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DE ØSTGRØNLANDSKE EXPEDITIONER TIL
KONG CHRISTIAN DEN X's LAND UDFØRT
I AARENE 1926—27 OG 1929—30
UNDER LEDELSE AF LAUGE KOCH

THE LOWER JURASSIC ROCKS OF EAST GREENLAND

PART I

BY

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WITH 57 FIGURES IN THE TEXT AND 13 PLATES

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PREFACE

As a member of the Danish Government Expedition to East Greenland in 1926—27 under the leadership of Dr. LAUGE KOCH I had ample opportunity of studying the sedimentary deposits within the Scoresby Sound area, especially the Jurassic beds in Jameson Land and Liverpool Land. The present paper deals with the Lias, which I subjected to a particular investigation.

It is my pleasant duty to thank the leader of the expedition, Dr. LAUGE KOCH, for pleasant company and much unselfish assistance during the expedition and for handing over to me for description a number of Liassic fossils from Liverpool Land. I am also indebted to Dr. TOM HARRIS, Cambridge, my fellow-member on the expedition, who has placed valuable Liassic material collected in Jameson Land at my disposal. Finally, my acknowledgements are due to my Greenlandish assistants, who with great zeal assisted me in my work, notably MIKAEL KUNAK, ELI NAPARTOK, and JOHAN ABELSEN.

In order to determine the Greenland Liassic fossils I have been enabled to make comparisons with European material in various foreign museums, and have thus become indebted to a number of geologists and palæontologists, who, within their special fields, have assisted me in my work, viz Professor Dr. HANS FREBOLD, Greifswald, Professor Dr. E. HENNIG, Professor Dr. Freiherr VON HUENE and Dr. RAU, Tübingen, Dr. BERKHEMER, Stuttgart, Dr. SCHÄFFLE, Ulm, Professor Dr. BROILI, München, Professor Dr. G. DUBOIS, Strassbourg, Professor Dr. K. A. GRÖNWALL, Lund, Professor Dr. SCHINDEWOLF, Berlin, Dr. LANG, Dr. L. F. SPATH, Miss HELEN M. MUIR-WOOD, and Dr. COX, the British Museum of Natural History, London. Last, but not least, I wish to express my thanks to Professor O. B. BØGGILD and Professor J. P. J. RAVN, of Copenhagen, who have at all times endeavoured to further my work and to lend me every possible assistance.

Finally I wish to tender my respectful thanks to the Rask-Ørsted Foundation and the Royal Technical College in Copenhagen, whose grants enabled me to visit the above-mentioned museums.

Copenhagen, June 21st, 1933.

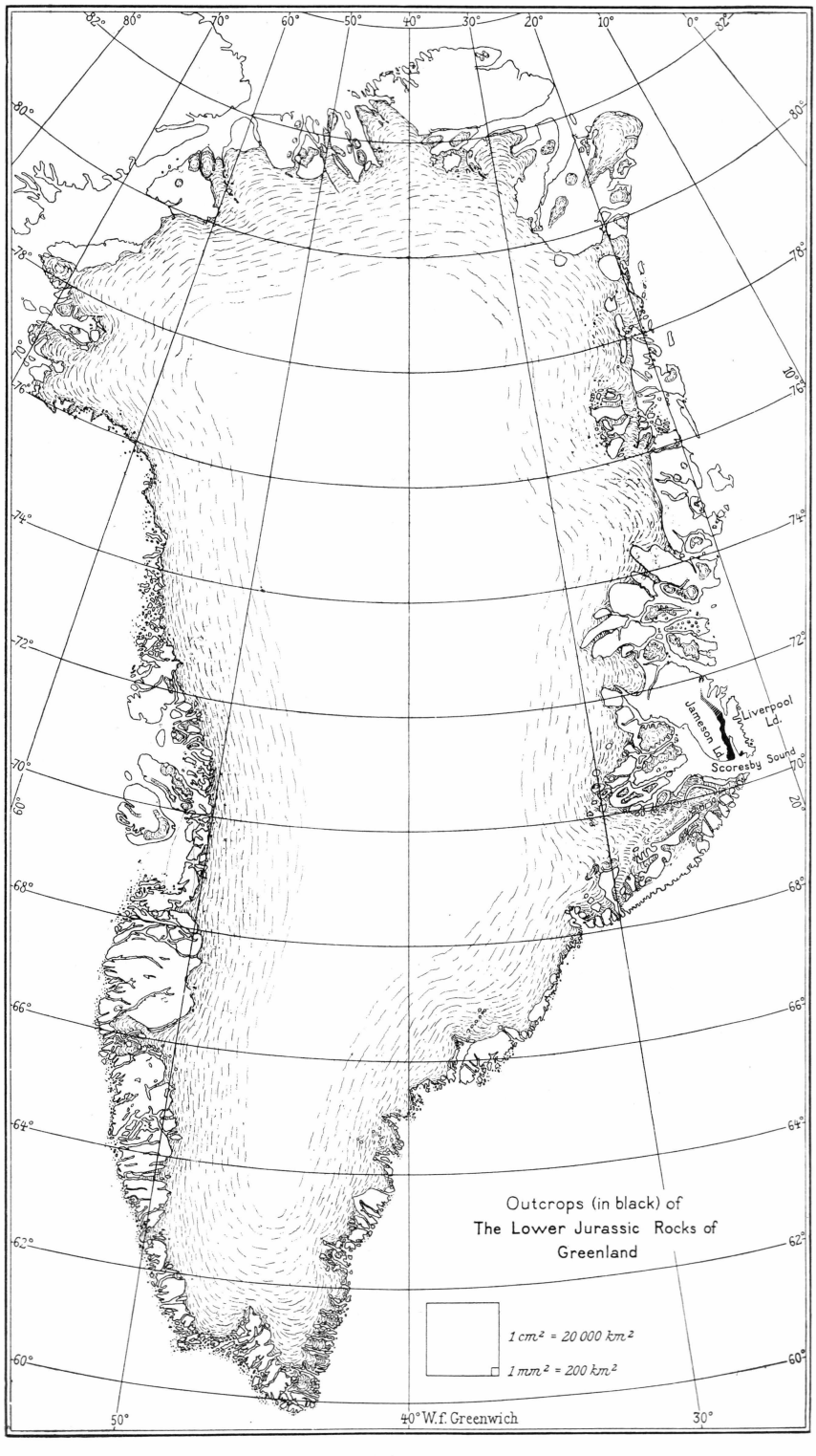
Outcrops (in black) of
The Lower Jurassic Rocks of
Greenland
1 cm² = 20 000 km²
1 mm² = 200 km²
Liverpool Ld.
Jameson Ld.
Scoresby Sound
40° W.f. Greenwich

