MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 119 · Nr. 3.

DE ØSTGRØNLANDSKE EXPEDITIONER TIL
KONG CHRISTIAN DEN X's LAND UDFØRT
I AARENE 1926—27 OG 1929—32
Under Ledelse af Lauge Koch

ON THE LOWER ORDOVICIAN FAUNAS OF EAST GREENLAND

BY

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WITH 18 FIGURES IN THE TEXT AND 8 PLATES

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1937

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PREFACE

The palaeontological material described and discussed in the present paper was collected by members of five geological expeditions to East Greenland viz. Dr. LAUGE KOCH (The Danish Expedition to East Greenland 1926—1927), Dr. I. M. WORDIE (The Cambridge Expedition to East Greenland 1926), Dr. W. F. WHITTARD (The Cambridge Expedition to East Greenland 1929), the geologists SIGURD HANSEN, Dr. A. NOE-NYGAARD, Docent A. ROSENKRANTZ and the writer (The Danish Expedition to East Greenland 1929), and Dr. A. NOE-NYGAARD and Dr. CURT TEICHERT (The Danish Triennial Expedition to East Greenland 1931—1934).

The writer desires to express his appreciation to Dr. LAUGE KOCH for the opportunity of becoming a member of the expedition in 1929, and tenders his sincere thanks to the geologists SIGURD HANSEN, Dr. A. NOE-NYGAARD, and Docent A. ROSENKRANTZ for excellent collaboration in the field; he is also greatly indebted to Dr. LAUGE KOCH, Dr. CURT TEICHERT, Dr. W. F. WHITTARD, and Dr. I. M. WORDIE for the readiness with which the valuable material was placed at his disposal, and he makes grateful acknowledgement of the financial support from the Carlsberg Foundation and the Rask-Ørsted Foundation, which made the publication of the present paper possible.

The material (except the collections of the Cambridge Expeditions) is preserved in the Geological Museum of the University of Copenhagen. All figures on the plates accompanying this paper are photographs taken with great care and ability by Mr. C. HALKIER. The prints have been slightly retouched by the writer when necessary in order to bring out characters which failed to appear in the photographs.

INTRODUCTION

NATHORST was the first geologist to study and classify the rocks of the Frantz Joseph Fjord and King Oscar Fjord districts. The geological result of his investigations was a very correct sketch of the geological structure of the region[1]). The huge series of folded sediments along the western boundary of the Old Red Sandstone was referred to the Silurian, but NATHORST was fully aware that still older Palaeozoic formations might be represented in this group of sediments.

Twenty-five years later KOCH visited the same region and succeeded in finding fossiliferous Lower Cambrian and some other new fossiliferous horizons; on this basis he divided NATHORST's "Silurian" into five divisions, as shown below[2]).

KOCH 1929	POULSEN 1930
Cape Weber formation	Narwhal Sound formation
	Cape Weber —
Eskimo Hut —	Cass Fjord —
	Dolomite Point —
Ella Island —	Hyolithus Creek —
	Ella Island —
Bastion —	Bastion —
	Spiral Creek —
	Tillite Canyon —
Eleonore Bay —	Cape Oswald —
	Eleonore Bay —

[1]) NATHORST, A. G., "Bidrag til nordöstra Grönlands geologi", Geologiska Föreningens i Stockholm Förhandlingar, vol. 23, Stockholm 1901.

[2]) KOCH, LAUGE, "Stratigraphy of Greenland", Meddelelser om Grönland, vol. 73, II, Copenhagen 1920.

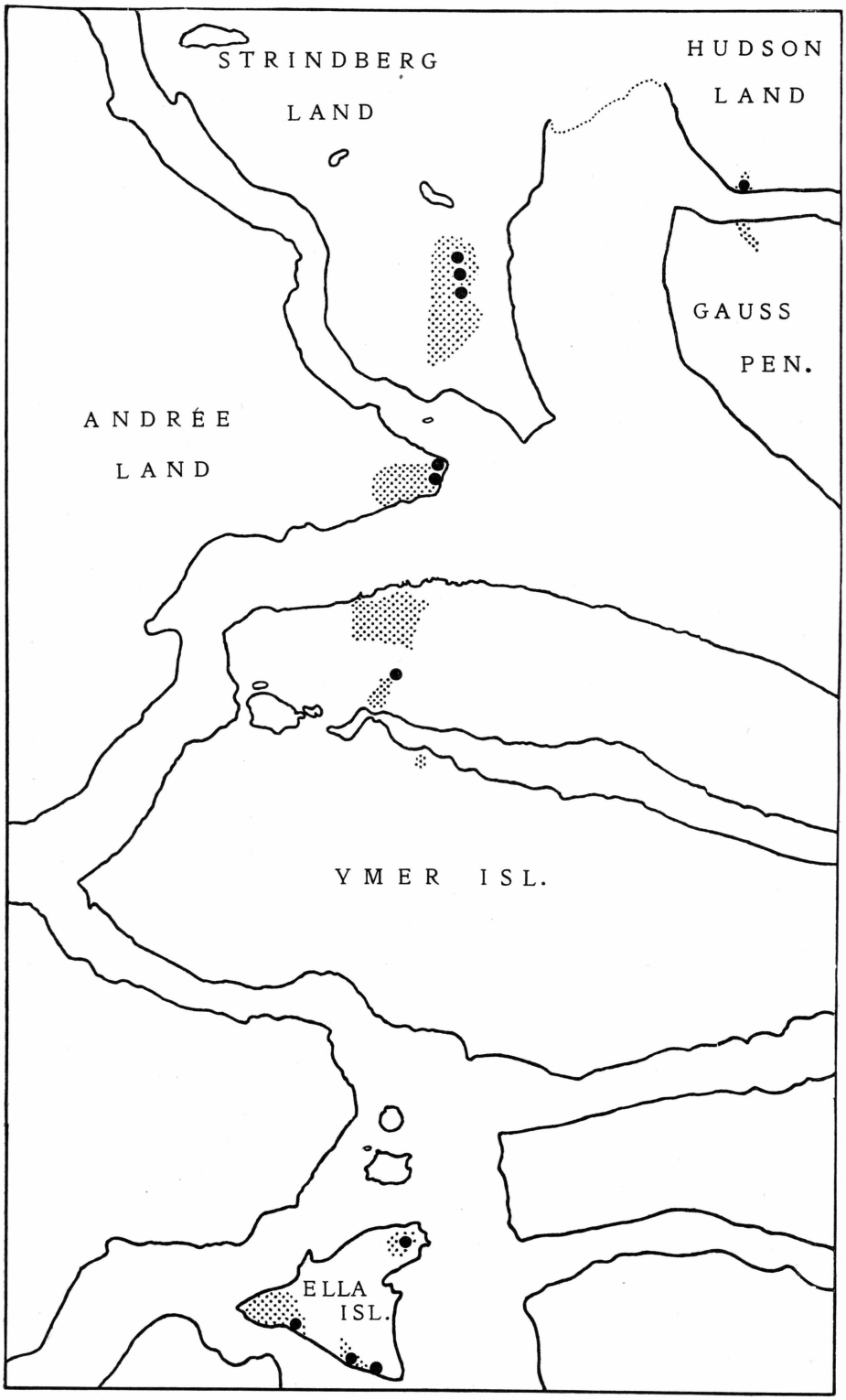

Fig. 1. Map (scale c. 1:600000), showing the location of the Ordovician areas in East Greenland (stippled) and the localities which furnished Ordovician fossils (•).

In 1929 the present writer studied the strata in question and succeeded in discovering several new, independent, stratigraphic units; thus it was necessary to make a more detailed division, as shown above[1]).

The Cass Fjord, Cape Weber, and Narwhal Sound formations constitute the East Greenland Ordovician, and the material described in the present paper originates from these formations.

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[1]) POULSEN, CHR., "Contributions to the Stratigraphy of the Cambro-Ordovician of East Greenland", Meddelelser om Grønland, vol. 74, p. 299. Copenhagen 1930.

THE LOCALITIES

The East Greenland Ordovician constitutes a narrow zone, extending from the interior of Strindberg Land southwards to the south coast of Ella Island. East of this zone, on both sides of Musk Ox Fjord, an isolated, narrow strip of Ordovician sediments occurs; it forms a part of the small area frequently referred to in the literature as the "Musk Ox Fjord inlier" (KOCH, BACKLUND, WORDIE, PARKINSON & WHITTARD, TEICHERT etc.).

Strindberg Land.

We owe our knowledge of the Ordovician of Strindberg Land exclusively to TEICHERT[1]), who gives the following description of the country: "Der ganze Südteil des Strindberglandes, also das Dreieck zwischen Buntem Tal, Geologfjord und Nordfjord, muss aber als eine Einheit behandelt werden. Dieser Teil kann als ein hügeliges Plateau von durchschnittlich 1000 m Höhe bezeichnet werden. Die topographischen Verhältnisse des Plateaus stehen deutlich mit dem geologischen Bau in Beziehung. Das ganze Plateau ist stark mit Schutt eingedeckt und von den Hügeln ergiessen sich mächtige Fliesserdeströme in die Senken. Die Aufschlussverhältnisse sind nicht gut, aber ausreichend zur Klärung des Baus. Während sonst überall das Plateau mit einem ca. 1000 m hohen Steilrand dicht an die Küste bezw. das grosse Tal tritt, senkt es sich nur nach Südwesten zum Kap Ovibos hinunter mit sanfteren Hängen. Dieser Teil der Halbinsel besteht aus devonischen Sandsteinen. Diese Sandsteinzone verschmälert sich nach Norden zu allmählich, bis sie kurz vor Erreichung des Ausgangs des Bunten Tales nur noch höchstens einen Kilometer breit ist. Die Sandsteine streichen nord-südlich, also parallel dem westlichen Devonrande, streichen mithin spitz gegen das Ufer des Nordfjords aus. Der Westrand des Devons wird durch eine

[1]) TEICHERT, C., "Untersuchungen zum Bau des kaledonischen Gebirges in Ostgrönland", Meddelelser om Grønland, vol. 95, no. 1, pp. 57—59. Copenhagen 1933.

Reihe von Kuppen markiert, die sich 150—200 m über das Plateau erheben, aber vom Fjord aus nicht sichtbar sind. Diese Kuppen gehören geologisch und topographisch in einen Zug zusammen mit dem *Gunvorberg*, der sich unmittelbar über der dänischen Station "Nordfjord" an der Südseite des Bunten Tales zu über 1200 m Höhe erhebt (Abb. 24). Der Gunvorberg, der nicht wesentlich höher ist als die übrigen Kuppen längs des westlichen Devonrandes, tritt nur deshalb auch von unten her so bedeutsam in Erscheinung, weil an seiner Ostflanke die Devonbedeckung fast vollständig beseitigt ist und nur noch in geringer Meereshöhe unter dem Gehängeschutt hier und da nachgewiesen werden kann.

"Dieser ganze Zug von Kuppen längs des Devonrandes einschliesslich des Gunvorberges besteht aus ordovizischen Gesteinen. Dieses Ordovizium liess sich durch eine fossilführende Zone mit *Helicotoma*, noch unbestimmten Trilobiten und einigen Cephalopoden belegen. Sein Liegendes ist indessen nirgends aufgeschlossen.

"Das Hangende dieses Fossilhorizonts bildet ein mehrere 100 m mächtiger rötlich anwitternder fossilleerer Kalk, aus dem u. a. auch der Gipfel des Gunvorberges selbst besteht.

"Nach Nordosten zu wird diese ordovizische Zone, noch vor Erreichung des Bunten Tales, durch eine saigere NW—SO streichende Verwerfung abgeschnitten, die am Gipfel des Gunvorberges in einer sehr imposanten nach Nordosten gerichteten, ca. 200 m hohen Steilwand in Erscheinung tritt (Abb. 24).

"Aber auch nach Westen wird die ordovizische Zone durch eine Störung begrenzt, die allerdings auf der weiten Schuttfläche des Plateaus nur sehr schwer als solche zu erkennen ist. Ihr Vorhandensein wurde zunächst bei den Arbeiten auf dem Plateau auf Grund der Lagerungsbedingungen erschlossen und erst später an der Küste des Geologfjords nachgewiesen (Abb. 25). Das Ordovizium im südlichsten Strindbergland ist also nur als eine schmale Zone erhalten, die zwischen zwei grossen Verwerfungen eingeklemmt ist. In südlicher Richtung sinkt das Ordovizium ab und verschwindet noch vor Erreichung des Geologfjords unter einem Konglomerat, das sich diskordant und in Taschen auf das Ordovizium legt und sehr rasch an Mächtigkeit zunimmt, sodass es dort, wo diese tektonische Zone gegen den Geologfjord ausstreicht, also in der kleinen Bucht nördlich der Björneinsel, bereits eine Mächtigkeit von 4—500 m erreicht hat."

TEICHERT collected fossils in three localities, viz. the western slope of the summit of Mt. Gunvor, the upper end of Devon Canyon, and mountain summit about 1 km south of Devon Canyon (fig. 1, p. 7, and fig. 2, p. 11).

The Ordovician limestone of *Mt. Gunvor* is very rich in fossils. The following species were obtained:

Archaeorthis groenlandica n. sp.
Helicotoma sp. ind.
Roubidouxia n. sp.
Genus et sp. ind. (gastropod)
Cephalopoda ind.
Petigurus groenlandicus n. sp.
Bathyurina megalops n. g. et n. sp.
Bathyurellus teicherti n. sp.
Niobe groenlandica n. sp.

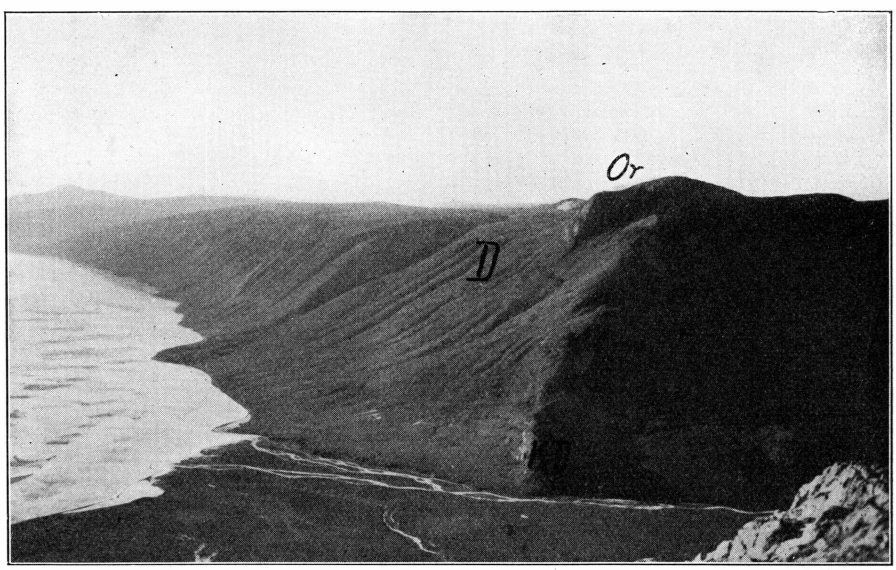

Fig. 2. Mt. Gunvor seen from the north. Or = Ordovician. D = Devonian. The other Ordovician localities are seen in the distance, Devon Canyon to the left, and mountain about 1 km south of Devon Canyon between D and Or. (After TEICHERT).

At the upper end of *Devon Canyon* (i. e. about 1 km south of Mt. Gunvor) the following species were found:

Archaeorthis groenlandica n. sp.
Hystricurus crassilimbatus n. sp.
Petigurus groenlandicus n. sp.
Niobe brevicauda n. sp.

The limestone of the mountain summit about 1 km *south of Devon Canyon* has furnished:

Archaeorthis groenlandica n. sp.
Helicotoma sp. ind.
Hystricurus crassilimbatus n. sp.

Petigurus groenlandicus n. sp.
Bathyurellus teicherti n. sp.

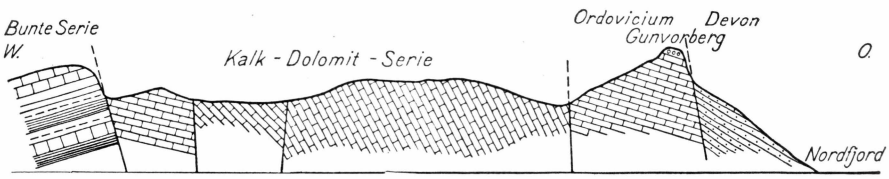

Fig. 3. Section, showing the geological structure of the Mt. Gunvor region. On the summit of Mt. Gunvor remnants of the so-called Bjørne Island conglomerate (Devonian) are found resting upon the Cape Weber formation. (After TEICHERT.)

In all three localities in Strindberg Land the strata agree lithologically as well as palaeontologically with those of the Cape Weber formation at Cape Weber (the type locality).

Andrée Land.

In Andrée Land the Ordovician is known only in the *Cape Weber* region. Cape Weber itself consists of the rocks of the Cape Weber formation, massive-bedded, hard, compact, dark grey limestone which weathers reddish and is penetrated by numerous veins of white calcite.

Between Cape Weber and Dolomite Point a small valley extends southwards a few hundred metres. In this valley the strata of the Cass Fjord formation are exposed in several places (loc. 2—5 on the geological sketch map p. 13).

The aforesaid Ordovician area is bordered on the west by Dolomite Point, which is formed by conglomerate beds of the Dolomite Point formation, and on the south and southwest by high walls of Quaternary moraine and scree, from which a mountain rises steeply to about 1200 m above the sea level.

Cape Weber forms a rather low area, the maximum height of which is about 125 m. The dip of the strata is generally about 45° to the northeast. A similar dip is found in the high mountain behind the low Cape Weber area, so that it seems probable that the strata of Cape Weber are directly continued in the mountain, the summit of which consists of the same reddish weathering limestone, overlying the greenish shales of the Cass Fjord formation.

Locality 1 is situated in the rocky wall NNW. of two old Eskimo huts (fig. 4, p. 13). The section is almost parallel to the dip of the strata. Fossils occur in abundance. The following species were collected by Dr. NOE-NYGAARD and the writer:

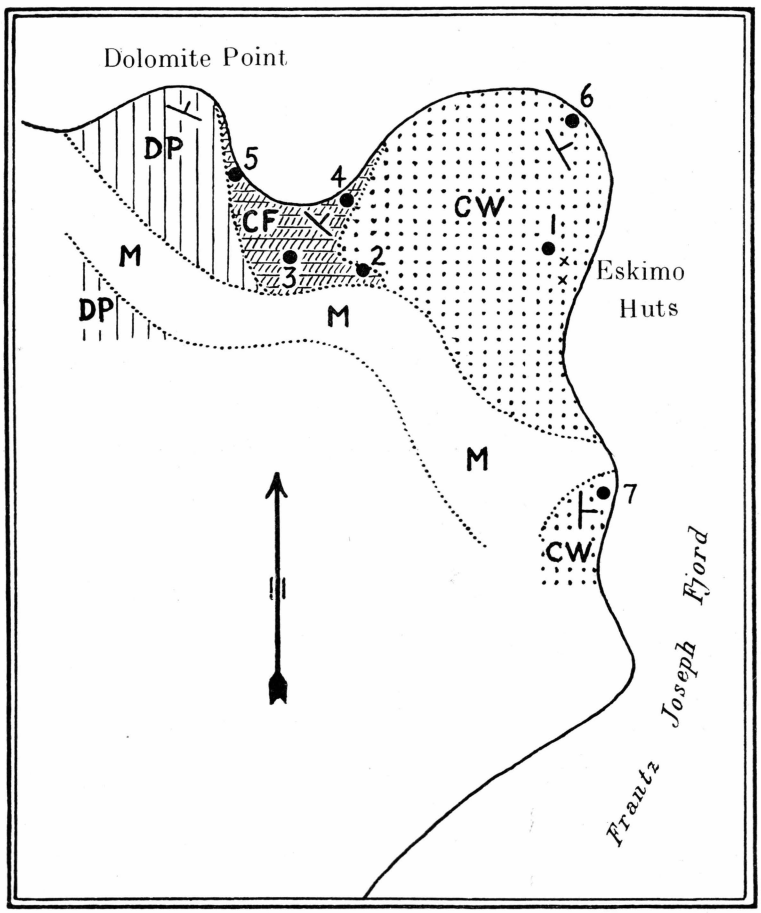

Fig. 4. Geological sketch map of the Cape Weber region, showing the location of fossiliferous outcrops (1—7). DP = Dolomite Point formation. CF = Cass Fjord formation. CW = Cape Weber formation. M = Quaternary moraine.

