains, marine pelecypods, and specimens of Lingula are fairly common. The Borden Island Formation commonly occupies a recessive interval and good exposures are rare. The stratigraphic interval is commonly characterized by subdued topography and reddish terrain composed of fragments derived from the thin beds of hard sandstone. This recessive interval is frequently bounded, below, by projecting outcrops of the uppermost, resistant, thick-bedded Heiberg sandstone. Above the Borden Island recessive interval lies another recessive unit, the Savik Formation. The rubble derived from this formation is also red, but of a different, more orange hue, and throughout the Eureka Sound area these two red units above the upper Heiberg sandstone are a conspicuous feature, important for mapping purposes.

Northeast of Blaa Mountain the Borden Island Formation is 280 feet thick, with Meleagrinella and Lingula (GSC loc. 51648). Southwest of Buchanan Lake, beneath the type section of the Savik Formation the thickness is 170 feet. On the east side of Black Top Ridge, 185 feet of Borden Island Formation is separated from the underlying Heiberg Formation by a covered interval of 94 feet. North of Mount Bridgman the uppermost Heiberg is followed by a 40-foot covered interval and then by 35 feet of typical Borden Island beds with a species of Meleagrinella (GSC loc. 51662) apparently identical to the one at Blaa Mountain. Above these Borden Island beds is 10 feet of red-weathering conglomerate, composed of small chert and quartzite pebbles. No recognizable exposures of the Savik Formation occur in this section, but it is possible that the covered interval above the conglomerate represents this interval. On the east side of "Sawtooth Range", 10 miles southwest of Cape With, 185 feet of Borden Island sand with red sandstone beds overlies the top Heiberg sandstone.

The specimens of Lingula obtained by Glenister (Fortier et al., 1963, p. 477) 1,700 feet above the Monotis bed of the Heiberg Formation, east of the head of Wolf Fiord, resemble those obtained northeast of Blaa Mountain, in form, preservation and matrix. These specimens probably indicate the occurrence of the Borden Island Formation.

The Borden Island Formation has not been recognized in Western Axel Heiberg Island.

Savik Formation

The type section of the Savik Formation is southwest of Buchanan Lake, where it was studied by J.G. Souther (Fortier et al., 1963, p. 435). Souther recognized two members in the type section and also at the head of Strand Fiord. The boundary between these members has been recognized throughout eastern Axel Heiberg Island and western Ellesmere Island and in the descriptions that follow these members will be termed the "Lower Savik" and the "Upper Savik". In 1962 the writer examined the type section and obtained some new fossil collections. All fossil and age determinations in the following section are by H. Frebold.

Unit	Thickness (feet) Unit	Thickness (feet) Total from Base
Overlying beds: basal, resistant, light-coloured Awingak sandstone.		
Upper Savik		
7 Siltstone and very fine grained sandstone, black and dark grey, in part friable and papery, in part micaceous. Dark dusky-red ironstone concretions occur. A bed of dark dusky-red ironstone, with a sharp lower contact, 2.5 feet thick, marks the base of the unit. Cardioceras sp. (GSC loc. 51710) of Lower Oxfordian age,		

Unit		Thickness (feet) Unit	Total from Base
	occurs 25 feet above the base. The upper beds become increasingly sandy and appear to be transitional to the overlying Awingak.	70	340
	Lower Savik		
6	Shale, light grey, with yellow mudstone concretions and marcasite nodules. cf. Leioceras opalinum (Reinecke) and Oxytoma jacksoni (Pompeckj) (GSC loc. 51709), of Lower Bajocian age occur 45 feet above base of unit.	70	270
5	Sandstone and shale interbedded, as unit 3.	5	200
4	Shale, grey, some siltstone bands, Grammoceras? sp. (GSC loc. 51707), probably of Upper Toarcian age, occurs 29 feet above base of unit.	89	195
3	Sandstone and shale interbedded. Shale is light grey, sandstone is fine-grained, weathering red, in beds up to 1 foot thick.	26	106
2	Shale, light grey, with numerous nodules of dusky-red weathering ironstone.	60	80
1	Shale and sandstone interbedded, poorly exposed.	20	20

Underlying beds: Borden Island Formation.

It was from the Upper Savik at this locality that Souther collected the ammonites identified by Frebold (1960, p. 22) as Cardioceras (Scarburgiceras) sp. indet., aff. C. mirum Arkell. The writer has suggested (Tozer, 1960, p. 11) that Souther's specimens might have been obtained from the Awingak Formation. This suggestion is now withdrawn. As noted above, the contact between the

Upper and Lower Savik is sharp, and that between the Upper Savik and Awingak is transitional. In lithology the Upper Savik beds resemble the dark silts and siltstones that occur within the Awingak. The occurrence of Lower Oxfordian fossils in the Upper Savik, 50 feet above a Lower Bajocian fauna (in the Lower Savik), is of interest in this connection. No fossils of Upper Bajocian, Bathonian, or Callovian age are known from this section. If deposits of these ages are present they must be very thin. On western Axel Heiberg Island a substantial thickness of Upper Bajocian, Bathonian and Callovian rock occurs in the Savik. It seems probable that the boundary between the Lower and Upper Savik at Buchanan Lake is disconformable.

Very marked changes take place in the Savik Formation when the beds are traced east and west from the type section.

Southwestern Axel Heiberg Island

Around Strand Fiord the Savik beds are almost entirely shale, and locally they attain a thickness of about 1,900 feet. On the northeast flank of the gypsum diapir 14 miles northeast of Cape Levvel the following section was measured. All fossil and age determinations are by H. Frebold. The Upper Bajocian, Bathonian and Callovian ammonites from this section are the subject of a GSC bulletin (Frebold, in press).

Unit		Thickness (feet) Unit	Total from Base
Overlying beds: Awingak Formation.			
11	Covered interval.	150	2,050
	Savik Formation		
10	Shale, grey and black, in part silty.	600	1,900
9	Shale, grey, with calcareous and ironstone concretions. Cadoceras spp.(GSC loc. 51629), of Callovian age, 945 feet above Heiberg Formation. Arctocephalites elegans Spath, Arctocephalites sp. nov. (GSC loc. 51628) of Middle Bathonian age, 685-690 feet above Heiberg Formation.	710	1,300

Unit		Thickness (feet) Unit	Total from Base
8	Shale, grey, non-calcareous, with siltstone beds (Gypsum sill, 1 foot).	20	590
7	Shale, grey, non-calcareous (Gabbro sill, 4 feet).	130	570
6	Shale, grey, non-calcareous.	130	440
5	Shale, as unit 3, with Pseudolioceras m'clintocki (Haughton), Oxytoma jacksoni (Pompeckj) (GSC loc. 51627), of Lower Bajocian age (Gypsum sill, 1 foot).	105	310
4	Shale, as unit 3, (Gabbro sill, 3 feet).	85	205
3	Shale, grey, non-calcareous, with dusky-red-weathering ironstone nodules (Gypsum sill, 2 feet).	55	120
2	Shale, poorly exposed; poorly preserved belemnites seen.	40	65
1	Covered interval.	25	25

Underlying beds: Heiberg Formation. Upper Heiberg beds are exposed as rubble. No beds of Borden Island lithology seen.