Fig. 1.

INTRODUCTION

The presence of Liassic deposits in Greenland was ascertained to some extent by N. HARTZ (8), who in 1896 described a collection of plant fossils from Cape Stewart in East Greenland. HARTZ referred these fossils to the Rhætic or the Rhæto-Lias, and was thus unable to separate with certainty special Liassic beds. Later TOM HARRIS (1931 (7)) ascertained that the uppermost part of the plant-bearing series in this locality and other localities in Jameson Land really belonged to the lowermost part of the Lias. Marine Charmouthian fossils were discovered in 1926 by EMILE HAUG (9), also in material from Cape Stewart, while the occurrence of Upper Lias was recorded by the present author in 1929 (21) from various points in Jameson Land, where in 1926—27 he also ascertained an extensive distribution of the Charmouthian beds[1]).

Thus it is only within a fairly limited area on the east coast of Greenland that the presence of Liassic beds has so far been ascertained with certainty. They are known from the eastern part of Jameson Land and from a small area in the south of Liverpool Land, both of which areas are situated north of Scoresby Sound (fig. 1). As will appear from the succeeding historical account, the Liassic beds have been known much farther back in time than appears from the above data. When their right age has not previously been recognised, this is due to a misapprehension of the fossil contents of the beds.

[1]) In this connection it deserves mention that SAM HAUGHTON (10) in 1859 by dredging on the sea-bottom off Godhavn in West Greenland secured a fossil that was determined as *Cardinia ovalis* (STUTCHBURY), a species belonging to the *angulatus* zone of the Lower Lias. If the determination is correct, this find must be said to be of great interest, Jurassic beds not otherwise being known from West Greenland. The fossil is assumed to have been carried to West Greenland by the pack-ice, but as the nearest place from which the Liassic beds are known is the Scoresby Sound area, this view seems not very probable. A closer investigation of the sea-bottom off Godhavn is therefore very desirable.

HISTORICAL REVIEW

The Liassic beds in Scoresby Sound were discovered in 1822 by WILLIAM SCORESBY jun. in Neill's Cliffs at Cape Stewart, the south point of Jameson Land. Next year SCORESBY published a report (22) including a description by JAMESON (11) of the geological objects found. SCORESBY's report as to this locality runs as follows: "Neill's Cliffs were found to be about 300 feet in height, full two-thirds of which were concealed by the debris of the higher strata: on this I ascended to the rock in situ; and found it to consist of a thick bed of bituminous slate, — coarse conglomerate, with a base of sandstone, — sandstone flag, or slaty sandstone, — calcareous sandstone, — fine granular limestone, full of organic remains, — and a coarse grained limestone, of a grey colour, containing numerous large specimens of pectinites and other bivalve shells. These were the principal rocks; but scattered specimens were also found of clay ironstone, slate-clay, common slate-coal, jet, splintery limestone, arenaceous limestone, &c. Most of these rocks were of a friable texture, and the general colour was light-brown. This tint gives the peculiar appearance to the cliffs of Jameson's Land which first excited my attention."