Archaeorthis groenlandica n. sp.
Helicotoma similis WHITFIELD ?
— sp. ind.
Maclurites sp.
Roubidouxia n. sp.
Petigurus groenlandicus n. sp.
Bathyurellus teicherti n. sp.
Niobe brevicauda n. sp.
Ceratopeltis latilimbata n. g. et n. sp.

Locality 2 is situated in a narrow pass at the eastern margin of the valley between Cape Weber and Dolomite Point (fig. 4, p. 13, and fig. 5, p. 14). Here a small section in a part of the Cass Fjord formation

shows soft, greenish shales with beds of intraformational limestone conglomerates, the thickness of which does not exceed about 1 m, and thin bands of limestone. Fossils are very rare in this locality and appear to be confined to the shales, from which the writer collected *Lingulepis tenuilineata* n. sp. and poor fragments of trilobites (probably *Hystricurus* and *Symphysurina*).

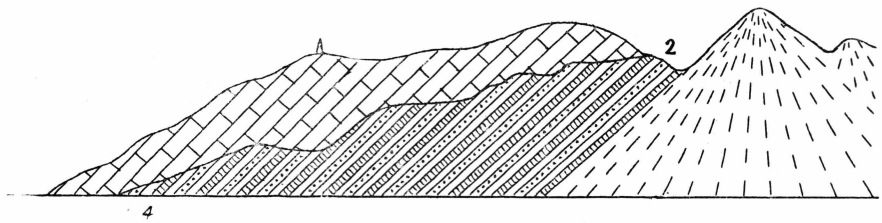

Fig. 5. Cape Weber seen from Dolomite Point. The section shows the location of the localities 2 and 4, and the disconformable contact between the Cass Fjord formation and the Cape Weber formation.

Locality 3 is a very small outcrop, showing thin-bedded grey limestone belonging to the Cass Fjord formation, and situated near the head of the valley between Cape Weber and Dolomite Point (fig. 4, p. 13). The limestone is highly fossiliferous, and the fossils are, as a rule, well preserved. Dr. NOE-NYGAARD and the writer collected the following species:

Hystricurus armatus n. sp.
— *nudus* n. sp.
— *sulcatus* n. sp.
Symphysurina elegans n. sp.
— *robusta* n. sp.

Locality 4 is situated on the beach of the small bay between Cape Weber and Dolomite Point at the eastern margin of the valley (fig. 4, p. 13, and fig. 5, p. 14). In this locality soft, greenish shales of the Cass Fjord formation are seen in a small exposure. Here Dr. NOE-NYGAARD and the writer found:

Genus et sp. ind. (cystid)
Lingulepis tenuilineata n. sp.
Hystricurus armatus n. sp.
Symphysurina cf. *woosteri* ULRICH.

Locality 5 is situated near the mouth and at the western margin of the valley between Cape Weber and Dolomite Point (fig. 4, p. 13). Here a fossiliferous limestone bed belonging to the Cass Fjord formation is exposed; it is similar to that of loc. 3, but considerably weathered. Only two species were obtained by Dr. NOE-NYGAARD and the writer, viz.:

Hystricurus armatus n. sp.
Symphysurina sp.

Locality 6 is situated where the coast of Cape Weber bends towards the west (fig. 4, p. 13). This locality was visited in 1927 by Dr. LAUGE KOCH, who examined the steep coast cliffs and found fossiliferous limestone belonging to the Cape Weber formation at a height of 10—20 metres above the sea level. The fossils obtained by Dr. KOCH have been determined as follows:

Archaeorthis groenlandica n. sp.
Helicotoma sp. ind.
Hystricurus crassilimbatus n. sp.
Bolbocephalus groenlandicus n. sp.
Petigurus groenlandicus n. sp.
Bathyurellus teicherti n. sp.
— sp.

Locality 7 is situated just south of the place where the above-mentioned Quaternary moraine and the eastern coast line meet. The coast cliff consists of the limestone of the Cape Weber formation, having the usual appearance, but the rock is very hard so that it is practically impossible to obtain determinable fossils in this locality. The limestone has furnished:

Polytoechia sp. ind.
Helicotoma? sp. ind.
Genus et sp. ind. (cephalopod).

Ymer Island.

The Ordovician of Ymer Island is imperfectly known; but, judging from the fact that the Ordovician sediments of Strindberg Land and Andrée Land agree completely with those of Ella Island, one may expect to find the same development of the series of strata in Ymer Island.

At the north coast of the island, opposite Cape Weber, TEICHERT[1]) noticed the occurrence of a thick limestone series occupying a considerable area (fig. 1, p. 7). He had not the opportunity of searching for fossils, but his observations are in favour of the supposition that the limestone should be referred to the Ordovician. The strata are described as follows (op. cit. p. 75): "Die ganze Kalkfolge ähnelt in ihrem petrographischen Habitus sehr den Kalken, welche den Bastionfelsen auf der Ellainsel aufbauen und unterscheidet sich durch ihre grosse Einheitlichkeit von

[1]) TEICHERT, C., "Untersuchungen zum Bau des kaledonischen Gebirges in Ostgrönland", Meddelelser om Grønland, vol. 95, no. 1, pp. 75—76, fig. 32 and pl. 1. Copenhagen 1933.

den gestreiften Paketen der Kalk-Dolomit-Serie der Eleonore Bay-Formation, für die immer und überall ein Wechsel von hellem Dolomit und dunklem Kalk kennzeichnend ist. Zukünftige Untersuchungen werden zweifellos zur Aufdeckung weiterer ozarkischer bis ordovizischer Fossilfundpunkte an dieser Stelle der Ymerinsel führen. Wenn auch die Felswände der Insel selbst nicht zugänglich sind, so dürfte doch die Suche nach Fossilien auf den Schutthalden erfolgreich sein."

A few km south of the aforesaid Ordovician area, at *Midnight Pass* (fig. 1, p. 7), CLEAVES and FOX[1]) in 1933 found a fossiliferous limestone, which with reservation they referred to the Middle Ordovician. The "upper blue limestone" of these authors contains:

Lophospira sp. ind.
Ectomaria sp. ind.
Holopea? sp. ind.

The geological conditions of this region have been thoroughly described by CLEAVES and FOX in the cited paper, to which the present writer refers. The question of the geological age of the "upper blue limestone" is discussed in a later chapter (pp. 71—72).

At the *head of Dusén Fjord*, i. e. in or close to the Ordovician limestones examined by CLEAVES and FOX, Dr. W. F. WHITTARD in 1929 found a limestone which furnished a cephalopod; unfortunately this fossil was so poorly preserved that it could not be identified. It deserves notice, however, that the limestone is of exactly the same type as that of the Cape Weber formation.

In 1934 BÜTLER[2]) observed Ordovician sediments on the south side of the interior of Dusén Fjord. He gives the following brief description of the geological conditions: "To the south of Ymer Island the Devonian marginal area rests on lower members of the limestone-dolomite series of the Eleonore Bay Formation. To the north it abuts on the Ordovician limestones of the Cape Weber Formation. The tillite and the Palaeozoic limestones are exposed at a fault on the south side of Dusén Fjord (fig. 4)". BÜTLER's fig. 4 shows the Devonian basal conglomerate resting upon the Cape Weber formation.

Ella Island.

Considerable portions of Ella Island are covered by Ordovician sediments. The most complete series of strata is found on the south

[1]) CLEAVES, A. B. and FOX, E. F., "Geology of the West End of Ymer Island, East Greenland", Bull. Geol. Soc. America, vol. 46, 1935, p. 473, pp. 476—477, and pp. 485—486; pl. 42—43.

[2]) BÜTLER, H., "Some New Investigations of the Devonian Stratigraphy and Tectonics of East Greenland", Meddelelser om Grønland, vol. 103, no. 2, p. 13. Copenhagen 1935.

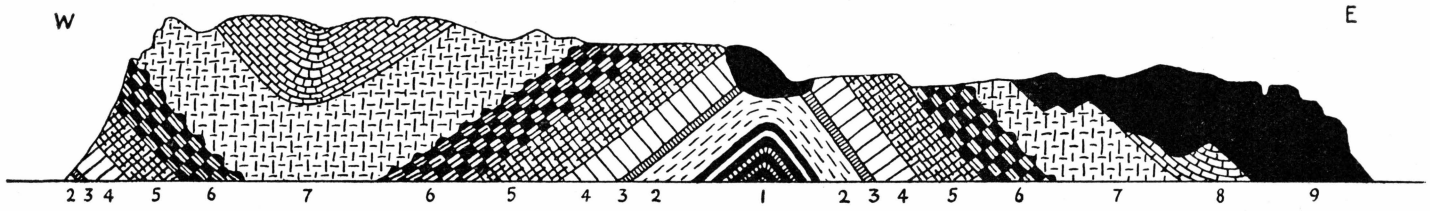

Fig. 6. Ella Island seen from the south.

1	Tillite Canyon formation	Lower Cambrian	
1	Spiral Creek —	Lower Cambrian	
2	Bastion —	Lower Cambrian	
3	Ella Island —	Lower Cambrian	
4	Hyolithus Creek —	?	
5	Dolomite Point —	?	
6	Cass Fjord —	Lower Canadian	Lower Ordovician
7	Cape Weber —	Upper —	Lower Ordovician
8	Narwhal Sound —	Chazyan	Lower Ordovician
9	Old Red Sandstone —	Devonian	

coast of the island, where folded formations ranging from Pre-Cambrian to Ordovician are exposed in the steep coast cliffs, the average height of which is about 1000 m. In the western part of this section (Mt. Bastion) the folded strata form a syncline (fig. 6, p. 17). Unfortunately the writer had not the opportunity of studying the Ordovician strata of this syncline in detail, but he found sufficient evidence of the occurrence of the Cass Fjord formation, the Cape Weber formation, and the Narwhal Sound formation. It deserves notice that the Narwhal Sound formation attains to a much greater thickness in the central part of the syncline than in the eastern part of the section, where a considerable portion has been removed by intense Pre-Devonian erosion (fig. 6, p. 17, and fig. 8, p. 20). Attention should be drawn to this fact, because the Narwhal Sound formation is but imperfectly known; in the centre of the syncline future investigators may happen to find slightly younger fossiliferous horizons than that found by the writer in the eastern part of the coast section.

Accessible outcrops exist farther eastward, in the flanks of the anticline (fig. 6, p. 17).

In the *western part of the anticline* the writer had the opportunity of spending half an hour searching for fossils in the strata of the Cass Fjord formation, which are similar to those of the Cape Weber region, i. e. about 300 m soft, greyish-green shales alternating with intraformational conglomerates and a few limestone beds. In the matrix of one of the conglomerates Mr. SIGURD HANSEN and the writer found the following species:

Ophiograptus inexpectans n. g. et n. sp.
Bryograptus? sp.
Clonograptus sp. (cf. *C. tenellus* (LNRS.) var. *callavei* LAPW.)
Genus et sp. ind. (hydrophorid)
Lingulepis tenuilineata n. sp.
Eoorthis sp.
Sinuopea whittardi n. sp.
Genus et sp. ind. (cf. *Rhachopea*)
Hystricurus armatus n. sp.
Symphysurina cf. *woosteri* ULRICH.

In the *eastern part of the anticline* the writer examined the limestone of the Cape Weber formation; it is about 600 m thick and similar to that of Cape Weber. A fossiliferous bed was found a little below the middle of the formation. This horizon furnished:

Bolbocephalus groenlandicus n. sp.
Bathyurellus teicherti n. sp.

Bathyurellus ? *affinis* n. sp.
Genera et sp. ind. (fragments of trilobites).

Farther eastward the strata of the Narwhal Sound formation are exposed (fig. 6, p. 17, and fig. 8, p. 20); the locality is very difficult of access. The lower part of the formation, which lies disconformably(?) upon the Cape Weber formation, consists of about 150 m thin-bedded, yellowish-grey, finely crystalline *dolomite* without fossils. These beds are

Fig. 7. Piece of intraformational conglomerate of the Cass Fjord formation from the south coast of Ella Island, viewed from above, showing numerous flat, irregular limestone pebbles ($\times$ 1/3).

followed by about 200 m thin-bedded, light grey, very hard *limestone* with irregular, rather big oolites; the lower beds of this limestone have yielded to the writer:

Bathyurellus? sp.
Heterochilina obliqua n. g. et n. sp.

The upper two-thirds of the section in this locality (about 600—700 m) consist of Devonian conglomerate. There is a strongly marked angular unconformity between the Narwhal Sound formation and the Devonian, and moreover the contact between them shows evidence of an intense Pre-Devonian erosion.

At *Cape Elisabeth*, the northernmost portion of the island, Ordovician limestone was discovered by Dr. Noe-Nygaard, who kindly informed me that it extends across the Cape with a dip towards the southeast. A couple of rock samples contained poorly preserved cephalopods, gastropods, and the peculiar spongiae figured on pl. 3. Although

the palaeontological evidence is far from satisfactory, there is no doubt that the strata belong to the Cape Weber formation; this appears clearly

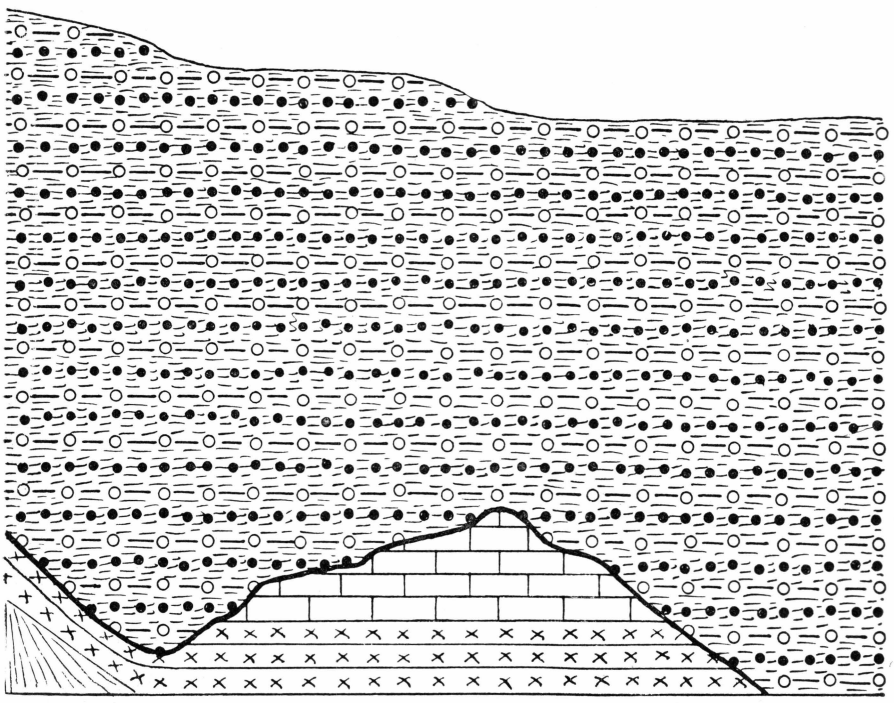

Fig. 8. Section at the eastern end of the anticline on the south coast of Ella Island, showing in ascending order crystalline dolomite, fossiliferous, oolitic limestone (Narwhal Sound formation), and Devonian conglomerate, resting upon the eroded Ordovician. The angular unconformity between the Ordovician and the Devonian is seen to the left, where the anticline terminates.

from the nature of the rock; and, moreover, the limestone forming the uppermost stratum of the cape must overlie the greenish shales of the Cass Fjord formation, which are exposed in the northern coast section[1]).

The Musk Ox Fjord Inlier.

On both sides and near the mouth of Musk Ox Fjord there is an isolated, narrow strip of Ordovician sediments which form a part of the small area frequently referred to in the literature as the "Musk Ox Fjord inlier".

The northern locality is situated on the southern slope of *Mt. Torbern Bergmann* (fig. 9, p. 21, and fig. 10, p. 22). The Ordovician of this

[1]) The occurrence of the Cass Fjord formation in the northern coast cliffs was observed by the writer in 1929 from the ship.

region is very imperfectly known. TEICHERT[1]) describes the geological conditions as follows: "Am Nordufer des Fjordes ist ersichtlich, dass die Westgrenze des Gneissmassivs durch eine Verwerfung gebildet wird, die einwandfrei prädevonischen Alters ist, da sie das hangende Devon nicht durchsetzt. Der Gneiss selbst ist gebankt und domförmig aufgewölbt. Vom Zentrum des Doms beschreibt WISEMAN Orthogneisse, nach aussen hin ?Paragneisse, Paraschiefer, aber auch andere Orthogesteine. Westlich der erwähnten Randverwerfung befindet sich ein Rest dunkler Kalke, die von plattigen dolomitischen Schichten unterlagert werden. Den Kalk kann man bis zu etwa 200 m Meereshöhe längs der Verwerfung verfolgen, wo er dann unter den Devondecke verschwindet

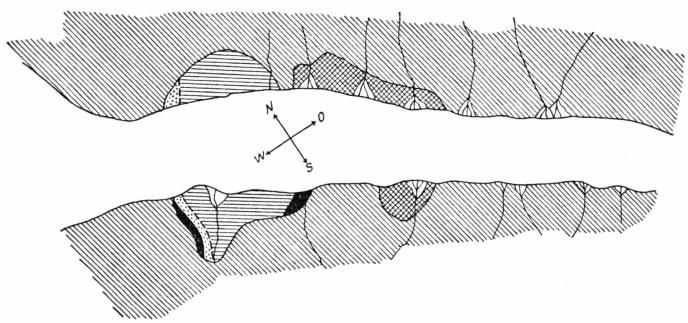

Fig. 9. Geological sketch map of the mouth of Musk Ox Fjord, showing the Ordovician (stippled) and other rocks of the inlier, gneiss (horizontally ruled) and the Devonian Bjørne-Ø conglomerate (black). (After TEICHERT.)

(Abb. 16)[2]). Die plattigen helleren Schichten im Liegenden verschwinden schon in geringer Meereshöhe unter dem Kalk. In dem dunklen Kalk, den ich ursprünglich für einen Rest der präkambrischen Kalk-Dolomit-Serie ansah, berichten PARKINSON & WHITTARD den Fund eines nicht näher bestimmbaren Gastropodenrestes, womit nunmehr ein canadisches oder ordovizisches Alter hinreichend gesichert erscheint.

"Gneiss und Sediment werden gleichmässig vom Devon eingedeckt. Von der Spitze des Torbern Bergmann-Berges wird (SKAUN 1932) "grauer Schiefer" berichtet.

"Das Profil an der Südseite des Fjordes entspricht genau dem an

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[1]) TEICHERT, C., "Untersuchungen zum Bau des kaledonischen Gebirges in Ostgrönland", Meddelelser om Grønland, vol. 95, no. 1, pp. 38—40. Copenhagen 1933.

[2]) According to BÜTLER (Meddelelser om Grønland, vol. 103, no. 2, p. 23. Copenhagen 1935) TEICHERT's fig. 16, which is reproduced in the present paper as fig. 10, shows Devonian "D" in the upper portion of the section in a place where Caledonian granite occurs. The Devonian rocks, however, are exposed at the western margin of the granite, which occupies only a narrow strip in the section; accordingly, the above quotation from TEICHERT's paper is adequate.

der Nordseite. Dass hier am Ostrande des Gneissmassivs ebenfalls Sedimente vorhanden sind, wurde schon von L. KOCH und später BACKLUND festgestellt, die eine Zugehörigkeit der Sedimente zur Eleonore-Bay-Formation vermuteten. Angesichts der Feststellungen von PARKINSON & WHITTARD betreffs des Alters des Sedimentvorkommens auf der anderen Fjordseite, kommt nun aber natürlich auch für die Sedimente der Südseite ein paläozoisches Alter in Betracht".