In addition to the fossils recorded above, Arkelloceras mclearni Frebold, of Upper Bajocian or Lower Bathonian age, was obtained about 80 feet below the beds with Arctocephalites elegans. The Arkelloceras locality (GSC loc. 51631) is about 1 1/2 miles south-east of the well-exposed section given above. Furthermore, a Cadoceras bed was found by A.H. McNair and A.A. Ormiston, in 1960, about 300 feet higher than the Cadoceras horizon recorded above. The uppermost beds of this section are dark and silty shale, much like the Upper Savik of Buchanan Lake, but in this section there does not appear to be a sharp boundary between the Upper and Lower Savik.

The Savik Formation in the section described above is substantially thicker than in the section 7 miles to the east (Fortier et al., 1963, p. 452) where the formation is about 900 feet thick with the Upper Toarcian Catacoeloceras fauna near the base (Frebold, 1957, pp. 3, 23).

The Savik Formation is widely exposed between Cape Southwest and Cape Maundy Thursday. No detailed studies have been made but the dominant lithology is shale. Thick gabbro sills intrude the shale throughout this area. The prominent buttes known as "The Two Craters" represent resistant outliers of a sill, overlying recessive Savik shale.

A section of the Savik Formation 13 miles northwest of Sherwood Head was briefly examined. The total thickness is about 700 feet. The basal part is light grey shale as on Fosheim Peninsula, then follows reddish-weathering sandstone, evidently the Jaeger Member. The upper half is black silty shale, comparable with the Upper Savik. No fossils were found.

Northwestern Axel Heiberg Island

Between the latitude of Strand and Bunde Fiords no detailed work has been done on the Savik Formation. In the upper reaches of Li Fiord, thick gabbro sills intrude the Savik.

Fay Islands

In 1956, J.G. Fyles visited the southwesternmost of the Fay Islands, that lie west of Middle Fiord on Axel Heiberg Island. About 50 feet of pale grey siltstone or baked shale underlies a gabbro sill. Poorly preserved belemnites and pelecypods were obtained (GSC loc. 48228). According to Frebold, no age determination can be offered. From the nature of the rock and the structural situation it seems probable that the beds represent the Savik Formation.

Eastern Axel Heiberg Island

Between Skraeling Point and Gibs Fiord, and in the area between May Point and the Whitsunday Bay Thrust, the Savik beds appear to be essentially the same as on Fosheim Peninsula described below. The Jurassic exposures on Schei Peninsula and east of Flat Sound are poor.

Western Ellesmere Island

On northern Fosheim Peninsula (east side of Black Top Ridge) the Lower Savik is represented by 40 feet of light grey, non-calcareous shale with red ironstone nodules (cf. unit 2 of type section) overlain by 200 feet of green glauconitic sand and sandstone with dusky-red hard beds up to about 1 foot thick. The basal shale has yielded poorly preserved harpoceratids; the overlying sand sequence provided *Catacoeloceras polare* Frebold, and *Grammoceras* sp. indet., identified by Frebold (1960, pp. 18, 23) and dated as Upper Toarcian.

This sand sequence is clearly equivalent to part of the Lower Savik shale on Axel Heiberg Island and the sand-shale relationship provides local documentation for the change from shale to sand facies that takes place between the axis and margin of the Sverdrup Basin (Tozer, 1960, p. 19, fig. 5). This unit of sand evidently represents a wedge, replaced by shale to the west. Contemporary sands on Cornwall Island, studied by H. Greiner (Fortier et al., 1963, pp. 83, 535; Frebold, 1960, p. 11) are assigned to the Jaeger Formation. It thus seems appropriate to refer to the sand unit on Fosheim Peninsula as the Jaeger Member of the Savik Formation. In 1956 a single small ammonite was obtained from rubbly outcrops, probably representing the upper part of the Jaeger Member, on the south side of Greely Fiord, 19 miles east of Iceberg Point. This specimen (GSC loc. 28961) has been identified by H. Frebold as Arkelloceras sp., of Upper Bajocian or Lower Bathonian age. It follows that the Jaeger Member of Fosheim Peninsula certainly includes Upper Toarcian beds and may range as high as the Upper Bajocian or Lower Bathonian.

In the section on the east side of Black Top Ridge, a mainly covered interval of 190 feet lies between the glauconitic sands of the Jaeger Member and the overlying light-coloured, basal Awingak sandstone. This interval includes some small outcrops of black siltstone, resembling the Upper Savik of the type section. The total Savik equivalent in this section is thus about 430 feet thick.

Equivalents of the Savik Formation occur in the foothills of "Sawtooth Range" but no good exposures are known. Commonly the uppermost Heiberg sandstone is succeeded by rubble of red sandstone. As already noted, parts of this sequence apparently represent the Borden Island Formation. In a section 4 miles southwest of the lake that occupies the most prominent pass in the "Sawtooth Range" the stratigraphic interval between the top of the Heiberg and the base of the Isachsen is about 400 feet. The lower part of this interval includes an outcrop of 3 feet of light grey shale, with red ironstone nodules, overlain by red sandstone rubble containing fragments of young harpoceratids (GSC loc. 47632) identified by H. Frebold. These fossils are dated as Toarcian or Lower Bajocian by Frebold and they establish beyond doubt that equivalents of the Savik Formation are present.

Northern Ellesmere Island

In the valley northeast of Blaa Mountain a section of the Savik Formation comparable to that of northern Fosheim Peninsula is exposed. The equivalent of the Lower Savik is about 200 feet thick and includes a basal light grey shale overlain by glauconitic sand and red sandstone (Jaeger Member). An ammonite in a talus nodule of red clay ironstone (it is not certain whether it is from the basal shale or the Jaeger Member) has been identified by H. Frebold as Pseudolioceras cf. m'clintocki (Haughton), of Lower Bajocian age (GSC loc. 51702). In this section the black Upper Savik silts and siltstones are unusually well exposed and attain a thickness of 400 feet, making a total thickness of about 600 feet for the Savik Formation. Poorly preserved pelecypods, possibly Buchia sp. (GSC loc. 51703), occur 200 feet above the base of the Upper Savik.