This coal-bearing series was referred to the Carboniferous, but we are now aware that the lower, coal-bearing part of the series belongs to the Rhætic and the lowermost part of the Lias, while the bed with pectinites (*Entolium frontale* DUM., fig. 2) are of Charmouthian age.

The Danish Expedition to East Greenland in 1891—92 re-investigated SCORESBY's classical locality at Cape Stewart, but also extended their investigations to the more northerly parts of Neill's Cliffs along the west coast of Hurry Inlet. The investigations were carried out by N. HARTZ and EDV. BAY, and a complete account of the geological results was given by BAY (1) in 1896 (translated): "The west coast of Hurry Inlet is formed by abruptly sloping, high cliffs, built up of alternating beds of limestone, sandstone, shales, and basalt — the so-called Neill's Cliffs, beginning to the south with Cape Stewart and rising evenly

towards the north. On the whole there is no change of any importance in the beds along this long stretch, and the description of the beds at Cape Stewart may therefore to some extent apply to the whole area.

The lowermost part of Cape Stewart consists of a foreland essentially

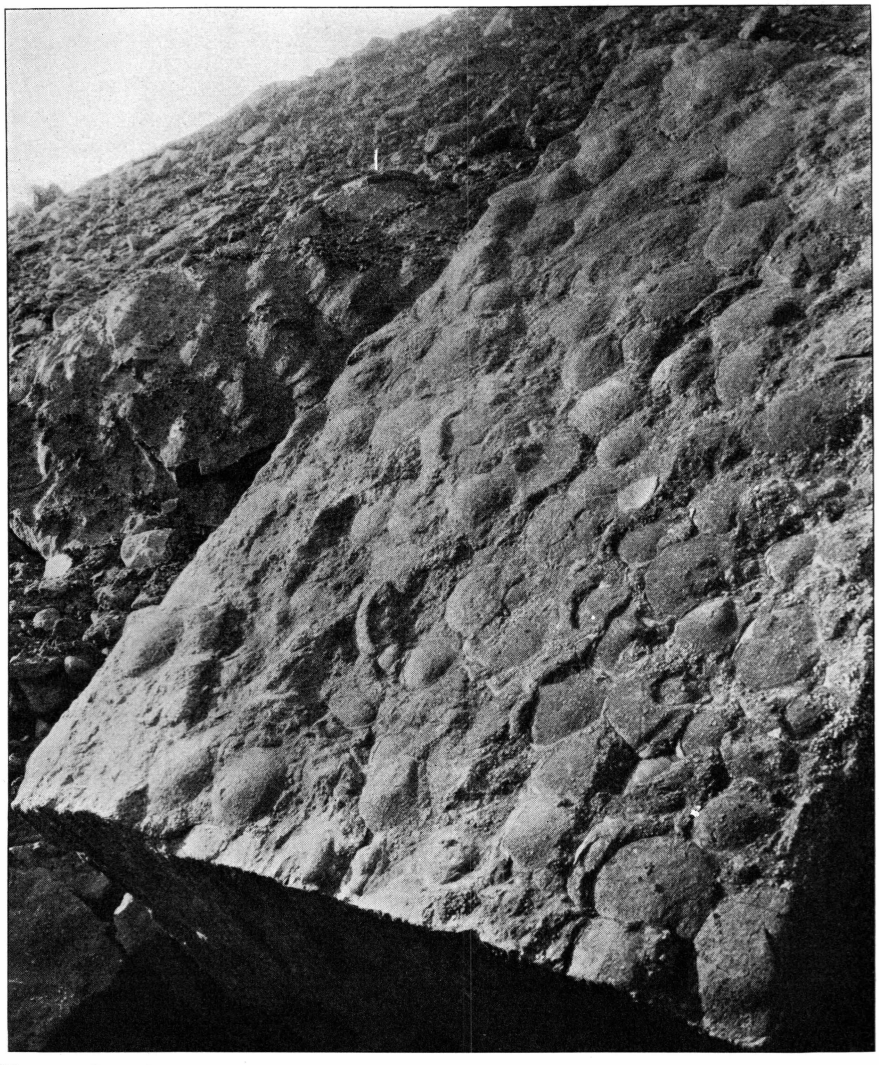

Fig. 2. Scoreby's coarse-grained pectinites limestone. The bedding plane covered with shells mainly belonging to *Entolium frontale* (Dum.). Ræve Kløft at Cape Stewart. 20.-9.-26.

made up of the disintegration products of the deposits occurring back of it, all of which are very easily disintegrated. From this foreland a narrow ravine leads up to the plateau on top of the cliff, where the various strata can be easily investigated.