The northern locality was visited in 1929 by WHITTARD, who collected two fossiliferous rock samples; the one, containing a specimen of

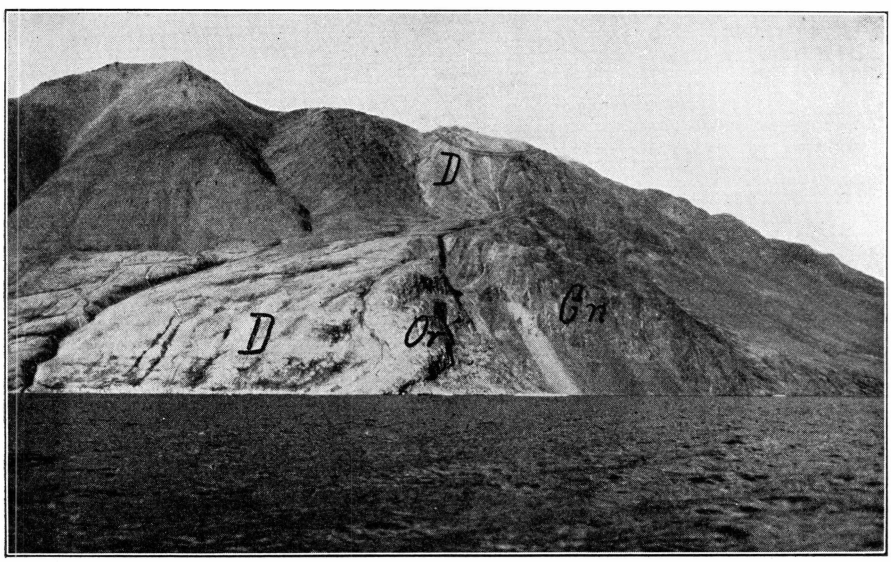

Fig. 10. The geological conditions at Mt. Torbern Bergmann. The Ordovician (Or) of the inlier is seen at the centre of the figure between gneiss (Gn) and Devonian (D). (After TEICHERT.)

Sinuopea whittardi n. sp., evidently originates from the Cass Fjord formation; the other, which holds indeterminable fragments, is a limestone of the same type as that of the Cape Weber formation.

Ordovician sediments have hitherto not been recorded in other parts of East Greenland. Attention should, however, be drawn to WEGMANN's find of fossiliferous erratics in the moraine at *Cecilia Nunatak*. These erratics were sent to the writer for examination; they consist of dark limestone and contain poorly preserved gastropods, which are comparable to the genera *Ectomaria* KOKEN and *Hormotoma* SALTER, but indeterminable. According to WEGMANN[1]), the erratics "originated from

[1]) WEGMANN, C. E., "Preliminary Report on the Caledonian Orogeny in Christian X's Land", Meddelelser om Grønland, vol. 103, no. 3, pp. 14—15. Copenhagen 1935.

the hinterlands of the division of the Caledonian mountain chain treated here". The genera *Ectomaria* and *Hormotoma* are stratigraphically wide-ranging, so that the age of the limestone in question cannot be determined with certainty, but WEGMANN's find is important, because it indicates the presence of Post-Cambrian Lower Palaeozoic sediments west of the metamorphic complexes of the inner fjord region.

FOSSILS FROM THE CASS FJORD FORMATION

GRAPTOLITHINA.

Dendroidea.

Genus **OPHIOGRAPTUS** n.g.

Rhabdosome of the general dendroid type. Stipes dividing dichotomously. Hydrothecae arranged biserially and alternating, supported along their inner side and connected with the main portion of the stipes by a membrane.

The genotype, *Ophiograptus inexpectans* n. sp., is the only known species of this genus.

Ophiograptus inexpectans n. sp.

Figs. 11—12.

This species is represented by a single, small fragment of the rhabdosome, showing the general habit of the order Dendroidea.

The stipes are almost straight, diverging slightly, apparently 12—13 per cm, 0.4 mm or less in width, separated by interspaces of about 0.2—0.4 mm, bifurcating at short intervals.

The hydrothecae are broadly conical, with simple, straight apertural margin, arranged biserially and in an alternating manner. The main portion of the stipes has the appearance of a strongly undulating tube. The hydrothecae face the concave sides of the undulating tube, and are connected with it by a thin membrane. The number of hydrothecae is about 20 in 10 mm.

Bithecae have not been observed, but they may be present on the not visible (inner?) side of the specimen at hand.

Remarks: The genus *Ophiograptus* appears to be closely related to the *Dictyonema-Callograptus* group of Dendroids. The general shape is very similar to that of *Dictyonema*, and the absence of dissepiments in the above-described specimen of *Ophiograptus* may be due to the fragmentary state of preservation. The aforesaid strongly undulating tube

may be comparable with the slightly undulating, continuous row of budding individuals of *Dictyonema*. *Ophiograptus*, however, differs considerably from Dendroids of the *Dictyonema* type in the shape and the pronounced biserial arrangement of the hydrothecae and the presence

Fig. 11. Fig. 12.

Fig. 11. *Ophiograptus inexpectans* n. g. et n. sp. (holotype) × 20.
Fig. 12. Diagrammatic figure of *Ophiograptus*, showing the alternating biserial arrangement of the hydrothecae, and (horizontally ruled) the supporting membrane.

of connecting membranes between the hydrothecae and the main portion of the stipes.

Locality: Western part of the anticline on the south coast of Ella Island.

Graptoloidea.

Genus **BRYOGRAPTUS** LAPWORTH[1]).

Bryograptus ? sp.

Fig. 13.

The species is represented by a single, fragmentary rhabdosome, which shows considerable resemblance to the pendent forms of *Bryograptus*.

Fig. 13. *Bryograptus*? sp. × 20.

[1]) In 1929 C. J. STUBBLEFIELD in his paper, "Notes on Some Early British Graptolites" (Geol. Mag., vol. 66), described specimens of *Bryograptus hunnebergensis* MOBERG and *Clonograptus tenellus* (LINNARSSON), with the variety *C. tenellus* var. *callavei* LAPWORTH from the Shineton Shales. STUBBLEFIELD discovered that

The stipes are slender, 0.3—0.5 mm in width at the level of the hydrothecal apertures. The branching is of the usual Bryograptid type.

The hydrothecae occur to the number of 8 in 10 mm, inclined at very acute angles, and with a marked curvature of the apertural end of their ventral margins. The amount of overlap is about $^1/_2$. The apertural angle varies from 60° to 120°.

Bithecae have not been observed.

Remarks: This species is probably new, but the material at hand does not allow of any adequate identification or use as a type.

Locality: Western part of the anticline on the south coast of Ella Island.

Genus **CLONOGRAPTUS** HALL.

Clonograptus sp.

Fig. 14.

The species is represented by a considerable portion of a rhabdosome and a couple of small fragments, which appear as extremely thin, dark films in the matrix.

The most complete specimen shows stipes of five orders; judging from the angles of bifurcation and the length of the stipes the orders of branching are the second to the sixth inclusive. The hydrothecae are not preserved. The width of stipes is about 0.4 mm.

Fig. 14. *Clonograptus* sp. × 1.

Remarks The Greenland specimens can scarcely be distinguished from similarly pressed specimens of *Clonograptus tenellus* (LINNARSSON) var. *callavei* LAPWORTH.

Locality: Western part of the anticline on the south coast of Ella Island.

CYSTOIDEA.

Genus et species ind.

Pl. 1, figs. 1—2.

Fragments of Cystoidea are very common in the rocks of the Cass Fjord formation, but it has not been possible to find determinable

these species bear bithecae and budding individuals comparable with those of *Dictyonema flabelliforme* (EICHWALD). Thus the view of several authors that the Dichograptidae are near relatives of *Dictyonema* was signally confirmed. The present writer agrees with STUBBLEFIELD when he writes: "Much could be said in favour of classing these species with the Dendroidea; it will, however, be left for later work to decide whether all, or merely other, species of these genera are to be similarly relegated". Unfortunately the Greenland specimens of *Bryograptus* and *Clonograptus* do not throw light on this question, and, accordingly, these genera are here provisionally referred to the graptoloidea.

specimens. The material at hand consists only of isolated stem-joints and poorly preserved fragments of the arms. The stem-joints agree in every respect perfectly with those from the Cass Fjord formation of Northwest Greenland described and figured by the writer[1]), and it seems probable that they belong to the same species.

Locality: Cape Weber, loc. 4; western part of the anticline on the south coast of Ella Island.

BRACHIOPODA.

Genus **LINGULEPIS** HALL.

Lingulepis tenuilineata n. sp.

Pl. 1, figs. 3—5.

This species is represented by a few almost complete valves and numerous fragments.

The general form is elongate ovate, with the pedicle valve acuminate, and the brachial valve ovate in outline.

The external surface is ornamented with extremely delicate, closely set lines of growth and numerous faintly marked, radiating, somewhat irregular wrinkles. In one brachial valve, which undoubtedly belongs to this species, the inner surface is marked by rather broad, flattened ribs, each of which is divided longitudinally by a narrow, shallow furrow.

The pedicle valve is about 1.5—1.7 times as long as it is wide, moderately convex, with an apical angle of about 45°. The interior of the pedicle valve shows a clearly defined area, which extends forward along the cardinal slopes to a point opposite the centre of the valve. The area is marked by very oblique, transversal striae. The pedicle groove is very wide. The visceral cavity is poorly defined, increasing rapidly in width; it can be traced to the centre of the valve. Muscle scars and vascular impressions are not visible in any of the pedicle valves.

The brachial valve is broadly ovate, moderately convex, with the greatest width towards the front. The interior is unknown with the exception of the above-described inner surface ornamentation.

Dimensions:	I (Holotype)	II	III
Length of pedicle valve	11 mm	13 mm	
Width - — —	7 - -	7.5 -	
Length - brachial —			c. 7 mm
Width - — —			c. 6.5 -

[1]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, p. 282, pl. 17, fig. 37. Copenhagen 1927.

Remarks: Lingulepis tenuilineata appears to be closely related to *Lingulepis acuminata* (CONRAD) (the genotype)[1]), but it is easily distinguished by the more delicate surface ornamentation; the pedicle valve differs from that of *Lingulepis acuminata* in having a larger area and a straight cardinal slope, instead of gently incurved.

The badly preserved specimens from the Cass Fjord formation of Northwest Greenland figured by the writer and mentioned as *Lingulella*? sp. ind.[2]) may be identical with the species here described.

Locality: Cape Weber, loc. 2 and 4; western part of the anticline on the south coast of Ella Island.

Genus **EOORTHIS** WALCOTT.

Eoorthis sp.

Pl. 1, figs. 6—8.

A few fragmentary and very badly preserved shells undoubtedly belong to the genus *Eoorthis*.

Remarks: The species at hand differs from those figured by WALCOTT, but, as appears from the figures, the Greenland specimens do not allow of any adequate identification or use as types for specific description. *Eoorthis* sp. ind. from the Cass Fjord formation of Northwest Greenland[3]) is not identical with the species referred to here.

Locality: Western part of the anticline on the south coast of Ella Island.

GASTROPODA.

Genus **SINUOPEA** ULRICH.

Sinuopea whittardi n. sp.

Pl. 1, figs. 9—10.

This species is represented by three more or less fragmentary specimens.

The shell is of medium size. The spire is low; the apical angle is estimated to be about 120°. The whorls are rather strongly inflated, expanding very rapidly; the upper side of the whorls has a flat, depressed

[1]) WALCOTT, C. D., "Cambrian Brachiopoda", Monogr. U. S. Geol. Surv., vol. 51, 1912, p. 545, pl. 40, figs. 1, 1a—s; pl. 41, figs. 1, 1a—n; pl. 42, figs. 1, 1a—o.

[2]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, p. 282, pl. 17, fig. 40. Copenhagen 1927.

[3]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, p. 282, pl. 18, fig. 1. Copenhagen 1927.

portion along the suture. It has not been possible to disengage the umbilicus from the very hard matrix, but it is estimated to be of the usual shape and size. The aperture is not preserved in any of the specimens at hand, but the shape of its outer margin appears clearly from the growth lines. The surface markings consist of prominent, sharp, irregularly spaced lamellae of growth, which are drawn back into angles of about 70°, corresponding to a rather deep >-shaped notch in the outer margin of the aperture a little below the median line of the whorl; the interspaces between the growth lamellae show numerous extremely delicate striae, which extend across the whorls parallel to the growth lamellae.

The dimensions of the holotype are: Height 14 mm (approximately), diameter 22 mm.

Remarks: Sinuopea whittardi differs from the hitherto described species of this genus in the very rapidly expanding whorls, the strongly marked depression of the whorls along the suture, and the coarse surface ornamentation.

The badly preserved specimen from the Cass Fjord formation of Northwest Greenland figured by the writer and mentioned as *Sinuopea*? sp. ind. may be identical with the species here described[1]); at least one of the unfigured Northwest Greenland specimens labelled as *Sinuopea*? sp. ind. must be referred to *Sinuopea whittardi.*

Locality: Northern shore of the Musk Ox Fjord at Mt. Torbern Bergmann; western part of the anticline on the south coast of Ella Island.

Genus et species ind.

Pl. 1, fig. 11.

A very low-spired gastropod species is represented by a considerably weathered, undeterminable specimen.

Remarks: The general habit of the specimen is much like that of the genus *Rhachopea* ULRICH et BRIDGE[2]), the occurrence of which in the fauna of the Cass Fjord formation is probable.

Locality: Western part of the anticline on the south coast of Ella Island.

[1]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, p. 283, pl. 18, fig. 4. Copenhagen 1927.

[2]) BRIDGE, J., "Geology of the Eminence and Cardareva Quadrangles", Missouri Bureau of Geology and Mines, vol. 24, 2. ser., 1930, p. 190.

CRUSTACEA.

Trilobita.

Genus **HYSTRICURUS** Raymond.

Hystricurus armatus n. sp.

Pl. 2, figs. 3—9.

This species is represented by several more or less fragmentary cranidia, free cheeks, thoracic segments, and a few pygidia.

The cranidium is almost as long as it is wide, strongly convex, with evenly and rather strongly curved anterior margin.

The glabella (occipital ring included) is about 1.5—1.6 times as long as it is wide, attaining its greatest width just in front of the occipital furrow, tapering rapidly toward the anterior end, where the width is only about half that of the posterior end, strongly convex, elevated considerably above the highest level of the fixed cheeks, almost evenly rounded in front, separated from the rim by a rather long preglabellar field. The glabellar furrows are indicated by three pairs of extremely shallow depressions, which are situated close to the axial furrow. The preglabellar, occipital, and axial furrows are deeply impressed. The occipital ring is narrow, rounded, and provided with a strong, gradually tapering occipital spine.

The preglabellar field slopes gradually downward to the wide, well defined, evenly curved frontal furrow and then it sharply turns upward into a thick rounded rim, which, when viewed from the front, is strongly arched.

The fixed cheeks are moderately wide, with faintly indicated, oblique ocular ridges. The palpebral lobes are rather short and but slightly curved. The posterior limbs are short, subtriangular, sloping rather steeply downward from the axial furrow. The posterior marginal furrow is well defined and broad.

The anterior branches of the facial suture extend from the palpebral lobes to the rim as almost straight, slightly diverging lines, and then they turn inward to cut the rim at acute angles; the posterior branches extend obliquely outward from the palpebral lobes to a point close to the genal angle, where they turn backward to cut the posterior margin.

The associated free cheeks are wide, moderately convex, bordered antero-laterally by a thick, slightly rounded rim, which increases gradually in width toward the genal angle, where it is produced into a straight genal spine of moderate length.

Associated thoracic segments are very common on the bedding planes of the rock, where they appear as transverse sections of the thorax which agree very well with the posterior margin of the cephalon.

A few fragmentary pygidia, which probably belong to the species here described, are about twice as wide as they are long (estimated), almost semicircular in outline, strongly convex, with the axis elevated considerably above the highest level of the lateral lobes. The axis occupies a little more than one-third of the width of the pygidium (estimated), strongly convex, tapering rapidly, evenly rounded posteriorly, extending to the border, divided into five axial rings, the anterior of which are rounded and separated from each other by deeply impressed furrows, whereas the two posterior rings have fused together almost completely. The axial furrow is indistinctly defined. The lateral lobes are strongly convex; four pleural segments can be distinguished, the anterior three of which have distinctly marked pleural furrows. The postero-lateral border is narrow and flat.

All convex portions of the test of the cranidium, the free cheeks, and the pygidium are ornamented with somewhat spaced tubercles of two sizes, but all rather small. In addition to the tuberculation the free cheeks show numerous fine, more or less distinct, radiating and inosculating ridges, which extend from the eye to the marginal furrow. In places where the test has been removed the cranidia show, numerous minute pits between the tubercles when seen under a strong lens.

Dimensions:	I	II (Holotype)	
Length of cranidium (occipital spine not included) ..	8.0	9.3	mm
Width - — at the posterior margin	9.0	9.5	-
— - — between the eyes.....	6.0	?	-
Length - glabella (occipital ring included)	5.7	7.0	-
Width - — at the base	3.7	4.3	-
— - — - - ocular ridges	2.3	2.6	-
Maximum distance of eye from the glabella	1.3	?	-
Distance - - — - anterior margin.	c. 3.0	2.6	-
— - - — - posterior — .	?	1.8	-

Length of pygidium.....	5.5	mm
Width - —	10.0	- (estimated)
Length - axis.....	5.3	-
Width - — at the anterior end	3.6	-

Remarks: Hystricurus armatus shows greater resemblance to *Hystricurus ravni* POULSEN[1]) from the Cass Fjord formation of Northwest Greenland than to any other hitherto described species, but it is readily

[1]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, p. 283, pl. 18, figs. 5—10. Copenhagen 1927.

distinguished by the more slender glabella, the presence of an occipital spine, and the nature of the tuberculation.

Locality: Cape Weber, loc. 3, 4, and 5; western part of the anticline on the south coast of Ella Island.

Hystricurus sulcatus n. sp.

Pl. 2, figs. 1—2.

This species is represented by four more or less fragmentary cranidia.

The cranidium is about 1.3 times as wide as it is long, strongly convex, with slightly curved anterior margin.

The glabella (occipital ring included) is almost 1.5 times as long as it is wide, attaining its greatest width just in front of the occipital furrow, tapering rapidly toward the anterior end to about two-thirds of its maximum width, strongly convex, elevated considerably above the highest level of the fixed cheeks, slightly truncate in front, and separated from the rim by a rather long preglabellar field. Three pairs of shallow but distinctly marked glabellar furrows are situated close to the axial furrow; the two anterior pairs of glabellar furrows, which have the shape of shallow pits, are situated close together in the anterior half of the glabella, whereas the basal glabellar furrows are relatively long, oblique, converging toward the occipital furrow, and separated from the second pair by a considerable space. The occipital ring is narrow, rounded, and provided with a strong occipital spine of unknown length. The preglabellar, occipital, and axial furrows are deeply impressed.

The preglabellar field slopes gradually downward to the frontal furrow, which is wide, well defined and almost straight. The frontal rim is rounded and strongly arched, when seen from the front.

The fixed cheeks are moderately wide, with very indistinctly defined, oblique ocular ridges. The palpebral lobes are rather short and but slightly curved, separated from the inner parts of the fixed cheeks by strong palpebral furrows, which extend forward along the palpebral lobes and the ocular ridges. The posterior limbs are long and narrow, sloping gently downward from the axial furrow. The posterior marginal furrow is deeply impressed.

The anterior branches of the facial suture extend from the palpebral lobes to the rim as gently curved lines, diverging posteriorly and converging anteriorly; the posterior branches extend directly outwards from the palpebral lobes parallel to the posterior margin of the posterior limbs, and then they turn backward to cut the posterior margin at angles of about 60°.

The surface of all convex portions of the cranidium is strongly pustulose, the pustules being of two sizes and closely set.

Dimensions:	I	II (Holotype)
Length of cranidium (occipital spine not included) ...	9.3	9.7 mm
Width - — at the posterior margin	12.0	? -
— - — between the eyes.....	8.3	9.7 -
Length - glabella (occipital ring included)	6.7	7.2 -
Width - — at the base	4.5	5.0 -
— - — - - ocular ridges	2.6	3.3 -
Maximum distance of eye from the glabella	2.0	2.3 -
Distance - - — - anterior margin..	3.3	3.3 -
— - - — - posterior	1.5	? -

Remarks: Hystricurus sulcatus is closely related to the preceding species, from which it differs, however, in having a wider glabella, straight frontal furrow, and a surface ornamentation consisting of larger, more closely set tubercles. Compared with *Hystricurus tuberculatus* (WALCOTT)[1]), which is likewise provided with an occipital spine, *Hystricurus sulcatus* is immediately distinguished by the robust occipital spine, the shape of the glabella, and the surface ornamentation. The most characteristic feature of *Hystricurus sulcatus* is the distinctly marked glabellar furrows.

Locality: Cape Weber, loc. 3.