The Savik Formation has been recognized west of Tanquary Fiord, but no sections have been measured. On the northeast side of the valley of Chapman Glacier, flowing into McKinley Bay, Catacoeloceras sp., of Upper Toarcian age (GSC loc. 51678) has been identified by H. Frebold. These specimens were obtained from the Jaeger Member. Higher beds, representing the Upper Savik, yielded a crushed ammonite (GSC loc. 51679), possibly Cadoceras sp. Frebold states that this ammonite, although very poorly preserved, is probably not older than Callovian.

Beds resembling the Jaeger Member occur above the Heiberg Formation at the divide of the Tanquary-Yelverton Pass but no determinable fossils were found.

Awingak Formation

The Awingak Formation was named by J.G. Souther (Fortier et al., 1963, p. 436) for the alternating marine and non-marine sandstones, siltstones and shales that lie between the Savik and Deer Bay Formations. The type section is southeast of Buchanan Lake, Axel Heiberg Island. Souther recognized three shale members within the formation and obtained marine fossils from the upper two. These fossils have been dated as Oxfordian or Kimmeridgian by Frebold (Fortier et al., 1963, p. 437). Awingak beds, essentially similar to those of the type section, occur throughout eastern Axel Heiberg Island, on Fosheim Peninsula and in northern Ellesmere Island between Blaa Mountain and Tanquary Fiord. The number of shale-siltstone members in these areas seems to be variable, and as exposures are poor compared with those of the type section it is not known whether the three shale members recognized by Souther are widely developed.

In the Eureka area the total thickness is about 950 feet. The topmost bed is about 20 feet of orange-weathering, medium-grained, fossiliferous, sandstone. J.C. Troelsen (1952, p. 208) was the first to recognize this sandstone and from it he collected fossils identified by J.A. Jeletzky as follows (GSC loc. 22776): Buchia n. sp. aff. volgensis Lahusen, and Buchia cf. terebratuloides Lahusen. Jeletzky states that these fossils can only be dated as uppermost Jurassic or lowermost Cretaceous. The sandstone with Buchia is overlain by the Deer Bay shale, from which Frebold (1960, p. 30) has identified ammonites of Upper Kimmeridgian or Volgian age. It follows that the Buchia-bearing sandstone at the top of the Awingak at Eureka is not younger than Upper Jurassic.

The Awingak Formation of western Axel Heiberg Island is mainly sandstone, most of which is carbonaceous and possibly of non-marine deposition. In the section 14 miles northeast of Cape Levvel the Awingak is about 500 feet thick and is mainly sandstone, with thin interbeds of black silty shale. On the north side of upper West Cape Fiord the Awingak Formation is represented by about 400 feet of mainly non-calcareous, medium-grained sandstone. Fossils collected from the uppermost part in West Cape Fiord (GSC loc. 51658) have been identified by Jeletzky as follows: Buchia cf. fischeriana (d'Orbigny), Buchia cf. piochii Gabb, and Aucellina(?) n. sp. aff. A. schmidti Sokolow and dated as late Portlandian sensu stricto or Upper Tithonian, i.e. late Lower Volgian or Upper Volgian. An identical fauna was obtained immediately east of Bad Weather Cape (GSC loc. 47633). Jeletzky states that the fossils from West Cape Fiord and Bad Weather Cape could be the same age as those that occur at the top of the Awingak near Eureka; a positive correlation is precluded by the preservation of the specimens from Eureka. There is thus some reason to suppose that the top of the Awingak Formation is essentially the same age throughout Ellesmere and Axel Heiberg Islands. There are reasons to suggest, however, that the base of the Awingak is not synchronous throughout this area. As already mentioned, the type section of the Awingak, on eastern Axel Heiberg Island, consists of alternating marine siltstone and non-marine sandstone. In the type section the middle shale and underlying Awingak beds are Oxfordian or Kimmeridgian, and clearly older than the fossiliferous Awingak beds of West Cape Fiord. It is thus possible that the Awingak beds of western Axel Heiberg Island are equivalent to only the uppermost part of the type section. According to this interpretation the type Awingak represents four tongues of non-marine sandstone, separated by three marine units of shale and siltstone; towards the west and northwest, the lower tongues disappear, and are replaced by shale (included in the Savik Formation). The Awingak of West Cape Fiord, in view of the tentative correlation with the topmost Awingak of Eureka, may be regarded as representing only the uppermost sandstone tongue. In order to prove this interpretation it is necessary to find Upper Oxfordian or Kimmeridgian fossils beneath the Awingak sandstone of western Axel Heiberg Island. These fossils have not been found in this position but they do occur on the island between Bunde and Bukken Fiords. In that area the Awingak has apparently disappeared entirely.

The easternmost exposures of the Awingak Formation are north of Mount Bridgman and in the foothills of "Sawtooth Range". The thickness north of Mount Bridgman is about 200 feet. In these sections the Awingak is overlain, directly and disconformably, by the Isachsen Formation.

Deer Bay Formation

The marine grey shales of the Deer Bay Formation (Heywood, 1955; 1957, p. 9; Fortier et al., 1963, p. 85) are uniform in gross lithology throughout western Ellesmere Island and Axel Heiberg Island. Upper Jurassic faunas have been described from the lower part (Frebold, 1960, pp. 23-24); Lower Cretaceous (Berriasian and Valanginian) ammonoids and Buchia species have been identified by Jeletzky from higher beds.

The thickness varies considerably as follows (all figures are in feet): Eureka area, 900; valley northeast of Blaa Mountain, 920; Buchanan Lake, 850 (Fortier et al., 1963, p. 437); Head of Strand Fiord, 2,800 (Fortier et al., 1963, p. 437); 20 miles east of Cape Levvel, 1,900 (Fortier et al., 1963, p. 452); 15 miles northeast of Cape Levvel, 3,000; 13 miles northwest of Sherwood Head, 1,100; east side of Glacier Fiord, 1,015 (see below); east side of Wolf Fiord, about 500; north side of West Cape Fiord, about 800. These figures reveal that there was more than one "depocentre" for the Deer Bay Formation; one was presumably situated northeast of Cape Levvel, another near the head of Strand Fiord (Douglas et al., 1963, fig. 17).