Hystricurus nudus n. sp.

Pl. 2, fig. 10.

This species is represented by a single fragmentary cranidium.

The cranidium is strongly convex, with evenly curved anterior margin.

The glabella (occipital ring included) is about 1.5 times as long as it is wide, attaining its greatest width just in front of the occipital furrow, tapering toward the anterior end to about two-thirds of its maximum width, strongly convex, elevated considerably above the highest level of the fixed cheeks, truncate in front, and separated from the rim by a relatively long preglabellar field. Three pairs of short, extremely shallow, and very indistinctly marked glabellar furrows are situated close to the axial furrow. The occipital ring is narrow and rounded. The preglabellar, occipital, and axial furrows are deeply impressed.

The preglabellar field slopes gradually downward to the frontal furrow, which is very wide, deeply impressed, paralleling the evenly

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[1]) WALCOTT, C. D., "Paleontology of the Eureka District, Nevada", Monogr. U. S. Geol. Surv., vol. 8, 1884, p. 91, pl. 12, fig. 9.

curved anterior margin. The frontal rim is very narrow, somewhat rounded, and moderately arched, when seen from the front.

The fixed cheeks are narrow, with relatively well defined ocular ridges, which bend gently backward toward the palpebral lobes. The palpebral lobes are rather long and but slightly curved, separated from the inner parts of the fixed cheeks by wide and deeply impressed palpebral furrows. The posterior limbs are not preserved, and the course of the facial suture is unknown.

The surface of the cranidium has a smooth aspect, but a very delicate granulation appears when it is seen under a strong lens, and fine, inosculating, likewise microscopical veins radiate from the glabella toward the frontal furrow.

Dimensions:

Length of cranidium	7.7 mm
Width - — at the posterior margin	? -
— - — between the eyes	7.0 -
Length - glabella (occipital ring included)	5.8 -
Width - — at the base	3.8 -
— - — - - ocular ridges	2.5 -
Maximum distance of eye from the glabella	1.7 -
Distance - - — - anterior margin	? -
— - - — - posterior —	? -

Remarks: By its smooth surface *Hystricurus nudus* differs from all species hitherto referred to the genus *Hystricurus*, except *Hystricurus cordai* (Billings)[1]). The Greenland species is undoubtedly closely allied to *Hystricurus cordai*, from which it is distinguished *inter alia* by its more rapidly tapering, truncate glabella and by the shape of the occipital ring.

Locality: Cape Weber, loc. 3.

Genus **SYMPHYSURINA** Ulrich.

Comparing this genus with *Symphysurus* Goldfuss and *Nileus* Dalman, Ulrich[2]) writes as follows: "The free cheeks show another, probably more important, difference in the extension of the doublure beneath the front of the cranidium. As described by Brögger and others, these extensions from the opposite cheeks unite in the middle of the head of typical species of *Symphysurus* and *Nileus* without leaving a

[1]) Billings, E., "Palæozoic Fossils", Geol. Surv. Canada, 1865, p. 259 and p. 412, fig. 242 and fig. 395.

[2]) Ulrich, E. O. in Walcott, C. D., "Cambrian and Ozarkian Trilobites", Smiths. Misc. Coll., vol. 75, no. 3, 1925, p. 110.

suture where they join. The two cheeks thus are united into a single piece. In *Symphysurina*, however, this never occurs, the two cheeks being separated by a suture precisely like that found in all of the true Asaphidae". The writer is of opinion that ULRICH is right in attaching much importance to this feature, which separates *Nileus* and *Symphysurus* from the Asaphidae. COWPER REED[1]) says: "The existence of a single median (sagittal) suture across the doublure seems to mark off the true Asaphids, and indeed has been given as one of the characters of the family by RAYMOND"[2]). Following ULRICH's suggestions COWPER REED classified *Symphysurina* with the Asaphidae, and with this the present writer is in complete agreement.

The relations of *Symphysurina* to other genera of the true Asaphidae are somewhat problematic, because several of the genera in question are imperfectly known. According to ULRICH (op. cit. p. 111—112) the following genera should be taken in consideration: *Platypeltis* CALLAWAY, *Psilocephalus* SALTER, *Platycolpus* RAYMOND, *Illaenurus* HALL, and *Hemigyraspis* RAYMOND, of which the latter two genera are regarded as stages in a single genetic line with *Symphysurina* as a connecting link.

The Upper Cambrian genera *Tsinania* WALCOTT and *Dictya* KOBAYASHI (the Tsinanidae of KOBAYASHI)[3]) show a striking resemblance to *Symphysurina*, but we are ignorant of the condition of the doublure and the ventral behaviour of their facial sutures; in *Dictya*, however, the dorsal part of the facial suture is typically isoteli-form, suggesting the presence of a ventral sagittal suture, and thus the relationship of these genera to *Symphysurina* and typical Asaphidae appears probable.

The genus *Giordanella* BORNEMANN[4]) may be mentioned as probably very closely related to *Symphysurina*. The cranidium of *Giordanella* differs from that of *Symphysurina* only in having less curved palpebral lobes, narrower glabella, larger posterior limbs, and in the absence of a median tubercle between eyes, which appears to be constant in the latter genus; the free cheeks of *Giordanella* do not differ essentially from those of the genotype of *Symphysurina*, and the thoracic segments and the hypostomes of the two genera are almost perfectly alike[5]).

[1]) COWPER REED, F. R., "A Review of the Asaphidae", Ann. and Mag. of Nat. Hist., ser. 10, vol. 5, 1930, p. 301.

[2]) RAYMOND, P. E. and WALCOTT, C. D. in ZITTEL-EASTMAN's "Text-book of Palæontology", vol. 1, 2nd ed., 1913, p. 718.

[3]) KOBAYASHI, T., "The Upper Cambrian of the Wuhutsui Basin, Liaotung", Japanese Journal of Geology and Geography, vol. 11, 1933, p. 131.

[4]) BORNEMANN, J. G., "Die Versteinerungen des Cambrischen Schichtensystems der Insel Sardinien", II, Nova Acta d. Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher, vol. 56, no. 3, 1891, p. 476.

[5]) The hypostoma of *Giordanella* is here compared with specimens which are associated with the East Greenland species of *Symphysurina*; they differ in certain respects from ULRICH's description of the associated Hypostoma.

Some Ozarkian forms, the *Plethometopus-Stenopilus* group[1]), are distinct genera, but they may be related to *Symphysurina.*

All these genera are small, smooth forms, the phylogenetical position of which is still problematic, not least because the ventral part of their sutures is in many cases unknown, but *Symphysurina*, and several of the genera with which it has been compared, have many characters in common and in their general habit differ considerably from normal Asaphidae; thus it seems probable that *Symphysurina* and at least some of the similar genera should be grouped as a subfamily of the Asaphidae.

The East Greenland collections contain the following four species, which show the typical features of the genus *Symphysurina:*

Symphysurina elegans n. sp.

Pl. 2, figs. 11—12, 13(?), and 14—18.

This species is represented by numerous cranidia, a free cheek, a hypostoma, some thoracic segments, and several pygidia.

The cranidium is about as long as it is wide, strongly convex, arching uniformly from front to back. The anterior margin is slightly but uniformly curved in both dorsal and front aspects. The rim is extremely narrow, flat, and ornamented with few ridges, which parallel the anterior margin. There is no real frontal furrow, the rim becoming distinct simply by its elevation. The median tubercle is situated very close to the centre of the cranidium.

The fixed cheeks are, as usual, very narrow and indistinctly defined in front of the palpebral lobes; the posterior limbs are relatively large, triangular, declining considerably outwards. The palpebral lobes are of medium size, situated opposite the centre of the cranidium, moderately convex, with strongly curved margin, declining slightly outwards. The axial furrows are very shallow near the posterior margin, becoming more distinct in passing the palpebral lobes, decreasing gradually in distinctness in front of the palpebral lobes, and vanishing completely midway between the palpebral lobes and the anterior corners of the cranidium. The facial suture does not differ essentially from that of other typical species of *Symphysurina.*

The free cheeks are moderately convex, bordered anteriorly by a narrow, straight rim, which tapers gradually in approaching a point opposite the anterior end of the eye, where it disappears; from this point the lateral margin is curved evenly backward to the posterior end of the facial suture without any tendency to form a genal spine.

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[1]) Bridge, J., "Geology of the Eminence and Cardareva Quadrangles", Missouri Bureau of Geology and Mines, vo. 24, ser. 2, 1930, p. 221.

The associated hypostoma is as long as it is wide, tapering rapidly from the rather large anterior wings to the posterior end, which is evenly curved; the central body is greatly swollen, divided by a very shallow and indistinctly defined middle furrow into a very long, ovate anterior lobe and a very short, crescentic posterior lobe; the lateral and posterior borders are narrow and rounded, separated from the central body by a narrow, deeply impressed furrow. This hypostoma differs from ULRICH's generic description[1]) in the shape of the anterior margin, which appears to have been evenly curved instead of bilobed. Another hypostoma (pl. 2, fig. 19), which is likewise associated with *Symphysurina elegans*, differs from that described above in having parallel lateral borders and in the less distinct bilobation of the central body.

An associated fragment of thorax shows four well preserved segments. The axis is moderately convex, occupying about three-sevenths of the width of the thorax; the axial rings are wide and provided with a broad, shallow transversal furrow. The axial furrows are distinctly defined. The pleurae are short and wide; the fulcrum is situated very close to the axial furrow; the long distal portion of the pleurae slopes gently downward with a slight backward direction, tapers gradually, and terminates almost bluntly.

The pygidium is about twice as wide as it is long, rounded subtriangular, rather strongly convex. The axis is prominent, distinctly outlined by shallow axial furrows, tapering slowly, evenly rounded posteriorly, and separated from the posterior margin by a narrow space. The lateral lobes slope gently and almost uniformly downward to the postero-lateral margin. The segmentation is obsolete or very obscurely indicated excepting the first rib inside of the anterior margin; some specimens (especially the larger ones) show faint traces of the second and third axial ring and the second pair of pleurae.

The surface of the test is marked by numerous microscopic pits.

Dimensions:	I (Holotype)	II	
Length of cranidium	6.7	10.5	mm
Width - —	7.7	?	-
— - — between the eyes	6.8	10.4	-
— - glabella at the base	4.8	7.8	-
Maximum distance of eye from the glabella	1.2	1.7	-
Distance - - — - anterior margin	1.8	2.8	-
— - - — - posterior —	1.5	2.8	-

[1]) ULRICH, E. O. in WALCOTT, C. D., "Cambrian and Ozarkian Trilobites", Smiths. Misc. Coll., vol. 75, no. 3, 1925, p. 108.

	I	II
Length of pygidium	2.0	4.3 mm
Width - —	4.0	9.0 -
Length - axis	1.7	4.0 -
Width - — at the anterior end	1.3	3.5 -
— - — - - posterior -	0.8	2.2 -

Remarks: Symphysurina elegans agrees in several respects with *Symphysurina woosteri* ULRICH (the genotype) and *Symphysurina eugenia* WALCOTT[1]), but it differs from the former in the longer anterior branch of the facial suture and in the absence of genal spines, and, compared with the latter, it is immediately distinguished by its much larger palpebral lobes; last but not least *Symphysurina elegans* differs from the two mentioned species in the absence of a caudal spine.

Locality: Cape Weber, loc. 3.

Symphysurina robusta n. sp.

Pl. 3, fig. 6.

This species is represented by a single, almost complete pygidium.

The pygidium is about 1.7 times as wide as it is long, rather strongly convex, with regularly curved postero-lateral margin. The axis is moderately convex, 1.3 times as long as its is wide, distinctly outlined by shallow but well defined axial furrows, occupying anteriorly about one-third of the width of the pygidium, tapering slightly, terminating a little in front of the posterior margin. The lateral lobes slope gently and uniformly downward to the postero-lateral margin. The segmentation is very obscurely indicated; the axis, the test of which has been broken off, shows five very indistinctly defined segments, whereas only the first segment inside of the anterior margin can be distinguished on the lateral lobes. The posterior end of the axis is connected with the posterior margin by a faintly marked, narrow ridge. The surface of the test is marked by numerous, microscopic pits, which are closely set and regularly spaced.

Dimensions:

Length of pygidium	9.0 mm
Width - —	15.0 -
Length - axis	8.0 -
Width - — at the anterior end	6.0 -
— - — - - posterior -	4.5 -

[1]) WALCOTT, C. D., "Cambrian and Ozarkian Trilobites", Smiths. Misc. Coll., vol. 75, no. 3, 1925, pp. 113—115, pl. 21, figs. 1—11, 25—29, 31—32.

Remarks: The pygidium of *Symphysurina robusta* is easily distinguished from that of other species without caudal spine by its proportions, as given in the above description; it differs *inter alia* from the American species of this group, *Symphysurina eurekensis* (WALCOTT)[1]) and *Symphysurina illaenoides* (BILLINGS)[2]) in the longer axis, and, compared with the Northwest Greenland species[3]), *Symphysurina inermis* POULSEN, *Symphysurina porifera* POULSEN, *Symphysurina? simulans* POULSEN, and *Symphysurina tumida* POULSEN, it is immediately distinguished by the more uniformly curved postero-lateral margin and the more prominent axis.

Locality: Cape Weber, loc. 3.

Symphysurina cf. woosteri ULRICH.

Pl. 3, figs. 1—5.

1924. *Symphysurina woosteri* ULRICH in WALCOTT, "Geol. Formations of Beaverfoot-Brisco-Stanford Range, British Columbia, Canada", Smiths. Misc. Coll., vol. 75, no. 1, p. 37, fig. 8.

1925. *Symphysurina woosteri* ULRICH in WALCOTT, "Cambrian and Ozarkian Trilobites", Smiths. Misc. Coll., vol. 75, no. 3, p. 115, pl. 21, figs. 1—11.

The specimens at hand, a few cranidia and several free cheeks, agree fairly well with ULRICH's description and WALCOTT's figures so far as can be seen from the fragmentary and poorly preserved material. The cranidia, however, differs slightly from that of the typical *Symphysurina woosteri* for instance in the absence of the low median ridge and in the axial furrows being faintly impressed instead of "quite obsolete" in passing the palpebral lobes. It deserves notice that the peculiar row of nine depressions in the under side of the doublure of the free cheek, which ULRICH regards as pits for the reception of the ends of the thoracic segments, has been observed in several of the East Greenland specimens.

Locality: Cape Weber, loc. 4; western part of the anticline on the south coast of Ella Island.

Symphysurina sp.

Pl. 3, fig. 7.

The species is represented by a single pygidium.

The pygium is nearly semi-circular in outline, moderately convex.

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[1]) WALCOTT, C. D., "Paleontology of the Eureka District", Monogr. U. S. Geol. Surv., vol. 8, 1884, p. 97.

[2]) BILLINGS, E., "Palæozoic Fossils", Geol. Surv. Canada, 1865, p. 414.

[3]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2, pp. 286, 287, 291, pl. 18, figs. 22—25, 27—28. Copenhagen 1927.

The axis is 1.35 times as long as it is wide, prominent, distinctly outlined, although the axial furrows are very shallow, occupying anteriorly about one-third of the width of the pygidium, tapering slowly, evenly rounded posteriorly, terminating about one-fourth of its length from the posterior margin. The lateral lobes slope gently downward to the margin. The anterior four axial rings are faintly indicated, whereas the lateral lobes show only the foremost segment. The test is poorly preserved and fails to show any surface markings.

Dimensions:

Length of pygidium	6.6 mm
Width - —	11.0 -
Length - axis	5.0 -
Width - — at the anterior end	3.7 -
— - — - - posterior -	2.6 -

Remarks: This species is probably new, but as the specimen at hand is rather poorly preserved, it seems inadvisable to use it as a type.

Locality: Cape Weber, loc. 5.

FOSSILS FROM THE CAPE WEBER FORMATION

SPONGIAE.

Genus et sp. ind.

Pl. 3, figs. 8—12.

A few specimens have the general character of spongiae, but further determination is impossible, the state of preservation being poor. The specimens are highly silicified, and even thin sections, cut for a study of the interior, fail to show the spiculae. The general form varies from tubular to cyathiform or more or less flabelliform, single or branching. The osculum is relatively small. The external surface is more or less wrinkled transversally. The skeleton is probably of hexactin origin; it is composed of strong, vertical and delicate, horizontal rays, which form a regular lattice-work with quadrangular meshes.

Locality: Cape Elisabeth.

BRACHIOPODA.

Genus **ARCHAEORTHIS** SCHUCHERT et COOPER.

Archaeorthis groenlandica n. sp.

Pl. 4, figs. 1—4.

This species is represented by numerous specimens, which are for the most part more or less exfoliated or otherwise poorly preserved; they agree fairly well with SCHUCHERT's and COOPER's generic description[1]).

The shell is small, sub-elliptic in outline. The majority of the specimens are a little wider than they are long, but the material shows considerable variation in regard to width. The cardinal extremities are obtuse. The hinge-line is a little narrower than the greatest shell width, which is about the mid-length. The ornamentation is multicostellate

[1]) SCHUCHERT, C. and COOPER, G. A., "Brachiopod Genera of the Suborders Orthoidea and Pentameroidea", Mem. Peabody Mus. Nat. Hist., vol. 4, pt. 1, p. 80. New Haven, Conn., 1932.

with a slight fascicostellate tendency. The ribs are of medium size and a little narrower than the spaces between them; the number of ribs, counted along the antero-lateral margin, is about 32—38.

The pedicle valve is strongly and uniformly arched. The inter-area (cardinal area) is apsacline. The beak is slightly incurved. The deltyrium is low and rather wide; the deltyrial margin forms an angle of about 50—70°. A deltidium has not been observed. The deltyrial cavity is deep. The teeth are strong, supported by short, thick dental plates, and provided with deep crural fossettes. The material at hand fails to show other details of the ventral interior.

The brachial valve is but slightly convex, with a low, apparently anacline inter-area. A well marked, but shallow depression, which increases rapidly in width, extends from the umbo to the anterior margin, where it occupies about half the greatest shell width. The dorsal interior is unknown.

Dimensions:

Length of pedicle valve (holotype)	4.3	mm		
Width - — — —	4.3	-		
	I	II	III	
Length - brachial —	3.8	4.2	5.0	mm
Width - — —	5.0	5.0	5.3	-

Remarks: Archaeorthis groenlandica finds its closest relative in *Archaeorthis putillus* (WALCOTT)[1]) from the Ozarkian Chushina and Mons formations of British Columbia and Alberta, Canada; it is, however, easily distinguished from the latter by its less fascicostellate ornamentation.

Locality: Mt. Gunvor, western slope of the summit; upper end of Devon Canyon; summit about 1 km south of Devon Canyon; Cape Weber, loc. 1 and 6.

Genus **POLYTOECHIA** HALL et CLARKE.

Polytoechia sp. ind.

Pl. 3, fig. 14.

The material is a single fragmentary pedicle valve, which agrees fairly well with BUTTS's figures of *Polytoechia filistriata* (ULRICH)[2]) as to

[1]) WALCOTT, C. D., "Cambrian and Ozarkian Brachiopoda, Ozarkian Cephalopoda and Notostraca", Smiths. Misc. Coll., vol. 67, no. 9, 1924, p. 509, pl. 114, figs. 6—7; pl. 115, fig. 9.

[2]) BUTTS, C., "Geology of Alabama", Geol. Surv. of Alabama, Special Report, no. 14, 1926, pl. 18, figs. 1—4. Dr. G. Arthur Cooper of the U. S. National Museum, Washington, D. C., kindly informed the writer that „*Deltatreta*" *filistriata* has proved to be a *Polytoechia*.

outline and surface ornamentation, but it is more uniformly convex. Although the valve is completely filled with calcite crystals, by the growth of which the structural features of the interior have been greatly injured, the writer succeeded in sectioning the beak, so as to confirm the generic determination.

Locality: Cape Weber, loc. 7.

PELECYPODA.

Genus et sp. ind.

Pl. 4, figs. 5—6.

A single natural cast of the interior of the shell is the only known representative of the pelecypoda of the East Greenland Ordovician. The general characters are those of the genera *Modiolopsis* HALL and *Orthodesma* HALL et WHITFIELD, but the specimen must remain undetermined, the state of preservation being very poor.

Locality: Cape Weber.

GASTROPODA.

Genus **HELICOTOMA** SALTER.

Helicotoma similis WHITFIELD?

Pl. 4, fig. 11.

1890. *Helicotoma similis* WHITFIELD, Bull. Amer. Mus. Nat. Hist., vol. 3, no. 1, p. 31, pl. 1, figs. 1—2.
1903. *Helicotoma similis* SARDESON, Journ. Geol., vol. 11, p. 481, fig. 19.
1910. *Helicotoma similis* SEELY, Vermont State Geol., Rep. 7, pl. 56, fig. 2.

A single, fragmentary, and somewhat weathered specimen agrees fairly well with WHITFIELD's description and figure (2) of *Helicotoma similis* from the Upper Canadian of the state of Vermont (Fort Cassin beds), and it is referred to that species with but little reservation, in spite of the rather poor state of preservation.

Locality: Cape Weber, loc. 1.

Helicotoma sp. ind.

Pl. 4, figs. 7—10.

The material consists of numerous specimens, which are so weathered or covered by adherent matter that the surface characters cannot be ascertained.

The shell is large, consisting of 4—5 whorls, the diameter of which

increases uniformly and so that the width of a whorl is always nearly twice that of the preceding one. The spire is very low. The sutures are deeply impressed. On the upper side the inner half of the whorls is slightly convex, whereas the outer half is slightly concave, with a narrow, faintly marked marginal ridge. The outer side of the whorls is gently convex and sub-vertical. On the lower side the whorls are uniformly convex. The umbilicus occupies about half the diameter of the shell.

One specimen shows a few strongly marked lines of growth, which curve gently backward from the suture to the margin.

Dimensions:	I	II	III	IV
Diameter of shell	17.0	22.0	46.0	c. 54.0 mm
Height - —	7.0	8.0	?	22.0 -
Width - the last whorl	4.0	6.0	12.0	14.0 -
Height - - - —	5.0	5.5	?	16.0 -

The material does not allow of any conclusions in regard to relationship to other species.

Locality: Mt. Gunvor, western slope of the summit; summit about 1 km south of Devon Canyon; Cape Weber, loc. 1, 6, and 7(?).

Genus **MACLURITES** Lesueur.

Maclurites sp.

Pl. 4, fig. 14; text fig. 15.

The species is represented by a single, badly preserved specimen, which cannot be disengaged from the very hard matrix; only the weathered upper side and the cross-section have been accessible for study.

The shell consists of 4 or 5 rather slender whorls, the upper side of which are but slightly convex, almost flat; the sides of the whorls are almost flat, sub-parallel, and form angles of about 50° or a little more with the plane of the perfectly flat spire. The height of the aperture is a little less than half the whole width of the shell. The umbilicus occupies about one-third of the whole shell width. The edge of the umbilicus is acute, the lowermost portion of the outer whorls being angular. The nature of the external shell surface is unknown.

Fig. 15. *Maclurites* sp. Vertical section. × 1.

Dimensions:

Diameter of shell	23.0 mm
— - umbilicus	7.5 -
Maximum height of shell	10.0 -

Remarks: "*Lecanospira* sp." of the preliminary list of fossils from the Cape Weber formation given by the writer in 1930[1]) is the same as the above described specimen, the cross-section of which was not known at that time.

The bad state of preservation prevents conclusions in regard to the affinities of the species.

Locality: Cape Weber, loc. 1.

Genus **ROUBIDOUXIA** ULRICH.

Roubidouxia n. sp.

Pl. 4, figs. 15—16.

This species is represented by a couple of poorly preserved specimens.

The shell is small, dome-shaped, consisting of about six slowly expanding whorls. The whorls are rhomboidal in cross-section; the outer slope is slightly sigmoidal in profile, slightly convex above and slightly concave below; the peripheral keel at the lowest portion of the whorl is moderately produced and fails to overlap on to the whorl below. The base is practically flat. The umbilicus occupies a little more than half the diameter of the shell. The surface markings are not preserved.

Dimensions:	I	II
Diameter of shell	17.0	21.0 mm
Height - —	8.0	10.0 -
Diameter - umbilicus	9.5	? -

Remarks: This species is easily distinguished from the species hitherto described by the dome-shaped spire; the specimens at hand, however, are very poorly preserved and do not allow of any use as types.

Locality: Mt. Gunvor, western slope of the summit; Cape Weber, loc. 1.

Genus et sp. ind.

Pl. 4, figs. 12—13.

A couple of very poorly preserved gastropods, which differ greatly from all of the preceding forms, are absolutely indeterminable; their general habit suggests some genus of the family Euomphalidae de KONINCK.

Locality: Mt. Gunvor, western slope of the summit.

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[1]) POULSEN, CHR., "Contributions to the Stratigraphy of the Cambro-Ordovician of East Greenland", Meddelelser om Grønland, vol. 74, p. 313. Copenhagen 1930.

CEPHALOPODA.

Genera et sp. ind.

Pl. 5, figs. 1—4.

Conches of cephalopods are rather common in the limestone of the Cape Weber formation, but, as a rule, they are very poorly preserved and usually appear as worthless sections on the weathered rock surface. The best specimens are figured on plate 5; however, they are not sufficiently complete for a generic identification. Two of the specimens (pl. 5, fig. 1—3) belong to the Endoceratidae.

A coiled genus is represented by small fragments of the conch.

Locality: Mt. Gunvor, western slope of the summit (the specimens represented by pl. 5, figs. 1 and 4); Cape Weber, loc. 7 (the specimen represented by pl. 5, figs. 2—3); fragments of coiled forms were found at the same localities.

CRUSTACEA.

Trilobita.

Genus **HYSTRICURUS** RAYMOND.

Hystricurus crassilimbatus n. sp.

Pl. 5, figs. 5—8.

This species is represented by a few cranidia, free cheeks, and fragments of the thorax.

The cranidium is moderately convex, with straight anterior margin.

The glabella (occipital ring included) is about 1.3—1.4 times as long as it is wide, attaining its greatest width just in front of the occipital furrow, strongly convex, subovate in outline, elevated considerably above the highest level of the fixed cheeks, evenly rounded in front, extending to the frontal furrow. The glabellar furrows are not developed as real furrows, but they are indicated by short lines without tuberculation, situated close to the axial furrow. The circumglabellar and occipital furrows are very deeply impressed. The occipital ring is narrow and but slightly rounded.

The rim is very thick and rounded, wide in front of the glabella, but tapering rather rapidly toward the facial suture. The anterior portion of the fixed cheeks is very narrow, without ocular ridge; the posterior limbs are not preserved, but the course of the facial suture, as appearing from the free cheek, shows that they have had the normal shape and size. The palpebral lobes are short, but rather strongly curved.

The course of the anterior branches of the facial suture has not

been ascertained, these portions of the cranidia and free cheeks being poorly preserved, but it seems probable that they extended forward to the rim as almost straight, slightly converging lines.

The associated free cheeks are wide, moderately convex, bordered antero-laterally by a very thick, rounded rim, which increases rapidly in width towards the genal angle where it is produced into a short, straight, obliquely backward-directed genal spine.

The associated thorax and pygidium (pl. 5, fig. 5) being poorly preserved do not allow of an adequate description.

The surface of all convex portions of the cranidium is strongly pustulose. The tuberculation of the free cheeks is less coarse; the rim of the free cheek is marked by delicate, raised, inosculating lines.

Dimensions:	I (Holotype)	II	
Length of cranidium	6.6	7.7	mm
— - glabella (occipital ring included)	5.8	6.6	-
Width - — at the base	4.0	c. 4.5	-
Maximum distance of eye from the glabella	?	c. 2.0	-

Remarks: Compared with the species hitherto described, *Hystricurus crassilimbatus* is easily distinguished by the narrower fixed cheeks and the very thick rim with its enormous increase in width towards the genal angle.

Locality: Upper end of Devon Canyon; summit about 1 km south of Devon Canyon; Cape Weber, loc. 6.

Genus **BOLBOCEPHALUS** WHITFIELD.

Bolbocephalus groenlandicus n. sp.

Pl. 5, figs. 9—13.

This species is represented by two cranidia and two pygidia; the specimens are fragmentary, but otherwise well preserved.

The cranidia are small, and they must originate from young individuals. Only the posterior half is preserved; this portion of the cranidium agrees almost perfectly with the corresponding part of young specimens of the genotype, *Bathyurus? seelyi* WHITFIELD[1]) from the Upper Canadian of Vermont (Fort Cassin beds). In consideration of the striking resemblance the best way in which to characterize the Greenland species is to call attention to the distinguishing characters in order to avoid a repetition of WHITFIELD's description. *Bolbocephalus groenlandicus* differs from *Bolbocephalus seelyi* (WHITFIELD) in the narrower,

[1]) WHITFIELD, R. P., Bull. Amer. Mus. Nat. Hist., vol. 1, 1886, no. 8, p. 339; ibid., vol. 3, 1890, no. 1, p. 35—37, pl. 3, figs. 1—6.

more sharply marked occipital furrow and in the shape of the occipital ring; in *Bolbocephalus groenlandicus* the occipital ring tapers toward the axial furrows, whereas in *Bolbocephalus seelyi* (WHITFIELD) it is equally broad throughout.

The pygidium is a little wider than it is long, with evenly curved postero-lateral margin, convex; the posterior margin is gently arched, viewed from behind. The axis is wide, depressed convex, and rising but slightly above the lateral lobes, occupying more than one-third of the whole width, and extending about three-fourths of the length, slightly tapering, somewhat truncate posteriorly, and divided by very faint transverse furrows into 5 axial rings. The axial furrow is shallow but distinct. The lateral lobes are sloping so as to form together with the axis an almost even arch; their segmentation is obscurely indicated by 3 narrow interpleural furrows, which terminate abruptly some distance from the lateral margin, and between which the pleural furrows are faintly indicated. The test is smooth, but natural casts of the interior are closely pitted.

Dimensions:	I	II
Width of glabella at the base	7.0	13.0 mm
Length of pygidium (Holotype)	23.0 mm	
Width - — —	28.0 -	
Length - axis	18.0 -	
Width - — at the anterior end	11.0 -	
— - — - - posterior -	8.5 -	

Remarks: The pygidium of *Bolbocephalus groenlandicus* closely recalls that described and figured by WHITFIELD as *Bolbocephalus? truncatus* WHITFIELD[1]), which, according to ULRICH (MS.), should be referred to *Bolbocephalus seelyi* (WHITFIELD); the Greenland species, however, is easily distinguished from the latter *inter alia* by the less convex, more distinctly segmented pygidium, and the longer pygidial axis.

Locality: Cape Weber, loc. 6; eastern part of the anticline on the south coast of Ella Island.

Genus **PETIGURUS** RAYMOND.

Petigurus groenlandicus n. sp.

Pl. 6, figs. 1—13.

This species is represented by numerous cranidia, free cheeks, and pygidia.

The cranidium is about 1.4 times as wide as it is long, approximately

[1]) WHITFIELD, R. P., Bull. Amer. Mus. Nat. Hist., vol. 3, 1890, no. 1, p. 37, pl. 2, figs. 6—8.

subtriangular in outline; the portion in front of the eyes slopes downward very steeply.

The glabella (occipital ring included) is about 1.45—1.6 times as long as it is wide, attaining its greatest width at the posterior margin, expanding slowly from the occipital furrow towards the front, moderately convex posteriorly, but strongly convex and rounded in front, projecting beyond the very narrow, rounded frontal rim; there are no traces of glabellar furrows. The preglabellar, occipital, and axial furrows are deeply impressed. The occipital ring is broad and rather flat.

The fixed cheeks are extremely narrow in front of the palpebral lobes. The palpebral lobes are flat, relatively short, and strongly curved. The posterior limbs are wide, sloping gently downwards from the axial furrow. The posterior marginal furrow is broad and deep.

The anterior branches of the facial suture are almost rectilinear, parallel to the axial furrows; the posterior branches turn abruptly outwards to cut the posterior margin near the genal angle at rather acute angles.

The free cheeks are wide, moderately convex, bordered anterolaterally by a thick, rounded rim, which increases gradually in width towards the genal angle, where it is produced into a long, stout, slightly curved genal spine, which is directed obliquely backward. The lateral marginal furrow is shallow, but well defined, and like the rim it increases gradually in width towards the genal angle.

The pygidium is 1.5—1.7 times as wide as it is long, almost semicircular or (frequently) somewhat triangular in outline, strongly convex, with the axis elevated considerably above the highest level of the lateral lobes. The axis occupies a little less than one-third of the width of the pygidium, about 1.8 times as long as it is wide, moderately convex, slightly conical, obtuse, not reaching to the posterior margin, divided by broad, deeply impressed furrows into 4 narrow, rounded axial rings and a terminal portion, the length of which corresponds to two axial rings. The axial furrow is relatively narrow, but well impressed. The lateral lobes are sloping so as to form an almost even arch, divided by deeply impressed interpleural furrows into 4 segments with strongly marked pleural furrows, which terminate abruptly some distance from the margin.

The surface of the test (except the furrows) is ornamented with numerous tubercles and shows an extremely delicate granulation between the tubercles, seen under a strong lens. Casts of the interior of the test show numerous minute pits in addition to the tuberculation.

Dimensions:	I (Holotype)	II	III	
Length of cranidium	14.0	20.0	29.0	mm
Width - —	?	?	c. 40.0	-
Length - glabella (occipital ring included)	14.0	20.0	29.0	-
Width - — at the base	8.5	c. 12.5	18.0	-

	I	II	III	
Length of pygidium	11.5	16.0	c. 28.0	mm
Width - —	18.0	25.0	44.0	-
Length - axis	10.0	14.0	c. 23.0	-
Width - — at the anterior end	5.5	8.0	13.0	-
— - — - - posterior -	4.0	5.5	9.0	-

Remarks: The cranidium of *Petigurus groenlandicus* shows great resemblance to that of *Petigurus nero* (BILLINGS) (the genotype)[1]), but it is easily distinguished by its more convex glabella and by the tuberculation being less coarse. The pygidium of *Petigurus groenlandicus* differs greatly from that of *Petigurus nero* (BILLINGS), above all in the narrower furrows and in the lateral lobes being less rugged.

A single glabella (pl. 6, fig. 1), which differs from the holotype in having more spaced tubercles, may represent a distinct species, but it is provisionally referred to *Petigurus groenlandicus*, with which it agrees very well in other respects.

Locality: Mt. Gunvor, western slope of the summit; upper end of Devon Canyon; mountain summit about 1 km south of Devon Canyon; Cape Weber, loc. 1 and 6.

Genus **BATHYURINA** n. g.

Bathyurina is a trilobite type possessing certain features known in *Bathyurus* BILLINGS and *Bathyurellus* BILLINGS; it agrees fairly well with the former in the shape of the glabella and with some species of the latter in having extremely large, semi-annular eyes. Compared with *Bathyurus*, it is easily distinguished by its enormous eyes, and it differs from *Bathyurellus* in the shape of the glabella, the lack of a concave anterior border, and in the more advanced position of the eyes.

The most characteristic feature of the genus *Bathyurina* is the vertical preglabellar field and the anterior portion of the fixed cheeks, which likewise slopes off vertically.

The genotype (*Bathyurina megalops* n. sp.) is for the present the only known species of this genus.

[1]) BILLINGS, E., "Palaeozoic Fossils", Geol. Surv. Canada, 1865, p. 260, fig. 243.

Bathyurina megalops n. sp.

Pl. 6, figs. 14—15; pl. 7, fig. 1.

This species is represented by two cranidia, which are somewhat fragmentary, but otherwise well preserved.

The glabella (occipital ring included) is about 1.6 times as long as it is wide, attaining its greatest width opposite the anterior end of the palpebral lobe, tapering inconspicuously toward the posterior end, strongly convex, elevated a little above the highest level of the fixed cheeks, evenly rounded in front, separated from the rim by a short preglabellar field. The glabellar furrows are indicated by 3 (4?) pairs of scarcely visible impressions, which are situated close to the axial furrow. The preglabellar furrow is narrow and moderately impressed, whereas the axial furrow and the occipital furrow are very wide and deep. The occipital ring is narrow and rather flat.

The preglabellar field slopes vertically downward to the wide, well defined, gently curved frontal furrow. Paralleling the frontal furrow is a narrow(?), rounded(?) rim, which, when viewed from the front, is strongly arched.

The fixed cheeks are very narrow; the posterior limbs are not preserved, but they are estimated to have been short, sub-triangular, and sloping rather steeply downward from the axial furrows. The palpebral lobes are very large, semi-circular. Ocular ridges are not developed.

The anterior branches of the facial suture extend from the palpebral lobes as straight, diverging lines, which cut the rim at right angles.

The surface of the test (except the furrows and the preglabellar field) is finely granulate. Seen under a strong lens the natural cast of the interior shows a great number of minute pits.

Dimensions:	I	II (Holotype)	
Length of cranidium	10.0	13.5	mm
Width - — between the eyes	13.0	19.0	-
Length - glabella (occipital ring included)	10.0	13.5	-
Width - — at the anterior end	6.5	8.5	-
— - — - - base	?	8.0	-
Maximum distance of eye from the glabella	3.0	6.0	-
Distance - - — - anterior margin	1.5	2.0	-

Locality: Mt. Gunvor, western slope of the summit.

Genus **BATHYURELLUS** Billings.

Bathyurellus teicherti n. sp.

Pl. 7, figs. 2—5.

This species is represented by a considerable number of cranidia, a few free cheeks, and a single pygidium.

The cranidium is a little wider than it is long, moderately convex.

The glabella (occipital ring included) is 1.6—1.7 times as long as it is wide, moderately convex, cylindrical, bluntly acuminate in front, only slightly elevated above the highest level of the fixed cheeks, separated from the rim by a short preglabellar field. The only visible furrow on the glabella is the occipital furrow, which is narrow and but faintly indicated. The preglabellar and axial furrows are narrow, but very distinctly marked. The occipital ring is narrow and rather flat.

The preglabellar field slopes rather steeply downwards to the rim, which is very wide, flat or slightly concave, nearly horizontal, with slightly and evenly curved anterior margin. There is no real frontal furrow, but paralleling the anterior margin is a strongly marked boundary line formed by the angle between the rim and the preglabellar field.

The fixed cheeks are narrow, moderately convex. Ocular ridges have not been observed in any of the specimens at hand. The palpebral lobes are very long, narrow, strongly curved, almost semi-circular, extending from a point opposite the centre of the cranidium to the occipital region. The posterior limbs are short, very narrow, sloping gently downwards from the axial furrow. The posterior marginal furrow is narrow but well defined.

The anterior branches of the facial suture extend obliquely outwards to the rim; then they turn obliquely inward, crossing the rim as converging lines. The posterior branches of the facial suture are rectilinear, strongly diverging.

The free cheek is small, strongly convex, bordered antero-laterally by a wide, slightly concave rim[1]). The genal angle is produced into a long, rather flat, gently curved genal spine, which is very wide at the base and slowly tapering; the concave marginal rim of the cheek is continued on the spine as a narrow furrow.

The pygidium is almost elliptic in outline, about 1.5 times as wide as it is long. The anterior angles are obliquely truncated for about half the width of the lateral lobes. The axis is narrow, strongly convex, decidedly conical, obtusely rounded posteriorly, considerably elevated above the other parts of the pygidium, occupying about two-thirds of

[1]) Fig. 4 on pl. 7 is misleading as regards the anterior portion of the border, which is slightly concave. Unfortunately the figure does not show this character correctly.

the whole length. Only the axis and a very small adjacent portion of the lateral lobes are convex; outside of this the whole of the pygidium is concave. The axial furrow is narrow but fairly well defined. Extremely faint traces of segmentation are found in the anterior part of the pygidium.

Cranidium, free cheeks, and pygidium show a very delicate ornamentation consisting of more or less irregular, inosculating lines (furrows), seen under a strong lens.

Dimensions:	I (Holotype)	II	III	IV	V	VI	
Length of cranidium	9.0	11.0	?	?	20.0	21.0	mm
Width - —	c. 11.0	?	?	?	?	?	-
— - rim	1.7	1.7	2.8	?	2.8	4.0	-
Length - preglabellar field	0.6	1.0	1.5	?	3.0	3.0	-
— - glabella (occipital ring incl.)	6.7	8.0	?	15.0	14.2	14.0	-
Width - — at the base ..	4.2	4.6	?	?	?	8.8	-
Maximum distance of eye from the glabella...	3.3	?	?	7.0	?	?	-
Distance of eye from the anterior margin ...	3.7	?	?	?	?	?	-
— - - — - posterior margin ...	1.3	?	?	?	?	?	-

Length of pygidium.....	5.0	mm
Width - —	7.4	-
Length - axis	3.3	-
Width - — at the anterior end	2.1	-

Remarks: It appears from the measurements that some variation in the width of the frontal rim and in the length of the preglabellar field occurs.