In southern Axel Heiberg Island a sandstone member occurs within the Deer Bay Formation. This is illustrated by a section measured by H.P. Trettin on the east side of Glacier Fiord, 3 miles from the head of the fiord.

Unit		Thickness (feet) Unit	Thickness (feet) Total from Base
Overlying beds: Isachsen Formation.			
	Deer Bay Formation		
3	Shale, dark grey, fissile, with ironstone concretions, weathering dark grey, recessive.	430	1,015
2	Sandstone and sandy siltstone, argillaceous and quartzose, medium grey, carrying plant matter, weathering yellow to buff.	120	585
1	Shale, very silty, dark grey, fissile, weathers dark grey and brown, recessive; and siltstone, shaly, dark grey, fissile, dark grey and brown-weathering, some ironstone concretions.	465	465
Underlying beds: Awingak Formation.			

The sandstone member appears to be present in all sections of the Deer Bay Formation south of a line joining Cape Southwest, the head of Glacier Fiord, and the head of Wolf Fiord. Between Cape Southwest and Surprise Fiord, fossils were obtained both above and below the sandstone member. Those obtained above (GSC loc. 47634) have been identified by J.A. Jeletzky as Buchia cf. sublaevis (Keyserling); those from below the sandstone as Buchia cf. keyserlingi (Trautschold) (GSC loc. 47640). Both are tentatively dated as Lower Valanginian by Jeletzky.

The Deer Bay Formation is known in the valley of Chapman Glacier, west of Tanquary Fiord, but the section has not been measured.

In "Sawtooth Range", on northern Raanes Peninsula, and probably also on Stor Island, the Deer Bay Formation is absent. In these areas the Isachsen Formation rests directly upon the Awingak or older formations, and no Deer Bay strata, if they were ever deposited this far east, have survived the period of erosion that preceded the deposition of the Isachsen Formation. It was formerly suggested (Tozer, 1960, fig. 6) that the Deer Bay Formation passed into a sand facies in "Sawtooth Range". This interpretation has been proved incorrect by the discovery of the sub-Isachsen unconformity.

Equivalents of Deer Bay, Awingak and Savik Formations, Bukken Fiord Area, Northwestern Axel Heiberg Island

Relatively good exposures of the beds between the Heiberg and Isachsen Formations occur on the island between Bunde and Bukken Fiords. This section has not been measured accurately but is about 2,000 feet thick. The lowest beds seen lie about 100 feet stratigraphically above the highest exposures of the Heiberg Formation. They comprise light grey, argillaceous shale and resemble the Lower Savik beds of other parts of Axel Heiberg Island. Immediately above the shale outcrops, from a level about 200 feet above the Heiberg, pelecypods identified by H. Frebold as Inoceramus sp. and Pecten sp. (GSC loc. 47630) occur in rubble of red sandy ironstone. These fossils are dated as Middle Jurassic by Frebold. Higher beds, between about 600 and 700 feet above the Heiberg, comprise black silty shale, with yellow-weathering concretionary material, from which the following fossils were obtained (GSC loc. 47631): Amoeboceras(?) sp. indet., Buchia(?) sp. indet. Frebold dated these fossils as Upper Oxfordian or Lower Kimmeridgian. The lithology of these beds resembles that of the Upper Savik and the silty shales within the Awingak. Similar fossils have been recorded from the Middle Shale of the Awingak Formation at the type section (Fortier et al., 1963, p. 437). The higher beds have not been examined in detail but all known exposures consist of grey shale, with yellow-weathering concretions at some levels. Near the contact with the overlying Isachsen Formation, poorly preserved specimens of Buchia were observed. In this section, which lies near the northwest margin of the Sverdrup Basin, the Awingak Formation seems to be unrepresented as a distinct lithological unit. However the occurrence of Amoeboceras(?) sp. suggests a correlation with the Middle Shale of the typical Awingak. There is thus some justification for the conclusion that the Awingak Formation is entirely replaced by shale in this section. The probable replacement of Awingak sands by contemporary shales on the northwest margin of the Sverdrup Basin lends support to the hypothesis that the source of the Awingak sands lay on the east, and possibly also south, margins of the basin.

CRETACEOUS

Isachsen Formation

The sedimentary rocks of the Isachsen Formation are remarkably uniform throughout the area, and indeed throughout the Sverdrup Basin and adjacent areas (Heywood, 1955; 1957, p. 11; Fortier et al., 1963, p. 87). The most distinctive feature is the presence of quartzose grits and conglomerates. An isopach map incorporating all available data has been published by Douglas et al. (1963, fig. 18).

It is now known that basalt flows occur in the Isachsen Formation of western Axel Heiberg Island and northern Ellesmere Island.

On the island between Bunde and Bukken Fiords there are at least two flows. The main area for basalt in the Isachsen Formation is between Bunde and West Cape Fiords. On the south side of Bals Fiord, on the sea cliffs that terminate 10 miles east of Cape Northwest, six flows of rock with columnar jointing were noted in the course of a helicopter flight. At least one basalt flow occurs between Li and Middle Fiords. Dr. R. Bechsel of Queen's University reports (personal communication) that pillow lavas cap a hill of Isachsen sediments 7 miles north of the entrance to Middle Fiord. Y.O. Fortier (Fortier et al., 1963, p. 514) has recorded basalt conglomerate, above typical Isachsen sedimentary rocks, south of Li Fiord.

In the valley northeast of Blaa Mountain, a basalt flow about 50 feet thick occurs at the contact between the Isachsen and Christopher Formations.

In 1962 it was found that the Isachsen Formation of west-central Ellesmere Island is transgressive. This relationship is displayed on central Fosheim Peninsula and in the country south of Bay and Strathcona Fiords. Throughout these areas the Isachsen Formation is composed entirely of sedimentary rocks. In west-central Ellesmere Island the Isachsen Formation attains a thickness of about 1,000 feet northeast of Mount Bridgman, but it is commonly considerably less.

Both north and south of Bay Fiord it is found that in travelling from west to east the basal Isachsen beds rest on progressively older formations.

South of Bay Fiord this may be documented as follows: south of the Gretha Islands the Isachsen rests on a thin unit of Jurassic beds. Throughout the country northwest of Trold Fiord the Isachsen beds rest directly upon the Heiberg Formation. Northeast of Trold Fiord, Isachsen beds overlie the Schei Point Formation. In these areas there is little angular discordance between the Isachsen and underlying Mesozoic formations. South of the peninsula between Bay and Strathcona Fiords the Isachsen overlies the Eids Formation (Devonian) with angular unconformity and south of Strathcona Fiord upon the Cornwallis, Cape Phillips, Allen Bay and Eids Formations (Ordovician to Devonian), again with angular unconformity.