Bathyurellus teicherti belongs possibly to the same specific group as *Bathyurellus fraternus* BILLINGS[1]) from the Chazyan of Cow Head, Newfoundland, and Mingan Islands, Canada, and *Bathyurellus expansus* BILLINGS[2]) from the Canadian (Beekmantown) at Stanbridge, Quebec; the Greenland species, however, is immediately distinguished *inter alia* by the enormous palpebral lobes and by the shape and relative size of the glabella.

Locality: Mt. Gunvor, western slope of the summit; mountain summit

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[1]) BILLINGS, E., "Palaeozoic Fossils", Geol. Surv. Canada, 1865, p. 267, fig. 251.
[2]) Ibid., p. 319, fig. 306.

about 1 km south of Devon Canyon; Cape Weber, loc. 1 and 6; eastern part of the anticline on the south coast of Ella Island.

Bathyurellus ? affinis n. sp.

Pl. 7, figs. 6—7.

This species is known from a few pygidia.

The pygidium is a little more than twice as wide as it is long, approximately semi-circular in outline. The axis is narrow, rather flat, slightly elevated above the lateral lobes, rapidly tapering, abruptly truncated posteriorly, occupying less than one-fourth of the whole width and a little more than half the whole length of the pygidium, divided by faintly indicated furrows into 5 (6?) segments. The axial furrow is obscurely indicated. The lateral lobes have a small, triangular, slightly convex, smooth area on each side, next the axis; outside of this the whole pygidium is strongly concave. The postero-lateral margin rises to about the same level as the crest of the axis. The test is smooth.

Dimensions:	I	II (Holotype)	
Length of pygidium	c. 4.0	5.5	mm
Width - —	8.5	11.5	-
Length - axis	2.5	3.0	-
Width - — at the anterior end	2.0	3.0	-
— - — - - posterior -	1.0	1.5	-

Remarks: Bathyurellus? affinis belongs to the same specific group as *Bathyurellus validus* BILLINGS[1]) from the Chazyan at Crown Point, New York; the Greenland species, however, differs from the mentioned species in having a convex area on each side of the axis. The pygidium is also very reminiscent of that of *Bathyurellus minor* RAYMOND[2]), which differs from the Greenland species in the same way as *Bathyurellus validus. Bathyurellus? affinis* and the mentioned American species differ in the general characters of their pygidia so much from the pygidium assigned to the genotype, *Bathyurellus abruptus* BILLINGS[3]), that they should probably be grouped as a sub-genus of *Bathyurellus* or as an independent genus; on the whole a revision of the family Bathyuridae is much needed. Thus the reference of the species here described to *Bathyurellus* is only provisional.

Locality: Eastern part of the anticline on the south coast of Ella Island.

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[1]) BILLINGS, E., "Palaeozoic Fossils", Geol. Surv. Canada, 1865, p. 267, fig. 252.

[2]) RAYMOND, P. E., "Trilobites of the Chazy Formation of Vermont", 7th Rep. Vermont Geol. Surv., 1910, p. 219, pl. 32, fig. 16.

[3]) BILLINGS, E., "Palaeozoic Fossils", Geol. Surv. Canada, 1865, p. 263, fig. 250.

Bathyurellus sp.

Pl. 7, fig. 8.

A very fragmentary pygidium probably represents a new species; its bad state of preservation, however, prevents an adequate description and the use of the specimen as a type.

Locality: Cape Weber, loc. 6.

Genus **NIOBE** ANGELIN.

Niobe groenlandica n. sp.

Pl. 7, fig. 11.

This species is represented by a somewhat fragmentary but otherwise well preserved pygidium.

The pygidium is slightly convex and appears to be approximately semi-circular in outline, with moderately convex axis and a very wide, slightly convex postero-lateral border; the anterior angles are obliquely truncated for about half the width of the lateral lobes (estimated). The axis is about 1.5 times as long as it is wide, conical, rapidly tapering, occupying a little more than two-thirds of the whole length of the pygidium, divided by faintly marked furrows into 6 (7?) axial rings. The axial furrow is narrow but distinctly marked. The lateral lobes have a small, slightly convex, sub-triangular area on each side, next the axis, showing 4 well marked pleural segments. All parts of the test are ornamented with fine, irregular, terraced lines.

Dimensions:

Length of pygidium	c. 14.5 mm	
Width - —	c. 25.0 -	(estimated)
Length - axis	c. 9.0 -	
Width - — at the anterior end	c. 6.0 -	
— - — - - posterior -	c. 4.0 -	
— - the postero-lateral border at the third pleural segment	6.0 -	

Remarks: The most characteristic features of the pygidium of *Niobe groenlandica*, the very short axis, the small number of pleural ribs, and the enormous width of the postero-lateral border, make this species easily distinguishable from the species hitherto described.

Locality: Mt. Gunvor, western slope of the summit.

Niobe brevicauda n. sp.

Pl. 7, figs. 9—10, 13(?).

This species is represented by three pygidia.

The pygidium is a little less than twice as wide as it is long, sub-

elliptic in outline, slightly convex, with a very wide, nearly flat postero-lateral border. The anterior angles are obliquely truncated for about half the width of the lateral lobes. The axis is about 1.5 times as long as it is wide, moderately convex, conical, occupying a little less than two-thirds of the whole length of the pygidium and a little less than one-fourth of the whole width, divided by narrow furrows into 6(?) flat axial rings. The axial furrow is narrow but well marked. The lateral lobes are slightly convex inside of the border, divided into 4 flat pleural ribs by narrow, deeply impressed furrows, which terminate as shallow impressions on the proximal part of the border. The test is ornamented with fine, irregular, terraced lines.

Dimensions of the most complete specimen:

Length of pygidium	20.0 mm
Width - —	c. 36.0 -
Length - axis	c. 12.0 -
Width - — at the anterior end	8.0 -

Remarks: The specimen represented by fig. 10 on pl. 7 shows that the doublure corresponds fairly well to the width of the postero-lateral border.

The pygidium of *Niobe brevicauda* shows much resemblance to that of the preceding species, from which it differs especially in being wider and less convex.

Locality: Upper end of Devon Canyon; Cape Weber, loc. 1.

Genus **CERATOPELTIS** n. g.

This genus is based upon a pygidium, which has the general characters of the genera *Mansuyia* Sun and *Kaolishaniella* Sun from the Upper Cambrian of North China[1]); it differs, however, from these genera in being narrower and in having a very short axis, relatively short and thick spines, and an extremely broad posterior border. The systematic position of *Ceratopeltis* is unknown at present, and the affinity of this genus to the above-mentioned genera is very questionable.

The genotype, *Ceratopeltis latilimbata* n. sp., is the only known species.

Ceratopeltis latilimbata n. sp.

Pl. 7, fig. 14.

This species is known from a single, slightly weathered, but otherwise well preserved pygidium.

[1]) Sun, Y. C., "The Upper Cambrian Trilobite-Faunas of North China", Palaeontologia Sinica, ser. B, vol. 7, fasc. 2, Peiping 1935.

The pygidium is a little longer than it is wide (exclusive of lateral spines), sub-elliptic in outline, moderately convex. The axis is about twice as long as it is wide, conical, divided into 8(?) narrow axial rings, occupying about a fourth of the whole width of the pygidium and about half the whole length. The lateral lobes do not show any division into pleural segments except the anterior one, which is produced into rather thick, backward directed, and slightly curved lateral spines. The border is slightly convex, extremely wide, attaining its greatest width at the median line.

Dimensions:

Length of pygidium	4.0	mm
Width - —	c. 3.7	- [1]
Length - axis	c. 2.0	-
Width - — at the anterior end	c. 1.0	-

Locality: Cape Weber, loc. 1.

Incertae sedis.

Pl. 8, figs. 1—5.

Four pygidia and a free cheek are more or less incomplete and fail to show distinct generic characters. Two of the pygidia, however, are suggestive of well-known genera; the pygidium figured as pl. 8, fig. 3 may represent a species of the genus *Hystricurus* RAYMOND, and that figured as pl. 8, fig. 4 may belong to a species of the genus *Bathyurus* BILLINGS.

Locality: Mt. Gunvor, western slope of the summit (pl. 8, fig. 1); upper end of Devon Canyon (pl. 8, fig. 3); eastern part of the anticline on the south coast of Ella Island (pl. 8, figs. 2, 4—5).

ALGAE?

Pl. 3, fig. 13.

A single specimen of the so-called *Cryptozoon* collected by Dr. KOCH may originate from the Cape Weber formation.

Locality: Cape Weber.

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[1] Exclusive of lateral spines.

FOSSILS FROM THE NARWHAL SOUND FORMATION

CRUSTACEA.

Trilobita.

Genus **BATHYURELLUS** BILLINGS.

Bathyurellus ? sp.

Pl. 7, fig. 12.

A single fragment of a pygidium should possibly be referred to the genus *Bathyurellus* BILLINGS. The specimen is so incomplete that it is impossible to give an adequate description, but a few of the most important characters should be mentioned.

The axis is rather large, moderately convex, apparently subcylindrical; the axial segmentation is only visible in places where the test has been removed. The axial furrow is shallow. The lateral lobes are distinctly divided by deeply impressed interpleural furrows into pleural segments, at least four in number; the interpleural furrows do not extend beyond the proximal (convex) portion of the lateral lobes, and the pleural furrows are only visible on the slightly concave border; the latter feature is met with in some genera of the Bathyuridae, especially in *Bathyurellus*.

Locality: Eastern part of the anticline on the south coast of Ella Island.

EUCRUSTACEA.

Ostracoda.

Genus **Heterochilina** n. g.

The shell is suboblong, of moderate size, rarely exceeding 5 mm in length. The ventral edge of the left valve is rounded so as to fit in with a furrow in the ventral edge of the right valve; thus the overlap is inconspicuous. The valves are very unequal; the left valve is similar to

that of *Leperditia* ROUAULT; the right valve on the other hand has a quite unique shape, being moderately convex posteriorly and greatly swollen antero-ventrally, culminating in a broad, rounded ridge, which rises gradually near the ventral margin and extends obliquely upwards toward the anterior margin. Both valves show an "eye tubercle".

Heterochilina is undoubtedly closely related to *Leperditia* ROUAULT and *Isochilina* JONES, from which it is easily distinguished by the peculiar shape of the right valve. It seems natural to place this genus in the family *Leperditiidae* JONES.

The genotype, *Heterochilina obliqua* n. sp., is at present the only known species of this genus.

Heterochilina obliqua n. sp.

Text figs. 16—17.

This species is represented by several specimens, but only few of them are well preserved.

The carapace is of moderate size, 1.4—1.6 times as long as it is high, obliquely subovate in outline, strongly convex. The greatest height

Fig. 16.

Fig. 17.

Fig. 16. *Heterochilina obliqua* n. g. et n. sp. Lateral and anterior views of right valves. × 3. The specimen to the left is the holotype.

Fig. 17. *Heterochilina obliqua* n. g. et n. sp. Lateral and posterior views of left valves. × 4.

is attained at the mid-length. The cardinal line is straight or (rarely) slightly concave, in length varying from about three-fourths to four-fifths of that of the valves. The anterior cardinal angle varies from 105° to 120°, whereas the posterior cardinal angle as a rule is less variable, about 130°.

The right valve has narrow, indistinctly defined anterior and posterior borders. The antero-ventral swelling or ridge gives the valve a somewhat angular appearance when viewed from the ends. On the inner side of the ventral edge of the right valve there is a long row of small, closely set papillae.

The left valve, which is less convex than the right one, has a low ridge-like thickening along the dorsal margin.

Both valves show a wide, shallow depression or undefined sulcus just behind the eye tubercle.

The surface is smooth.

Dimensions:

Right valve:	I (Holotype)	II	
Length	5.25	6.40	mm
Width	3.75	4.00	-
Left valve:	III	IV	
Length	3.10	3.30	-
Width	2.00	2.15	-

Locality: Eastern part of the anticline on the south coast of Ella Island.

THE STRATIGRAPHICAL OCCURRENCE OF THE FAUNAS

It has been very difficult to investigate the stratigraphical occurrence of the faunas, because the exposures are most frequently found in very steep, often almost vertical, rocky walls, the higher portions of which are inaccessible, and, last but not least, because the time available for examination of the huge East Greenland series of Ordovician strata was so limited that an attempt at a subdivision of the formations into zonal units had to be abandoned. There are, however, a few facts concerning this question which deserve mention.

Supposing that the greater part of the *Cass Fjord formation* (about 300 m) is represented in the small valley between Cape Weber and Dolomite Point (fig. 4, p. 13), which appears probable, the beds exposed in loc. 3 belong to the lower third of the series, whereas the localities 2 and 5 represent the middle third, and loc. 4 the upper third. The stratigraphical grouping of the species which have been collected in this region is shown in the following table:

	Lower (loc. 3)	Middle (loc. 2 and 5)	Upper (loc. 4)
Genus et sp. ind. (cystid)	..	..	*
Lingulepis tenuilineata n. sp.	..	*	*
Hystricurus armatus n. sp.	*	*	*
— *nudus* n. sp.	*	..	..
— *sulcatus* n. sp.	*	..	..
Symphysurina elegans n. sp.	*	..	..
— *robusta* n. sp.	*	..	..
— cf. *woosteri* ULRICH	..	..	*
— sp.	..	*	..

Attention should be drawn to the fact that the collection from the lower part of the series (loc. 3) consists of a great number of specimens, and may be considered approximately exhaustive. On the other hand,

the material from the middle and upper parts of the Cass Fjord formation cannot be taken as a complete representation. Thus there is no absolutely satisfactory basis on which to subdivide the Cass Fjord formation; judging from the grouping of the species of *Symphysurina*, however, the writer is inclined, at least provisionally, to divide the Cass Fjord formation into a *lower sub-zone, characterized by Symphysurina elegans*, and an *upper sub-zone, characterized by Symphysurina* cf. *woosteri.*

The thickness of the *Cape Weber formation* has been estimated by the writer at about 600 m. In the greater part of this huge series of strata the search for fossils has been in vain. The writer has only found two fossiliferous horizons; the one, which has furnished the Cape Weber collections, is in the lower part of the formation, the other, which is represented by a small collection of fossils from the south coast of Ella Island, is found in the middle part. The latter horizon has only afforded three determinable fossils viz. *Bolbocephalus groenlandicus* n. sp., *Bathyurellus teichertii* n. sp., and *Bathyurellus? affinis* n. sp. The first two species are also found in the lower part of the formation. Accordingly, the material at hand does not allow of any division of the Cape Weber formation into sub-zones.

It appears from the table on p. 69 that the fossiliferous beds in Strindberg Land hold essentially the same relatively rich fauna as those of Cape Weber, and it seems probable that they belong to one and the same horizon.

As mentioned above (p. 18), future research in the Mt. Bastion syncline may result in the discovery of slightly younger fossiliferous horizons in the *Narwhal Sound formation* than that found by the writer in the basal part of this series of strata.

STRATIGRAPHIC CORRELATIONS

The East Greenland Lower Cambrian is followed by two sedimentary formations, the *Hyolithus Creek* formation and the *Dolomite Point* for-

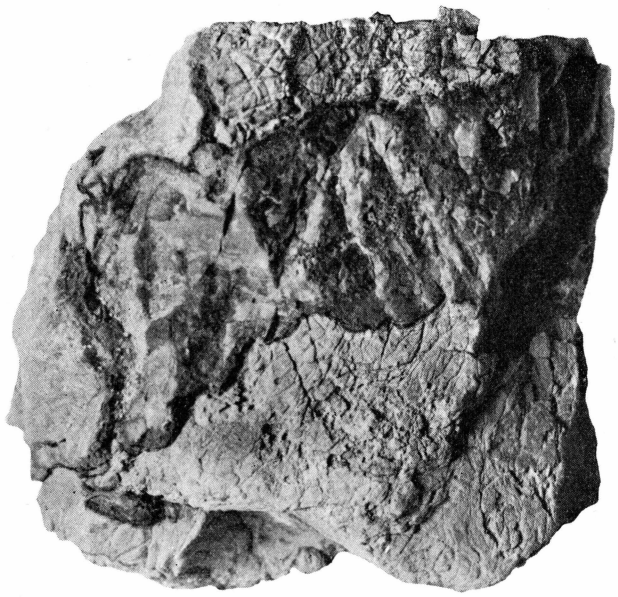

Fig. 18. Flint band in dolomite of the Dolomite Point formation. × 1.

mation, the age of which cannot be determined with certainty; the former is destitute of fossils, whereas the latter contains irregular lumps or (rarely) bands of Flint (fig. 18) and *stromatolites*, which are more or less comparable to *Cryptozoon* and similar structures (pl. 8, fig. 7). In the writer's opinion the presence of such greatly varying and indefinite forms as those occurring in the Dolomite Point formation do not allow of conclusions concerning the age and correlation of the strata.

Nothing can be said with regard to the age of the two formations in question except that *they were deposited in the period between the Lower Cambrian and the basal Ordovician.*

The disconformity between the Dolomite Point formation and the

overlying Cass Fjord formation is indicated by the abrupt change of the nature of the sediments.

The fauna of the *Cass Fjord* formation is especially characterized by the presence of the genera *Sinuopea* ULRICH, *Hystricurus* RAYMOND, and *Symphysurina* ULRICH.

According to ULRICH and BRIDGE[1]) "*Sinuopea* is one of the most common and one of the most widely distributed genera of early Paleozoic gastropods. It appears to be limited to the Cambrian and the proposed Ozarkian system of ULRICH".

The genus *Hystricurus* is represented by a great many different forms in the North American *Gasconade* formation (Upper Ozarkian); *Hystricurus*, however, also occurs in the *Canadian* (Beekmantown).

According to WALCOTT[2]) the stratigraphic range of *Symphysurina* is "Lower or Middle to Upper Ozarkian".

The brachiopod genera of the Cass Fjord formation, *Lingulepis* HALL and *Eoorthis* WALCOTT are well-known in the Ozarkian, but their stratigraphic range is very conspicuous, and, accordingly, they must be left out of consideration in this connection. It appears, however, from the other genera mentioned above that we have to do with an unmistakable Ozarkian fauna.

It is by no means the intention of the writer to take up a definite attitude with reference to the standing discussion on the so-called Ozarkian problem, because the material at hand does not permit of far-reaching conclusions; but a few facts, which throw new light on the question of the stratigraphic position of some Ozarkian formations, should be mentioned.

The discovery of graptolites in the rocks of the Cass Fjord formation is of considerable interest from a stratigraphic point of view. The new dendroid genus, *Ophiograptus*, is of minor importance in this respect, but the find of *Clonograptus* sp. (closely related to or possibly identical with *Clonograptus tenellus* (LINNARSSON) var. *callavei* LAPWORTH) and *Bryograptus*? sp. shows clearly that *the Cass Fjord formation is a stratigraphic equivalent of the upper portion of the Scandinavian Dictyonema shales and of the Clonograptus zone of the British Shineton shales* (*Tremadocian*).

In British Columbia the *Chushina* formation, which WALCOTT[3])

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[1]) BRIDGE, J., "Geology of the Eminence and Cardareva Quadrangles", Missouri Bureau of Geology and Mines, vol. 24, 2. ser., 1930, p. 193.

[2]) WALCOTT, C. D., "Cambrian and Ozarkian Trilobites", Smiths. Misc. Coll., vol. 75, no. 3, 1925, p. 109.

[3]) WALCOTT, C. D., "Pre-Devonian Paleozoic Formations of the Cordilleran Provinces of Canada", Smiths. Misc. Coll., vol. 75, no. 5, 1928, p. 226; p. 358.

regarded as equivalent to a portion of the Ozarkian *Mons* formation, has yielded corresponding fossil evidence. WALCOTT gives the following list of fossils from one of the type localities, Billings Butte (61 q):

"*Lingulella ninus* WALCOTT
— *ibicus* WALCOTT
Obolus ino WALCOTT
Acrotreta atticus WALCOTT
— *discoideus* SALTER
Eoorthis putillus (MEEK)
Billingsella archeas WALCOTT
Syntrophia sp.
Endoceras robsonensis WALCOTT
Walcottoceras? *monsensis* (WALCOTT)
Moxomia hecuba WALCOTT
Hystricurus bituberculatus (WALCOTT) and other species
Apatocephalus sp.
Kainella billingsi WALCOTT and at least seven other species
Symphysurina, at least seven species
Xenostegium taurus WALCOTT
Leiostegium, at least six species of this and related genera
There are also many other species that have not been named".