On Fosheim Peninsula an analogous situation is found. In the foothills of "Sawtooth Range" the Awingak Formation is concordantly beneath the Isachsen. Between the mouth and head of Vesle Fiord the Isachsen successively rests, without marked angular discordance, upon Jurassic beds, the Heiberg Formation, and the Schei Point Formation. Four miles east of the head of Vesle Fiord, Pennsylvanian or Permian red beds underlie the Isachsen Formation. On the next range to the east the Isachsen rests with angular discordance upon Devonian and older rocks.

The unconformity beneath the Isachsen Formation on western Ellesmere Island is closely analogous to the relationship found on Melville Island (Thorsteinsson and Tozer, in press). This unconformity evidently disappears completely in the axial part of the Sverdrup Basin, for on western Axel Heiberg Island (Fortier et al., 1963, pp. 454, 479) and on Ellef Ringnes Island (Heywood, 1957, p. 11) the lower Isachsen beds contain Buchia species of Valanginian age, and the boundary with the underlying Deer Bay Formation, although readily mapped, appears to be conformable, without any indication of hiatus.

Christopher, Hassel, Bastion Ridge, Strand Fiord and Kanguk Formations

Recent field work has added relatively little to our knowledge of these Cretaceous formations (Fortier et al., 1963, pp. 88-92).

In northwestern Axel Heiberg Island, on the south side of Bunde and Bals Fiords, basalt flows are interbedded with marine shales of the Lower Cretaceous Christopher Formation. No detailed work has been done in these areas. Elsewhere the Christopher Formation consists entirely of sedimentary rocks, with thin tuff beds noted in the Strand Fiord area (Fortier et al., 1963, p. 440). On the east side of Glacier Fiord, J.W. Kerr measured a section 4,600 feet thick. This is the thickest known section of the Christopher Formation.

The Strand Fiord Volcanic Formation (Fortier et al., 1963, p. 91) underlies the Kanguk Formation (Upper Cretaceous) in the vicinity of Strand and Expedition Fiords and between Sand Bay and Cape Levvel. In the Strand Fiord area a shale unit locally lies between the Hassel sandstone and the Strand Fiord basalts (Fortier et al., 1963, p. 90). Dr. Peter Fricker has recently found marine fossils in this shale and has named it the Bastion Ridge Formation (Fricker, 1961, p. 155; 1962).

Twenty-five miles west of the head of Gibs Fiord the Hassel Formation is overlain by about 100 feet of basalt which in turn is overlain by conglomerate assigned to the Eureka Sound Formation. This basalt flow is interpreted as an equivalent of the Strand Fiord Volcanic Formation (Tozer and Trettin, 1963).

On the west side of Mokka Fiord, about 100 feet of basalt underlies the Eureka Sound Formation. The basalt exposures are adjacent to the fiord and the underlying rocks are not visible. No volcanic rocks occur in the Christopher or other Mesozoic formations of eastern Axel Heiberg Island and it is therefore possible that this basalt represents the easternmost exposure of the Strand Fiord volcanic formation.

The Hassel-Kanguk stratigraphic interval (in which the Strand Fiord basalts locally occur) is exposed in Glacier Fiord, on the east side of the Depot Point anticline, on Fosheim Peninsula and south of Bay and Strathcona Fiords. In all these areas there are no volcanic rocks between the Hassel and Kanguk beds. Four miles east of the head of Vesle Fiord, approximate thicknesses of these formations are as follows: Christopher, 600 feet; Hassel, 400 feet; Kanguk, 400 feet.

As already noted the Isachsen Formation (Lower Cretaceous) is transgressive on western Ellesmere Island. In the areas where the Isachsen is transgressive it is conformably overlain by thin representatives of the Christopher, Hassel and Kanguk Formations.

TERTIARY

Eureka Sound Formation

The Tertiary rocks of Ellesmere and Axel Heiberg Islands, now known as the Eureka Sound Formation (Troelsen, 1950) were formerly believed to have been deposited after the folding of the Mesozoic strata. In 1955 (Fortier et al., 1963, pp. 92-95, 444) it was found that the Tertiary rocks of western Axel Heiberg Island are folded, and lie concordantly upon the Upper Cretaceous Kanguk shale. In 1956 (Thorsteinsson and Tozer, 1957) a similar relationship was demonstrated on western Fosheim Peninsula and it was also found that towards the east the Eureka Sound beds are transgressive, and rest, essentially concordantly, on folded and faulted Lower Palaeozoic rocks at the head of Bay Fiord.

The Eureka Sound beds of western Ellesmere Island, between Baumann and Canyon Fiords, consist of sandstone, shale and coal. The entire sequence is of non-marine deposition. Conglomerate is not an important constituent. The total thickness may reach 10,000 feet.

Tertiary beds, assigned to the Eureka Sound Formation, are now known to underlie extensive areas of eastern Axel Heiberg Island.

West of May Point, sands and coal beds concordantly overlie the Kanguk Formation, as on western Fosheim Peninsula. Good Kanguk exposures occur at the latitude of May Point but when the Kanguk beds are traced northwards, towards Depot Point, they apparently disappear and the Eureka Sound Formation seems to rest directly upon the Hassel Formation. This, of course, implies an unconformity beneath the Eureka Sound beds; unfortunately the exposures are not quite good enough to establish this beyond doubt.

The remaining Tertiary beds of eastern Axel Heiberg Island, in the belt extending from Whitsunday Bay to the coast north of Stang Bay, rest unconformably upon Mesozoic formations ranging in age from Triassic (Blaa Mountain Formation) to Lower Cretaceous (Christopher Formation). Clearly there is a substantial unconformity beneath the Eureka Sound beds and this indicates that eastern Axel Heiberg Island experienced earth movements between the Lower Cretaceous and the early Tertiary. This is in contrast to the Strand Fiord, Glacier Fiord and western Fosheim Peninsula areas where a concordant sequence extends from the Lower Cretaceous, through the Upper Cretaceous, to the early Tertiary. Although the existence of the regional sub-Eureka Sound unconformity is well established on eastern Axel Heiberg Island it is found that in most areas there is no marked angular discordance between the Eureka Sound and underlying Mesozoic formations. This may be demonstrated in the following areas:

On the east side of Schei Peninsula soft Eureka Sound sands rest concordantly upon Blaa Mountain rocks dipping steeply to the east. At the north end of this area of Eureka Sound exposures a thin remnant of the Heiberg Formation underlies the Tertiary beds. Plant micro-fossils from this area (GSC loc. 5834) have been dated by G.E. Rouse as Paleocene or Eocene. Three miles south of the head of Stang Bay, Eureka Sound conglomerate overlies Blaa Mountain beds. At the locality a gabbro dyke cutting the Blaa Mountain Formation is truncated at the contact with the conglomerate.

On the west side of Flat Sound, soft Eureka Sound sands, with numerous compressed, carbonized, wood fragments, concordantly overlie Awingak strata (Jurassic) dipping east at 55°.

Fifteen miles southeast of the head of Mokka Fiord, soft Eureka Sound sands overlie the Isachsen Formation (Cretaceous). Here again the contact appears concordant at outcrop but within 5 miles to the north a thin remnant of the Christopher Formation is intercalated between the Eureka Sound and Isachsen beds. This area, like Schei Peninsula, illustrates the relatively low amplitude of the unconformity between the Eureka Sound and underlying Mesozoic formations.

The Eureka Sound beds clearly rest directly upon the Christopher Formation at three localities: at the head of Gibs Fiord; 12 miles southeast of the head of Mokka Fiord; and in the syncline southwest of Depot Point. Age determinations based on plant microfossils by G.E. Rouse are as follows: from Gibs Fiord (GSC loc. 5829), Tertiary, probably Eocene or Oligocene; south of Mokka Fiord (GSC loc. 5830), Oligocene or Miocene; southwest of Depot Point (GSC loc. 5837), early Tertiary, Paleocene or Eocene.

In the faulted area 25 miles west of the head of Gibs Fiord, sand, coal, and cobble-conglomerate, with compressed, carbonized wood fragments, concordantly overlie basalt assigned to the Strand Fiord Volcanic Formation. In this area dips are steep and locally the basalt-Eureka Sound contact is vertical. Plant microfossils from this locality (GSC loc. 5833) have been dated as Tertiary, probably Oligocene or Miocene, by Rouse.

The Tertiary beds that occur between Whitsunday Bay and Stang Bay contain considerable cobble-conglomerate, unlike the apparently contemporary beds of the Strand Fiord, Glacier Fiord, Depot Point and May Point areas. The cobbles are clearly of local derivation and consist mainly of weathered gabbro and basalt, and Heiberg-like sandstone. The conglomerate beds north of Whitsunday Bay have been described by Fortier (Fortier et al., 1963, pp. 470-472). In some areas, notably between Mokka Fiord and Whitsunday Bay, and on the east side of Schei Peninsula the lower Eureka Sound beds are mainly sand and the upper beds mainly conglomerate. Elsewhere, as in the sections 25 miles west of Gibs Fiord and south of Stang Bay, the basal Eureka Sound beds are conglomerate. Possibly the conglomerates represent a distinct formation, younger than the more typical, fine-grained Eureka Sound sands. However, in the section on the north side of Mokka Fiord, conglomerate is interbedded with sands and coal beds and the writer favours the interpretation that the conglomerates are simply a local lithofacies within the Eureka Sound Formation and that their distribution is probably related to the locus of contemporary fault scarps. The great concentration of conglomerate in the area east of the Whitsunday Bay Thrust is of interest in this connection (Tozer, 1960, p. 14; Thorsteinsson and Tozer, 1960, p. 17).

Tertiary beds characterized by conglomerates composed of material of local source, occur at several localities in northern Ellesmere Island.

The first area to be considered is on the peninsula between Hare and Otto Fiords, south of Degerbøls Island. One area of outcrop is on the south shore of Otto Fiord, immediately south of the island. Here, there are exposures of soft coal measures, which have not been examined closely. The structure is complicated but it would appear that the coal measures, at their western limit, concordantly overlie steeply-east-dipping beds of the Blaa Mountain Formation. Exposures inland, 10 miles south-southwest of Degerbøls Island comprise about 400 feet of intermittently exposed beds, mainly conglomerate composed of poorly sorted chert and limestone pebbles up to 4 inches in diameter. Beds of sand and flattened, carbonized, wood fragments also occur. These beds rest on the Blaa Mountain Formation. Plant microfossils from this locality (GSC loc. 6446) have been dated by D.C. McGregor as Tertiary.

Conglomerates were found on the south side of Emma Fiord by R. Thorsteinsson in 1957. The conglomerates are in faulted contact with Lower Palaeozoic slates and Permo-Carboniferous limestone; most of the clasts in the conglomerates are derived from these formations. Plant microfossils from this locality (GSC loc. 5022) have been dated as early Tertiary by D.C. McGregor.

Comparable deposits have been noted east of Alert Point, on the north coast of Ellesmere Island (Christie, 1957, p. 22).

In 1961, Dr. G. Hattersley-Smith of the Defence Research Board discovered conglomerate and interbedded silts on a nunatak at the head of M'Clintock Glacier, in the central part of northern Ellesmere Island. Dr. Hattersley-Smith described the conglomerate as composed of cobbles and pebbles of fossiliferous Permo-Carboniferous limestone. Wood fragments and plant microfossils occur in the silt; the latter (GSC loc. 5851) are dated as "probably Tertiary" by D.C. McGregor.

The occurrence of Eureka Sound beds resting on the Triassic south of Otto Fiord indicates a sub-Tertiary unconformity comparable with the unconformity developed on eastern Axel Heiberg Island. No Mesozoic rocks are known in the immediate vicinity of the isolated Tertiary occurrences of Emma Fiord, Alert Point and M'Clintock Glacier and this suggests that the sub-Tertiary unconformity observed south of Otto Fiord may occur throughout the northeastern part of northern Ellesmere Island.