In 1930 RUEDEMANN[1]) described specimens of *Dictyonema flabelliforme* (EICHWALD) var. *anglica* BULMAN from the same formation and locality and arrived at the conclusion that "The occurrence of this graptolite in the Chushina formation suggests that that part of the supposed Ozarkian is at the Cambrio-Canadian boundary". In Great Britain, *Dictyonema flabelliforme* var. *anglica* occurs in the transitional beds of the Shineton shales, slightly above the *Dictyonema flabelliforme* zone.

It appears from the above that *the Chushina and Cass Fjord formations are practically contemporaneous.*

Another formation, which may be compared with the Cass Fjord formation, is a portion (zone 2—4) of the so-called *McKay* group of the Brisco-Dogtooth area, British Columbia, which contains *inter alia* *Symphysurina*, *Hystricurus*, and *Apatocephalus*[2]).

As mentioned above (p. 65) the Cass Fjord formation should be removed from the Ozarkian and placed in the basal Ordovician (Tremadocian). This is in complete agreement with the occurrence of the genus

[1]) RUEDEMANN, R., "A Graptolite from the Chushina Formation", American Journ. Sci., vol. 20, 1930, p. 308.

[2]) EVANS, C. S., "Brisco-Dogtooth Map-Area, British Columbia", Geol. Surv. Canada, 1933, p. 129.

Apatocephalus BRÖGGER in the contemporaneous Chushina fauna, as it is one of the characteristic genera of the basal Ordovician in Great Britain (Shineton shales) and Scandinavia (*Ceratopyge* beds).

The recent finds of Lower Ordovician graptolites in "Ozarkian" formations have made a revision of several of the supposed Ozarkian formations in America highly desirable in order to settle the question of their exact stratigraphic position.

The following list of fossils from the Cass Fjord formation shows the geographical distribution of the species.

Fossils of the Cass Fjord Formation	East Greenland			N.W. Greenland
	C. Weber	Ella Isl.	Musk Ox Fj.	C. Clay
Ophiograptus inexpectans n. g. et n. sp.	..	rr	..	..
Bryograptus? sp.	..	rr	..	..
Clonograptus sp. (cf. *C. tenellus* (LNRS.) var. *callavei* LAPW.)	..	rr	..	..
Genus et sp. ind. (hydrophorid)	cc	rr	..	cc
Lingulepis tenuilineata n. sp.	cc	rr	..	?
Eoorthis sp.	..	rr	..	..
— ? sp. ind.	..	..	..	rr
Sinuopea whittardi n. sp.	..	rr	rr	rr
Genus et sp. ind. I (gastropod)	..	..	..	rr
— - - - II —	..	..	..	rr
— - - - (cf. *Rhachopea*)	..	rr	..	..
Hystricurus armatus n. sp.	cc	rr	..	..
— *longicephalus* POULSEN	..	..	..	rr
— *nudus* n. sp.	rr	..	..	..
— *ravni* POULSEN	..	..	..	cc
— *sulcatus* n. sp.	rr	..	..	..
Symphysurina elegans n. sp.	cc	..	..	..
— *robusta* n. sp.	rr	..	..	..
— cf. *woosteri* ULRICH	r	rr	..	..
— sp.	rr	..	..	..

rr = 1—5 specimens; r = 6—15; cc = 30 +.

It appears from the material at hand that the Cass Fjord formation of East Greenland and that of Northwest Greenland have only a few species in common viz. the undeterminable hydrophorid, *Sinuopea whittardi*, and possibly *Lingulepis tenuilineata*. *Sinuopea whittardi* may provisionally be regarded as the guide fossil of the Cass Fjord formation. The material from Cape Clay in Northwest Greenland was collected by Dr. LAUGE KOCH on a sledge journey under difficult conditions, so that

the collections had to be considerably restricted; it therefore seems probable that by renewed investigations at Cape Clay it will be possible to find several of the East Greenland species, for instance some species of the genus *Symphysurina*.

Lithologically the strata in both regions agree almost perfectly, in spite of the fact that in East Greenland they were deposited in a geosyncline, whereas the corresponding sediments in the Cape Clay region of Northwest Greenland are extrageosynclinal deposits. In both regions the formation is developed as soft greyish-green shales alternating with limestone beds, which are, with few exceptions, intraformational conglomerates. In Northwest Greenland the Cass Fjord formation attains a thickness of about 400 m, whereas in East Greenland the thickness does not exceed 300 m.

The fauna of the *Cape Weber* formation is difficult to compare with other fossil faunas, because it consists mainly of new species; it holds, however, the trilobite genera *Bathyurellus* BILLINGS, *Bolbocephalus* WHITFIELD, and *Petigurus* RAYMOND, which are typical of the Lower Ordovician of eastern North America.

Bolbocephalus is known from the Upper Canadian of Northwest Greenland (Nunatami formation) and from the upper portion of the Beekmantown limestone of Vermont (Fort Cassin beds).

As far as is known, *Petigurus* has about the same stratigraphic range as *Bolbocephalus*, and it is likewise recorded from eastern North America (Vermont, New York, and Newfoundland); on the European side of the Atlantic ocean *Petigurus* is recorded from northern Scotland (Durness dolomite).

Bathyurellus is one of the most common trilobite genera of the Lower Ordovician of eastern North America, where it occurs partly in the Canadian, partly in the Chazyan; this genus is also represented in the Upper Canadian Nunatami formation of Northwest Greenland.

It appears from the foregoing that, judging from the predominant trilobite genera, *the Cape Weber formation should be referred to the Upper Canadian*; none of the other genera of the Cape Weber fauna are contrary to this view. In fact the affinity of the Cape Weber fauna to Upper Canadian faunas of eastern United States and Newfoundland is unmistakable, and there can be no doubt that the East Greenland trough had some connection with the North Appalachian province (the St. Lawrence geosyncline); the find of a gastropod comparable to *Helicotoma similis* WHITFIELD, one of the species of the Upper Canadian Fort Cassin fauna, in the Cape Weber formation confirms this view. In the writer's opinion the difference between the faunas in the two regions in question can be explained as a result of different climatic conditions.

The *Cape Weber* formation and the Northwest Greenland *Nunatami* formation have the genera *Bathyurellus* and *Bolbocephalus* in common, but for the rest the two faunas are very different. The Cape Weber fauna has not yet been met with in Northwest Greenland, and the question now is whether it is contemporaneous with the Nunatami fauna or not. This question cannot be answered without taking some of the results of the *Oxford University Ellesmere Land Expedition* 1934—35 into consideration. Dr. R. BENTHAM, who was the geologist of the expedition, succeeded in collecting a great number of Lower Palaeozoic fossils from several formations on the southeast coast of Grinnell Land. The greater part of this collection was sent to the writer for study and description. The material proves the existence of the Nunatami formation in Grinnell Land, which is not surprising, as the distance from the localities in question to Nunatami does not exceed 250 km. In addition to the Nunatami fauna, Dr. BENTHAM found fossils which evidently belong to another fauna; judging from the geological conditions these fossils are younger

Fossils of the Cape Weber Formation	Greenland						America	
	Mt. Gunvor	Devon Canyon	Mt. 1 km S. of Devon Canyon	C. Weber	C. Elisabeth	South coast of Ella Isl.	Grinnell Ld.	Vermont (U. S. A.)
Genus et sp. ind. (spongiae)	..	..	..	..	rr	..	..	..
Archaeorthis groenlandica n. sp.	cc	r	cc	r	..	..	*	..
Polytoechia sp. ind.	..	..	..	rr	..	..	..	..
Genus et sp. ind. (pelecypod)	..	..	..	rr	..	..	..	..
Helicotoma similis WHITFIELD?	..	..	..	rr	..	..	..	*
— sp. ind.	r	..	rr	r	..	..	R	..
Maclurites sp.	..	..	..	rr	..	..	..	..
Roubidouxia n. sp.	rr	..	..	rr	..	..	..	..
Genus et sp. ind. (gastropod)	rr	..	..	..	..	..	..	..
Cephalopoda ind.	rr	..	..	rr	..	..	..	..
Hystricurus crassilimbatus n. sp.	..	rr	rr	rr	..	..	*	..
Bolbocephalus groenlandicus n. sp.	..	..	..	rr	..	rr	..	R
Petigurus groenlandicus n. sp.	rr	rr	rr	cc	..	..	R	..
Bathyurina megalops n. g. et n. sp.	rr	..	..	..	..	..	..	..
Bathyurellus teicherti n. sp.	r	..	rr	r	..	rr	*	..
— ? *affinis* n. sp.	..	..	..	..	..	rr	..	..
— sp.	..	..	..	rr	..	..	..	..
Niobe groenlandica n. sp.	rr	..	..	..	..	..	..	..
— *brevicauda* n. sp.	..	rr	..	rr	..	..	..	..
Ceratopeltis latilimbata n. g. et n. sp.	..	..	..	rr	..	..	..	..
Cryptozoon	..	..	..	rr	..	..	..	..

rr = 1—5 specimens; r = 6—15; cc = 30 +; * = occurrences in America; R = occurrences of closely related species.

than the Nunatami fauna. Some of the species show clearly that the beds to which they belong constitute the stratigraphical equivalent of the Cape Weber formation. The Grinnell Land material contains for instance *Archaeorthis* cf. *groenlandica*, *Hystricurus crassilimbatus*, and *Bathyurellus teicherti*, which are regarded as guide fossils of the Cape Weber formation.

The above list of fossils from the Cape Weber formation shows the geographical distribution of the species.

Knowing that the Cape Weber fauna is represented in Grinnell Land, it seems reasonable to conclude that it must be found somewhere in the Northwest Greenland series of strata.

The Cass Fjord, Cape Clay, and Nunatami formations appear to be fairly well examined, and, judging from Dr. LAUGE KOCH's description of the geological conditions in southern Washington Land[1]), there is no probability of finding the Cape Weber fauna in the series of strata just mentioned; accordingly, we may expect to find it in some younger beds. The uppermost subdivision of the Nunatami formation, the *ostracod limestone*, is overlain by the so-called *Cape Webster* formation, the exact stratigraphic position of which is unknown; this formation is 290 m thick. KOCH writes (op. cit. pp. 22—24): "The Ostracod limestone passes without any sharp limits into a light yellow limestone. At the same time the limestone conglomerates change their nature and occur more sparsely, and fossils are rare. . . . . The lowermost strata consist of light limestone with limy gravel and still contain a few ostracods. Throughout the remainder of the series, strata of light yellow compact limestone alternate with dark shales. The thickness of the strata of shales ranges from a couple of centimeters to about two meters. Limestone conglomerates occur occasionally, but always in very thin bands (about 2 or 3 centimeters) . . . . Fossils are very rare. In some strata crinoid stems occur in fairly great numbers, but apart from these I found only a badly preserved cephalopod".

This cephalopod has been described by TROEDSSON[2]), who referred it to *Protocycloceras lamarcki* (BILLINGS) with reservation. The specimen agrees fairly well with *Protocycloceras lamarcki* (BILLINGS), but it is poorly preserved and fails to show the siphuncle; for this reason TROEDSSON correctly states that "the identification remains uncertain". TROEDSSON further writes (op. cit. p. 31): "If the Greenland specimen really belongs here, it indicates Canadian age of the yellow limestone".

In 1928, however, TROEDSSON[3]) adds some new suggestions regarding

[1]) KOCH, LAUGE, "The Geology of the South Coast of Washington Land", Meddelelser om Grønland, vol. 73. Copenhagen 1929.

[2]) TROEDSSON, G. T., "On the Middle and Upper Ordovician Faunas of Northern Greenland I", Meddelelser om Grønland, vol. 71, p. 31, pl. 10, fig. 1. Copenhagen 1926.

[3]) TROEDSSON, G. T., "On the Middle and Upper Ordovician Faunas of northern Greenland II", Meddelelser om Grønland, vol. 72, p. 147. Copenhagen 1928.

the possible age of the Cape Webster formation. After having mentioned his previous view, he writes: "However, as was mentioned by KOCH, this limestone contains also crinoid stems, which hardly appear in beds of Canadian age". For this reason TROEDSSON is inclined to believe that the yellow limestone may be Post-Canadian, "probably Chazyan, which, however, cannot be proved by the poor fossil evidences".

As mentioned above, the present writer is of opinion that the North Greenland equivalent of the Upper Canadian Cape Weber formation is to be found above the Nunatami formation, as indicated by the geological structure of the southeast coast of Grinnell Land, and probably in the Cape Webster series. The following data are in favour of this conception: 1) In Grinnell Land some of the ostracoda of the Nunatami formation occur in the Cape Weber fauna as survivals or recurrent species, 2) the absence of a sharp limit between the Nunatami formation and the Cape Webster series, and 3) the occurrence of ostracoda in the lowermost strata of the Cape Webster series[1]).

It appears from the above that the existence of the stratigraphic equivalent of the Cape Weber formation in North Greenland cannot be directly proved on the basis of the material at hand, but it is an obvious conclusion that the sequence of strata in North Greenland corresponds to the Grinnell Land section; consequently, *the Cape Weber formation is probably represented by the lowermost portion of the Cape Webster series.*

The three gastropods from Midnight Pass on Ymer Island (cf. the map p. 7) described by CLEAVES and FOX[2]) as *Lophospira* sp. ind., *Ectomaria* sp. ind., and *Holopea*? sp. ind., are unfortunately badly preserved and fail to give a hint in regard to the exact age of the "upper blue limestone" of these authors.

Similar gastropods are met with in the rocks of the Cape Weber formation, but they have not been taken into consideration in the present paper, their state of preservation being too poor.

CLEAVES and FOX write (op. cit. p. 477): "Three small gastropods were collected from this formation. All of them have well-developed spires and suggest Middle Ordovician age. In no case, however, are they sufficiently well preserved to justify a specific identification".

The present writer is inclined to regard the Ordovician at Midnight

[1]) Unfortunately these ostracoda mentioned by KOCH (op. cit. 1929) were not found in his collections, and, accordingly, we are ignorant of their stratigraphic value; they are, however, mentioned here in order to point out the possibility that they may be survivals or recurrent species like the ostracoda of the Cape Weber fauna in Grinnell Land.

[2]) CLEAVES, A. B. and FOX, E. F., "Geology of the West End of Ymer Island, East Greenland", Bull. Geol. Soc. America, vol. 46, 1935, pp. 485—486, pl. 42, figs. 2—4.

Pass as identical with the Cape Weber formation, but he is fully aware of the possibility that in the immense Ordovician series of strata some fossiliferous horizons may have been overlooked, all the more so because in several localities the almost vertical rocky walls prevent close examination, and furthermore, because the writer's stay at each locality was but short.

The *Narwhal Sound* formation is the youngest of the East Greenland Ordovician formations. The few fossils known from this series of strata, *Bathyurellus*? sp. and *Heterochilina obliqua* n. g. et n. sp., fail to settle the question of the exact age of the strata. The Narwhal Sound formation, however, being younger than the Cape Weber formation, cannot be older than Upper Canadian and not younger than the Chazyan, since, as far as is known, the genus *Bathyurellus* BILLINGS does not occur in strata younger than the Chazyan. In this connection it should be noticed that, as pointed out by the writer in 1927[1]), the stratigraphic position of the Nunatami formation is very close to the upper boundary of the Canadian; consequently the overlying Cape Weber formation probably represents the *uppermost* Canadian. Thus it seems reasonable to conclude that *the Narwhal Sound formation should be referred to the Chazyan.*

Correlation table.

<table>
<tr><th>East Greenland</th><th>Northwest Greenland</th><th>American Time Scale</th><th>British Time Scale</th></tr>
<tr><td>Narwhal Sound form.</td><td rowspan="2">?</td><td rowspan="2">Chazyan</td><td rowspan="2">Llandeilo</td></tr>
<tr><td>Probable hiatus</td></tr>
<tr><td>C. Weber formation</td><td>Lower part of C. Webster formation</td><td rowspan="5">Upper Canadian
Middle —
Lower —</td><td rowspan="3">Arenig</td></tr>
<tr><td rowspan="4">Hiatus</td><td>Nunatami formation</td></tr>
<tr><td>Hiatus</td></tr>
<tr><td>C. Clay formation</td><td rowspan="3">Tremadoc</td></tr>
<tr><td>Probable hiatus</td></tr>
<tr><td colspan="2">Cass Fjord formation</td></tr>
</table>

Copenhagen, May 1937.

[1]) POULSEN, CHR., "The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland", Meddelelser om Grønland, vol. 70, no. 2. Copenhagen 1927.

PLATES

Plate 1.

Page

Fig. 1—2. Genus et sp. ind. (hydrophorid) 27

- 1. Stem joints (× 12). Cass Fjord formation; Cape Weber, loc. 4.
- 2. Fragments of arms (× 12). Cass Fjord formation; Cape Weber, loc. 4.

- 3—5. *Lingulepis tenuilineata* n. sp. 28

- 3. Pedicle valve (× 3). *Holotype.* Cass Fjord formation; western part of the anticline on the south coast of Ella Island.
- 4. Interior of a pedicle valve (× 3). Cass Fjord formation; Cape Weber, loc. 4.
- 5. Brachial valve (× 3). Cass Fjord formation; Cape Weber, loc. 2.

- 6—8. *Eoorthis* sp. 29

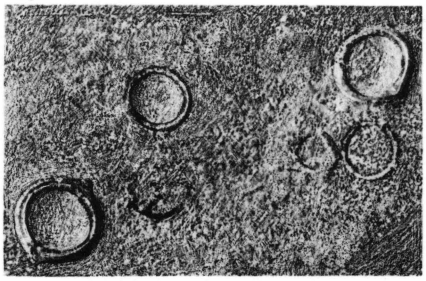
- 6. Fragmentary pedicle valve (× 3). Cass Fjord formation; western part of the anticline on the south coast of Ella Island.
- 7. Interior of a fragmentary brachial valve (× 2). Cass Fjord formation; western part of the anticline on the south coast of Ella Island.
- 8. Interior of a fragmentary pedicle valve (× 3). Cass Fjord formation; western part of the anticline on the south coast of Ella Island.

- 9—10. *Sinuopea whittardi* n. sp. 29

Lateral and dorsal views (× 2). *Holotype.* Cass Fjord formation; Mt. Torbern Bergmann.

- 11. Genus et sp. ind. (cf. *Rhachopea*) 30

Dorsal view (× 1). Cass Fjord formation; western part of the anticline on the south coast of Ella Island.



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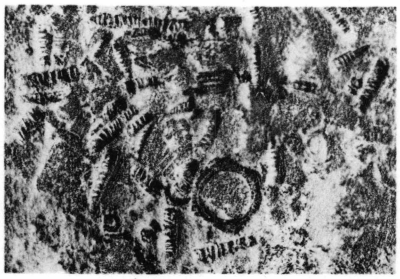

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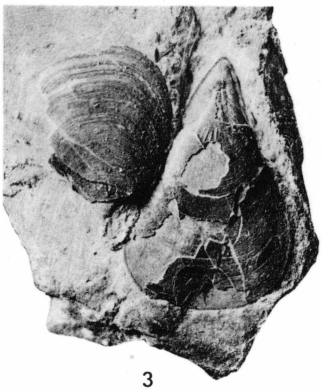

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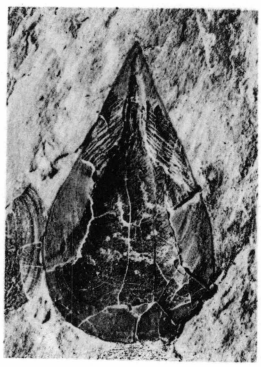

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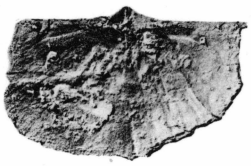

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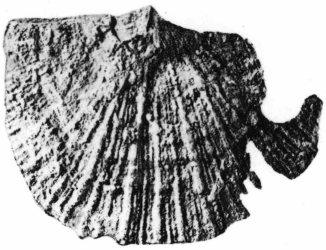

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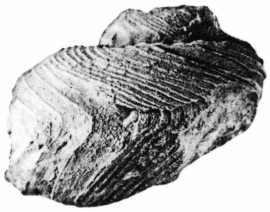

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Plate 2.