AGE OF THE MESOZOIC IGNEOUS ACTIVITY

From the time of the earliest studies it has been known that gabbroic sills intrude many Mesozoic formations. They are particularly abundant in the following formations: (1) Blind Fiord Formation, between Hare and Borup Fiords; (2) Blaa Mountain Formation of all areas east of Borup Fiord except the section at the mouth of Strand Fiord; (3) lower Heiberg beds of eastern, northern, and northwestern Axel Heiberg Island, and northern Ellesmere Island; (4) Savik Formation between Capes Southwest and Maundy Thursday, and between Middle and Bunde Fiords; (5) Awingak Formation of upper Strand and Expedition Fiords, and probably also upper Good Friday Bay; (6) Deer Bay Formation northeast of Cape Levvel, between Strand and Middle Fiords, and south of Bunde Fiord; (7) relatively thin sills are common in the Isachsen Formation of western Axel Heiberg Island; and (8) Bastion Ridge Formation of Strand and Expedition Fiords. No sills are known to cut the Upper Cretaceous Kanguk Formation. Dykes are common cutting the Christopher (Lower Cretaceous) and older formations. Mesozoic extrusive rocks are known only in the Christopher, Isachsen and Strand Fiord Formations, all of Cretaceous age. The principal area for the Cretaceous volcanic rocks is western Axel Heiberg Island; they appear to thicken to the north and west and their source may have lain northwest of Axel Heiberg Island. No igneous intrusive rocks are known to cut the Tertiary Eureka Sound Formation. South of Stang Bay, as already noted, the basal Eureka Sound beds truncate a dyke cutting Triassic rocks. No extrusive rocks of Tertiary age are known. On Axel Heiberg and Ellesmere Islands the Mesozoic igneous activity thus started in the Lower Cretaceous and there is no evidence of activity since the Upper Cretaceous. Some sills could be older than Cretaceous, but for this there is no evidence.

It appears that all the Mesozoic volcanic rocks of Ellesmere and Axel Heiberg Islands are older than the Tertiary extrusives of the "Brito-Arctic" or "Thulean Province" that extends across the north Atlantic from Scotland to west Greenland (Richey, 1948, p. 38; Donovan, 1957, p. 167; Wenk, 1961, p. 283). The basalts of Franz Joseph Land overlie plant-bearing Lower Cretaceous beds (see Frebold, 1951, p. 88) and could be the same age as those in the Isachsen Formation, but some workers have suggested that they belong to the "Thulean Province". In Spitsbergen the volcanic rocks are regarded as Quaternary (Harland, 1961, p. 114), but dolerites that cut the Triassic and Jurassic formations are tentatively dated as Upper Cretaceous (Harland, 1961, pp. 106, 114). These dolerites could be the same age as the intrusions in the Mesozoic rocks of Ellesmere and Axel Heiberg Islands.

AGE OF FOLDING AND FAULTING OF MESOZOIC AND TERTIARY ROCKS

On western and southern Axel Heiberg Island, and on western Fosheim Peninsula, Ellesmere Island, there is no evidence of tectonic disturbance or uplift between Triassic and early Tertiary times. In these areas there is a perfectly concordant sequence extending from the Triassic, through the Jurassic and Cretaceous, to the early Tertiary. The folding in these areas appears to have been post-Paleocene or post-Eocene (Fortier et al., 1963, p. 25; Thorsteinsson and Tozer, 1957, 1960).

In west-central Ellesmere Island an unconformity occurs beneath the Lower Cretaceous Isachsen Formation. However, the discordance between the Isachsen and underlying Mesozoic Formations is not pronounced and it would appear that this area experienced uplift and erosion, but no Mesozoic folding, prior to deposition of the Isachsen Formation.

At the head of Bay Fiord the Eureka Sound beds have overstepped the whole Mesozoic sequence and rest on Lower Palaeozoic rocks but in this area there is no evidence for Mesozoic folding prior to deposition of the Eureka Sound beds (Thorsteinsson and Tozer, 1957).

On eastern Axel Heiberg Island, and in northern Ellesmere Island the Eureka Sound beds rest on various Mesozoic formations and probably on even older rocks in northern Ellesmere Island. Here again there is no evidence for a marked angular unconformity between Mesozoic and Tertiary beds although it is clear that considerable uplift and erosion took place between deposition of the Lower Cretaceous and Tertiary beds. The sub-Eureka Sound unconformity adjacent to the gypsum domes and diapirs east of Gibs Fiord, on Schei Peninsula and east of Flat Sound, suggests that these structures were active before deposition of the Eureka Sound beds. However, the Eureka Sound beds are inclined adjacent to these gypsum intrusions and it thus appears that movement continued after deposition of the Tertiary strata. The gypsum intrusions of western Axel Heiberg Island appear to be different, for they are flanked by a concordant sequence ranging in age from Triassic to early Tertiary (Fortier et al., 1963, p. 447).

In conclusion it would appear that western Axel Heiberg Island and western Fosheim Peninsula experienced no appreciable Mesozoic or Tertiary movements before deposition of the Tertiary Eureka Sound Formation. The Mesozoic and Tertiary rocks of central Ellesmere Island record two periods of uplift before the main Tertiary folding. The earlier period occurred before the deposition of the Lower Cretaceous Isachsen Formation; the later one between deposition of the Kanguk (Upper Cretaceous) and Eureka Sound beds. The area of later uplift lies to the east of the belt demonstrably affected by the earlier period. Eastern Axel Heiberg Island and northern Ellesmere Island experienced uplift before deposition of the Eureka Sound beds. The cobble-conglomerates of these areas suggest the presence of exposed fault scarps and much of the Eureka Sound Formation of these areas is probably a syntectonic deposit.

In all the areas mentioned above, the main period of folding and faulting followed the deposition of the Eureka Sound Formation (Thorsteinsson and Tozer, 1961, pp. 16, 17; Fortier et al., 1963, p. 25).