Page

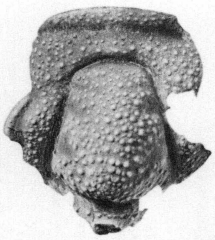
Fig. 1—2. *Hystricurus sulcatus* n. sp. 33
Fragmentary cranidia (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 1. *Holotype.*

- 3—9. *Hystricurus armatus* n. sp. 31
- 3. Fragmentary cranidium (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 4—5. Dorsal and lateral views of a fragmentary cranidium (× 3). *Holotype.* Cass Fjord formation; Cape Weber, loc. 3.
- 6. Free cheek of a large individual (× 3). Cass Fjord formation; Cape Weber, loc. 5.
- 7. Free cheek (× 3). Cass Fjord formation; Cape Weber, loc. 5.
- 8. Free cheek of a small individual (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 9. Fragmentary pygidium (× 3). Cass Fjord formation; Cape Weber, loc. 3.

- 10. *Hystricurus nudus* n. sp. 34
Fragmentary cranidium (× 3). *Holotype.* Cass Fjord formation; Cape Weber, loc. 3.

- 11—18. *Symphysurina elegans* n. sp. 37
- 11—12. Dorsal and lateral views of a cranidium (× 3). *Holotype.* Cass Fjord formation; Cape Weber, loc. 3.
- 13. Large cranidium (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 14. Thoracic segments (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 15. Hypostoma (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 16. Free cheek (× 3). Cass Fjord formation; Cape Weber, loc. 3.
- 17—18. Pygidia (× 3). Cass Fjord formation; Cape Weber, loc. 3.

- 19. *Symphysurina?* sp. 38
Hypostoma (× 3). Cass Fjord formation; Cape Weber, loc. 3.



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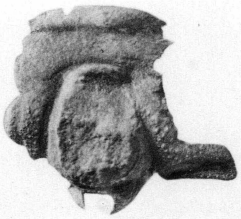

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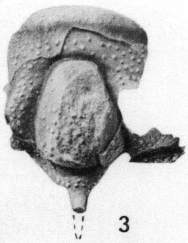

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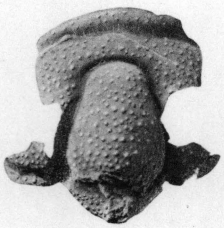

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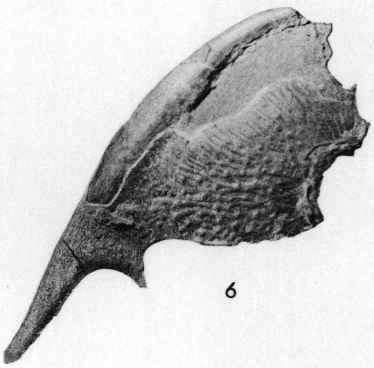

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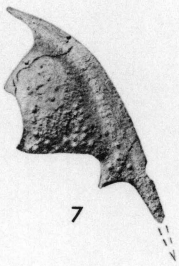

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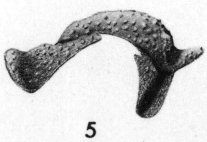

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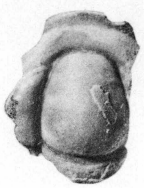

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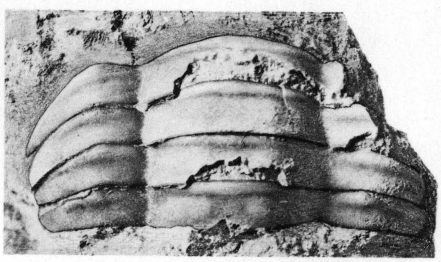

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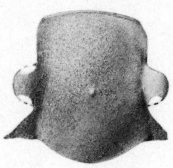

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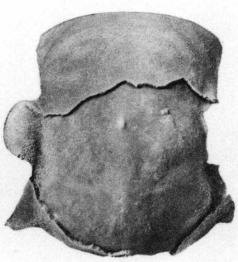

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Plate 3.

Page

Fig. 1—5. *Symphysurina* cf. *woosteri* Ulrich 40

- 1. Fragmentary cranidium (× 3). Cass Fjord formation; Cape Weber, loc. 4.
- 2—3. Free cheeks (× 3). Cass Fjord formation; Cape Weber, loc. 4.
- 4. Free cheek of a small individual (× 3). Cass Fjord formation; Cape Weber, loc. 4.
- 5. Ventral view of a fragmentary free cheek referred to the same species with reservation (× 3). Cass Fjord formation; western part of the anticline on the south coast of Ella Island.

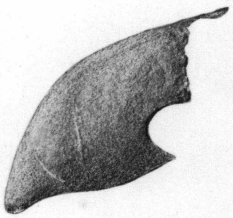
- 6. *Symphysurina robusta* n. sp. 39
  Pygidium (× 2). *Holotype.* Cass Fjord formation; Cape Weber, loc. 3.

- 7. *Symphysurina* sp. 40
  Pygidium (× 3). Cass Fjord formation; Cape Weber, loc. 5.

- 8—12. Spongiae ind. 42
- 8—9. Lateral and top views of a flabelliform specimen (× 1). Cape Weber formation; Cape Elisabeth.
- 10—11. Lateral and top views of a branching specimen (× 1). Cape Weber formation; Cape Elisabeth.
- 12. Internal structure of the fig. 10—11 specimen (× 3).

- 13. Stromatolite 58
  Polished vertical section (× 1). Cape Weber formation? Cape Weber.

- 14. *Polytoechia* sp. ind. 43
  Fragmentary pedicle valve (× 3). Cape Weber formation; Cape Weber, loc. 7.



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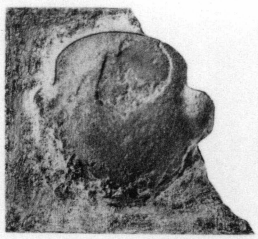

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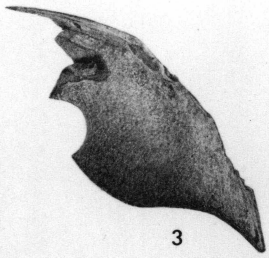

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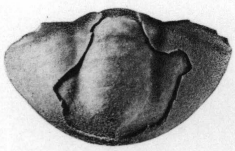

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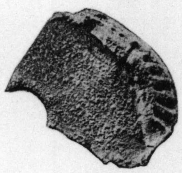

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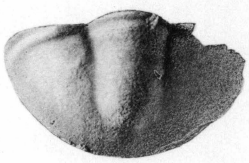

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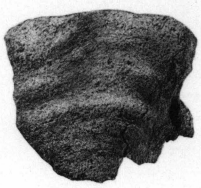

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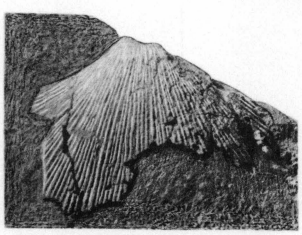

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Plate 4.

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Fig. 1—4. *Archaeorthis groenlandica* n. sp. 42

- 1. Pedicle valve (× 3). *Holotype.* Cape Weber formation; mountain summit about 1 km south of Devon Canyon.
- 2. Brachial valve with indistinctly defined median depression (× 3). Cape Weber formation; Cape Weber, loc. 1.
- 3. Brachial valve with normally developed median depression (× 3). Cape Weber formation; mountain summit about 1 km south of Devon canyon.
- 4. Brachial valve with deep median depression (× 3). Cape Weber formation; mountain summit about 1 km south of Devon Canyon.

- 5—6. Genus et sp. ind. (pelecypod) 44
  Lateral and top views of a natural cast of the interior (× 1). Cape Weber formation; Cape Weber.

- 7—10. *Helicotoma* sp. ind. 44
- 7. Dorsal view of a large shell (× 1). Cape Weber formation; Cape Weber, loc. 1.
- 8. Dorsal view of a large shell, showing remnants of the marginal ridge (× 1). Cape Weber formation; mountain summit about 1 km south of Devon Canyon.
- 9. Dorsal view of a small shell (× 1). Cape Weber formation; Cape Weber, loc. 1.
- 10. Lateral view of another small shell (× 1). Cape Weber formation; Cape Weber, loc. 1.

- 11. *Helicotoma similis* WHITFIELD? 44
  Dorsal view (× 2). Cape Weber formation; Cape Weber, loc. 1.

- 12—13. Genus et sp. ind. (gastropod) 46
- 12. Dorsal view (× 1). Cape Weber formation; Mt. Gunvor, western slope of the summit.
- 13. Vertical section of another specimen (× 2). Cape Weber formation; Mt. Gunvor, western slope of the summit.

- 14. *Maclurites* sp. 45
  Dorsal view (× 1). Cape Weber formation; Cape Weber, loc. 1.

- 15—16. *Roubidouxia* n. sp. 46
  Dorsal and lateral views (× 2). Cape Weber formation; Cape Weber, loc. 1.

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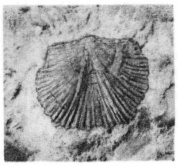

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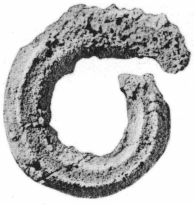

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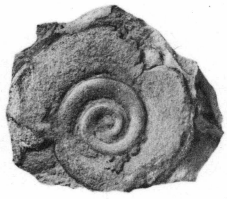

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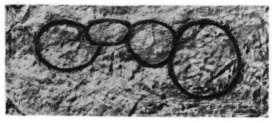

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Plate 5.

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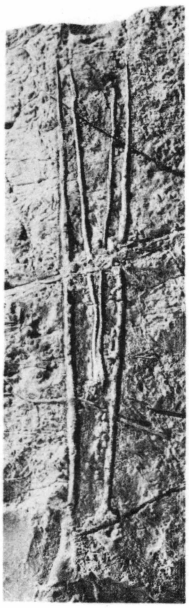
Fig. 1. Genus et sp. ind. (cephalopod) 47
Siphuncle of some Endoceratid; longitudinal section, showing an endosiphocone (× 1). Cape Weber formation; Mt. Gunvor, western slope of the summit.

- 2. Genus et sp. ind. (cephalopod) 47
Longitudinal section (× 1). Cape Weber formation, Cape Weber, loc. 7.
- 3. Enlarged portion of the same specimen, showing holochoanitic invagination of the septal necks (× 11).

- 4. Genus et sp. ind. (cephalopod) 47
(× 1). Cape Weber formation; Mt. Gunvor, western slope of the summit.

- 5—8. *Hystricurus crassilimbatus* n. sp. 47
- 5. Poorly preserved thorax and pygidium (× 3). Cape Weber formation; upper end of Devon Canyon.
- 6. Fragmentary cranidium (× 3). Cape Weber formation; Cape Weber, loc. 6.
- 7. Fragmentary cranidium (× 3). *Holotype.* Cape Weber formation; Cape Weber, loc. 6.
- 8. Fragmentary free cheek (× 3). Cape Weber formation; Cape Weber, loc. 6.

- 9—13. *Bolbocephalus groenlandicus* n. sp. 48
- 9—10. Fragmentary cranidia (× 2). Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.
- 11—12. Dorsal and lateral views of a pygidium (× 1). *Holotype.* Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.
- 13. Enlarged portion of the same specimen, showing the pitted surface of the natural cast of the interior.



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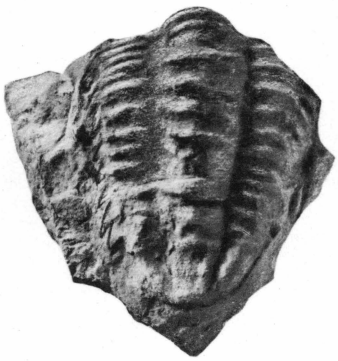

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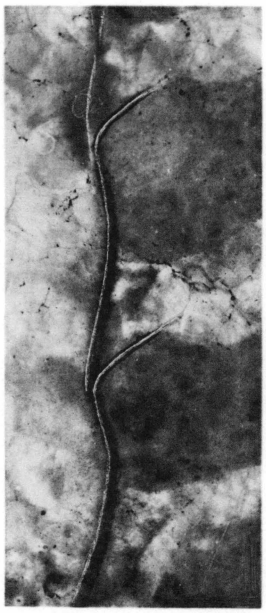

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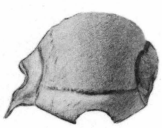

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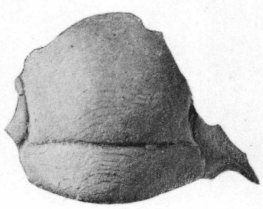

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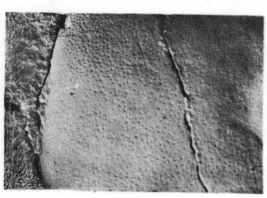

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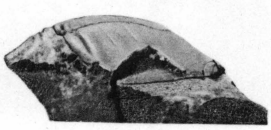

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Plate 6.

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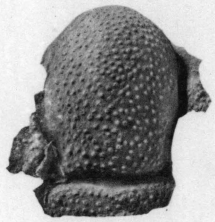
Fig. 1—13. *Petigurus groenlandicus* n. sp. 49

- 1. Large glabella (× 2). Cape Weber formation; Mt. Gunvor, western slope of the summit.
- 2—3. Dorsal and lateral views of a glabella (× 2). *Holotype.* Cape Weber formation; Cape Weber, loc. 6.
- 4—5. Dorsal and lateral views of a large, fragmentary cranidium (× 1). Cape Weber formation; mountain summit about 1 km south of Devon Canyon.
- 6—7. Dorsal and front views of a fragmentary cranidium (× 2). Cape Weber formation; Cape Weber, loc. 1.
- 8. Posterior portion of fixed cheek with palpebral lobe (× 2). Cape Weber formation; Cape Weber, loc. 1.
- 9. Fragmentary free cheek (× 2). Cape Weber formation; mountain summit about 1 km south of Devon Canyon.
- 10. Fragmentary free cheek (× 2). Cape Weber formation; Cape Weber.
- 11. Pygidium without test (× 1). Cape Weber formation; Cape Weber, loc. 6.
- 12. Pygidium (× 2). Cape Weber formation; Cape Weber, loc. 1.
- 13. Large pygidium (× 1). Cape Weber formation; Cape Weber, loc. 6.

- 14—15. *Bathyurina megalops* n. sp. 52

- 14. Fragmentary cranidium (× 2). *Holotype.* Cape Weber formation; Mt. Gunvor, western slope of the summit.
- 15. Fragmentary cranidium (× 2). Cape Weber formation; Mt. Gunvor, western slope of the summit.



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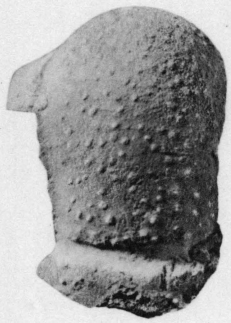

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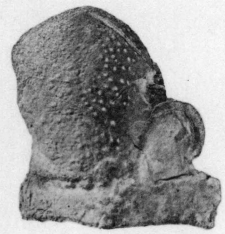

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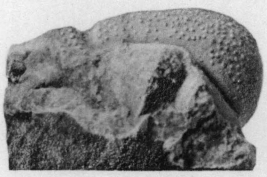

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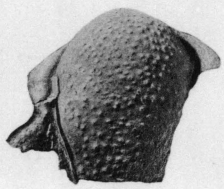

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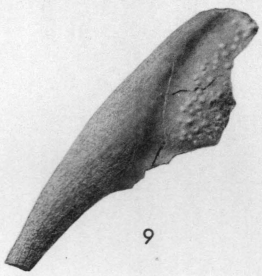

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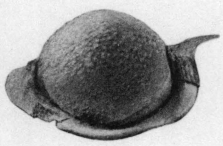

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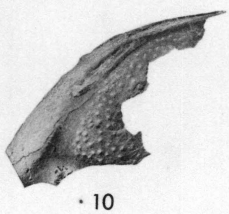

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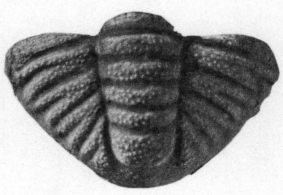

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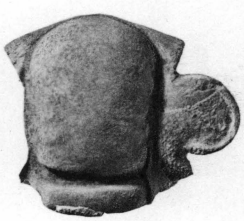

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Plate 7.

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Fig. 1. *Bathyurina megalops* n. sp. 52
Lateral view of the *holotype* (pl. 6, fig. 14).

- 2—5. *Bathyurellus teicherti* n. sp. 53
- 2—3. Dorsal and lateral views of a cranidium (× 3). *Holotype*. Cape Weber formation; Mt. Gunvor, western slope of the summit.
- 4. Free cheek (× 3). Cape Weber formation; Mt. Gunvor, western slope of the summit.
- 5. Pygidium (× 3). Cape Weber formation; Cape Weber, loc. 6.

- 6—7. *Bathyurellus? affinis* n. sp. 55
- 6. Fragmentary pygidium (× 2). Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.
- 7. Cast of an almost complete pygidium (× 2). *Holotype*. Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.

- 8. *Bathyurellus* sp. 56
Fragmentary pygidium (× 3). Cape Weber formation; Cape Weber, loc. 6.

- 9—10. *Niobe brevicauda* n. sp. 56
- 9. Cast of a fragmentary pygidium (× 2). *Holotype*. Cape Weber formation; Cape Weber, loc. 1.
- 10. Ventral view of a pygidium (× 1). Cape Weber formation; Cape Weber, loc. 1.

- 11. *Niobe groenlandica* n. sp. 56
Fragmentary pygidium (× 3). *Holotype*. Cape Weber formation; Mt. Gunvor, western slope of the summit.

- 12. *Bathyurellus?* sp. 59
Cast of a fragmentary pygidium (× 2). Narwhal Sound formation; eastern part of the anticline on the south coast of Ella Island.

- 13. *Niobe brevicauda* n. sp.? 56
Fragmentary pygidium (× 2). Cape Weber formation; upper end of Devon Canyon.

- 14. *Ceratopeltis latilimbata* n. g. et n. sp. 57
Pygidium (× 3). *Holotype*. Cape Weber formation; Cape Weber, loc. 1.

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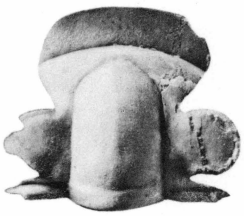

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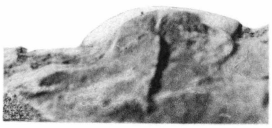

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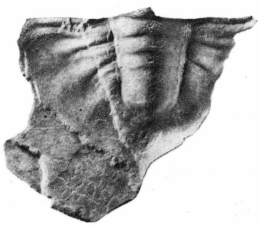

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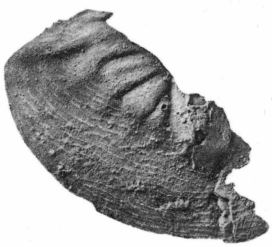

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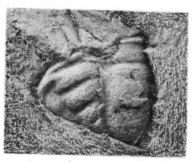

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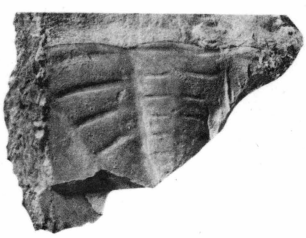

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Plate 8.

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Fig. 1. Genus et sp. ind. (trilobite) 58
Fragmentary pygidium (× 3). Cape Weber formation; Mt. Gunvor, western slope of the summit.

- 2. Genus et sp. ind. (trilobite) 58
Fragmentary pygidium (× 3). Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.

- 3. Genus et sp. ind. (cf. *Hystricurus*) 58
Fragmentary pygidium (× 3). Cape Weber formation; upper end of Devon Canyon.

- 4. Genus et sp. ind. (cf. *Bathyurus*) 58
Fragmentary pygidium (× 3). Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.

- 5. Genus et sp. ind. (trilobite) 58
Free cheek (× 1). Cape Weber formation; eastern part of the anticline on the south coast of Ella Island.

- 6. This figure is misleading and has been rejected by the writer.

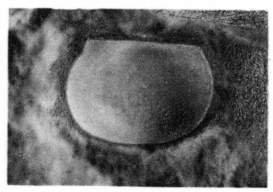
- 7. Stromatolite 64
(× c. 0.5). Dolomite Point formation; Dolomite Point.

1

2

3

5



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