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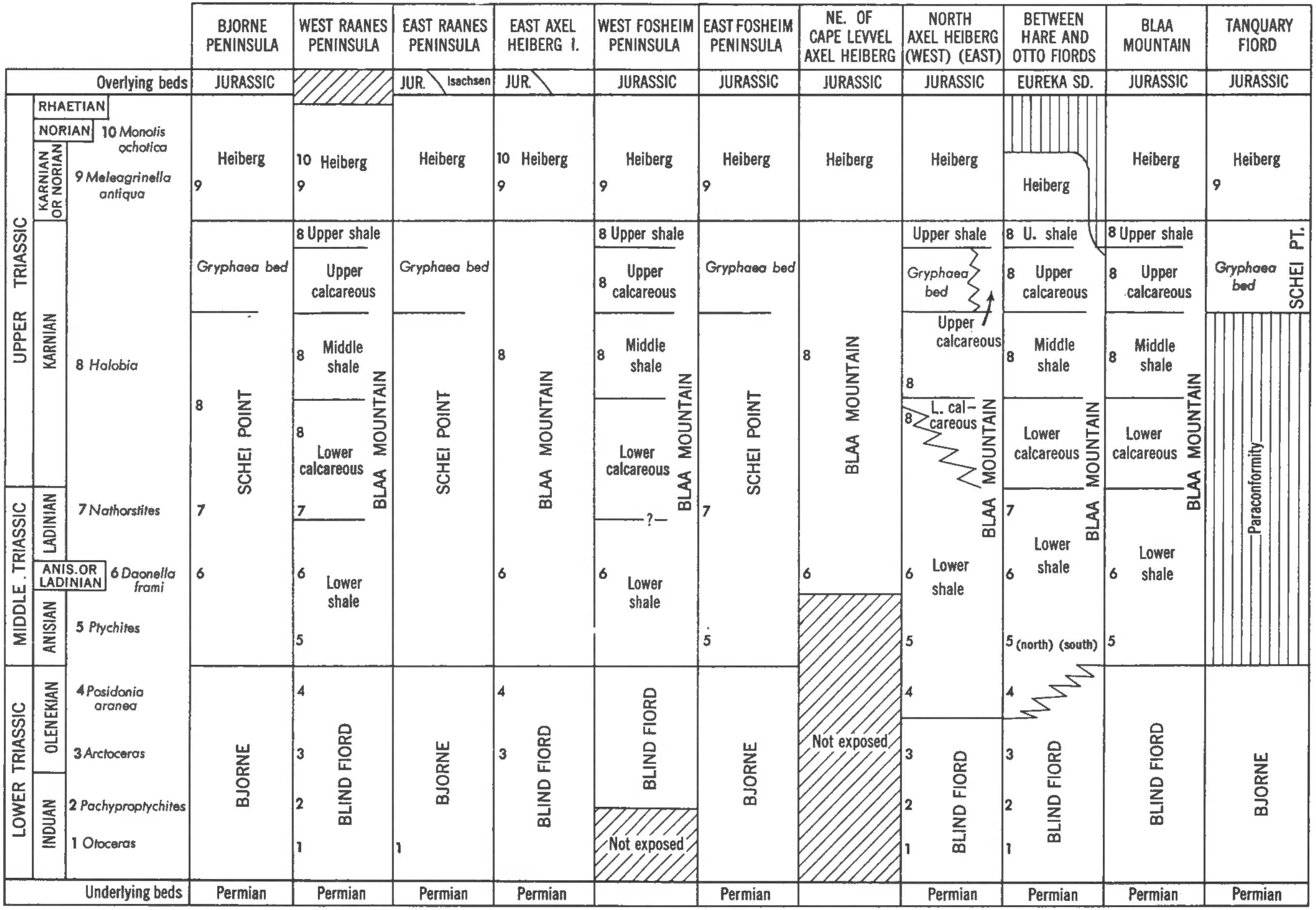

Table 1. Triassic formation names and correlations

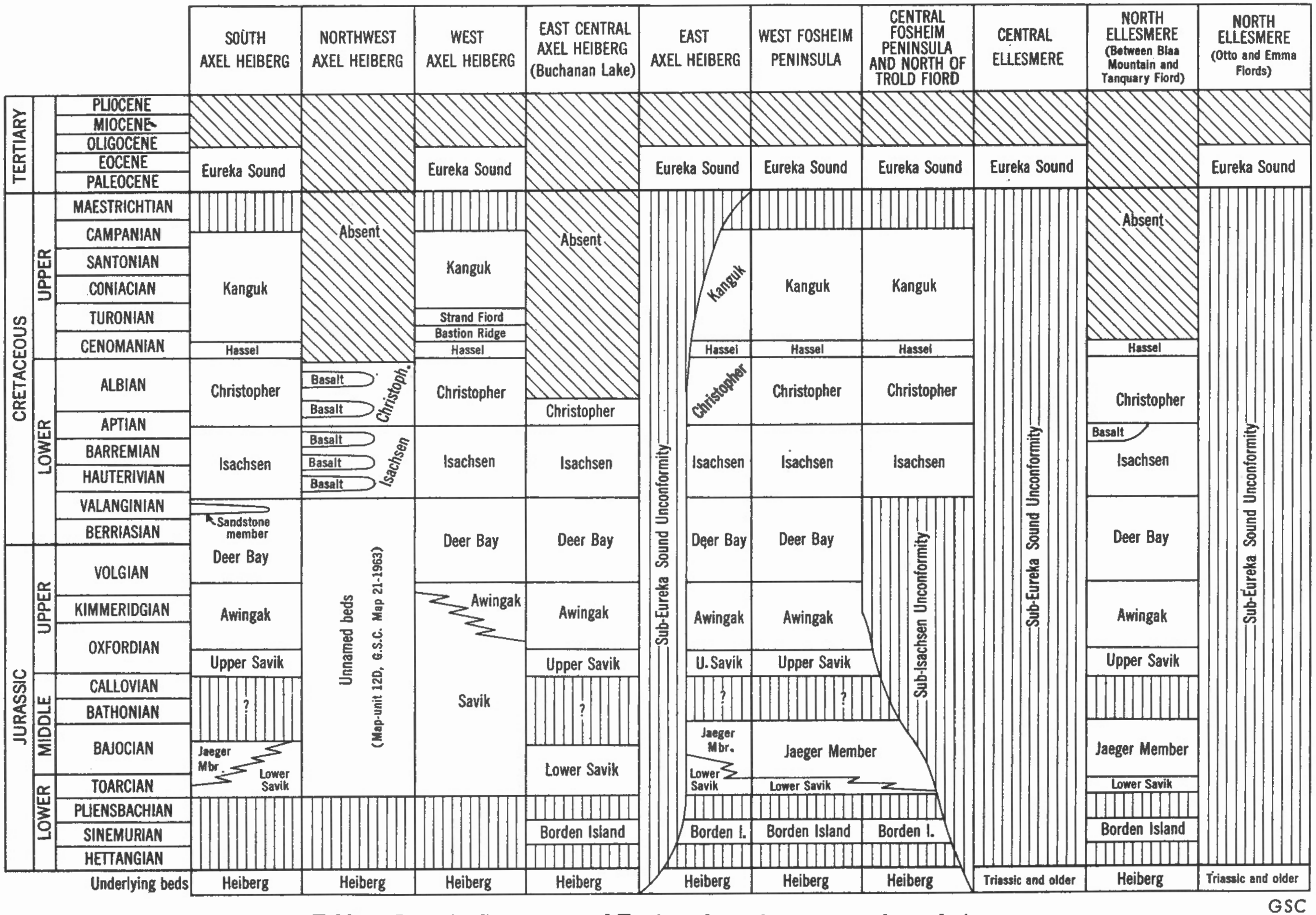

Table 2. Jurassic, Cretaceous and Tertiary, formation names and correlations

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