In most places the lowermost fixed strata that crop out are made up of grey, somewhat arenaceous clay shales, containing the Rhætic plant fossils mentioned by HARTZ in the succeeding treatise. However, below this bed, quite close to the shore and below the northernmost part of the bluff, HARTZ found a green sandstone, which is doubtless fixed, even if it was not found in Neill's Cliff north of Cape Stewart. This bed of plant-bearing shales is probably very thick, since in a place nearby it crops out almost right down at the shore, and in the above-mentioned ravine it attains a height of some 160′—180′[1]) above the sea. This bed contains numerous fossils.

Above this shale there follows a stretch of scree, which is again followed by a somewhat varying bed, most appropriately termed a very impure reddish limestone, holding animal fossils. In places it is free from foreign admixtures of any importance, but is still very rich in sand, and if so, it hardly ever contains any fossils. In other places it is full of pebbles, sometimes rounded, sometimes fairly sharp-edged, so that the rock assumes the appearance of a conglomerate or a breccia; in other places again it rather resembles a shell breccia on account of the large number of animal fossils of Jurassic age. All these varieties of the same rock occur side by side and pass evenly into each other. In addition to animal fossils, remains of trunks and branches may occasionally be met with. — This bed is 7′ thick and occurs at an altitude of 186′ above the sea.

Above follows a very arenaceous grey shale in which I failed to find any fossils. The same shale probably continues uninterrupted to a height of 270′, but in a couple of places it is covered with down-fallen weathering products, which also conceal its upward boundary.

At an altitude of 300′ there occurs a bed of a thickness of 10′, consisting of a blackish-grey, very fine-grained olivine-bearing basalt. Its contact with the surrounding beds could not be investigated on account of the highly weathered condition of the latter.

The basalt is overlain by a bed of yellow sandstone, about 6′ thick, at the head of the ravine. This bed varies greatly, being now a typical sandstone, which is shaly to a slight extent only, and now approaching an impure clay shale. However, these varieties occur side by side and without sharp boundaries. With the exception of a few carbonised plant remains, no fossils occur in this bed, whereas it is an extremely common thing to encounter raised figures in it which are highly reminiscent of those occurring in the so-called *Scolithus* sandstone of Sweden, and have no doubt originated in the same way. (see fig. 12, page 39.)

This sandstone bed is the top bed at Cape Stewart, but looking

[1]) Danish feet.

towards the interior of the country, sedimentary beds are seen to crop out in many places — probably sandstone too. In addition HARTZ observed a dark clay shale at an altitude of about 1400′ northwest of Cape Stewart.

All the beds at Cape Stewart — and in Neill's Cliffs on the whole — dip 6° towards the south 50° west."

In Varde Kløft, 17 km north of Cape Stewart, investigations of Neill's Cliffs were further made. BAY writes as follows (translated): "At the base there occur some shales which frequently assume the appearance and character of sandstone; they are overlain at about 1000′ by the fossiliferous limestone, the lower and upper parts of which are here conglomeratic or breccia-like, while the middle part consists of a more pure limestone.

Above this there follow, as at Cape Stewart, shales overlain by a greyish-yellow sandstone bed, succeeded by basalt (c. 1300′) and this again by alternating beds of sandstone and a greyish-black, rather fine-grained, slightly olivine-bearing dolerite. At a sandstone bed at about 1400′ altitude, HARTZ found some cone marl, and at about 2200′ numerous pieces of fossil wood lying in loose blocks among the sandstone fragments. — As will be seen, there are several more beds at the top than at Cape Stewart, and farther inland still more are to be seen."

The material of fossils brought back by this expedition has been worked out partly by HARTZ (8), who, as already stated, was able to refer the plant-bearing beds at Cape Stewart to the Rhæto-Lias, partly by BERNHARD LUNDGREN, who worked out the marine animal fossils. LUNDGREN published the result of his investigations in 1895 (14). All the fossils are derived from SCORESBY's pectinites beds at Cape Stewart. LUNDGREN distinguishes between two different rock types, "a somewhat calcareous, micaceous, grey, fine-grained sandstone, sometimes compact, at others containing rounded quartz-grains and quite fresh fragments of felspar of pea's-size and a dark-coloured, almost black, very calcareous rock, also containing mica", but points out that rocks intermediate between these two types occur too. My investigations in 1926—27 have proved both of LUNDGREN's main types to belong to the zone with *Uptonia jamesoni* and to contain the same fauna. Hence the faunal differences mentioned by LUNDGREN are more apparent than real. All the fossils ascertained by LUNDGREN are given in the subjoined list, irrespective of the rock in which they were found, together with the determinations arrived at by me on a re-examination of the same fossils.

LUNDGREN 1895.	Revised names:
Lingula sp.	*Lingula sacculus* CHAP. & DEW.
Rhynchonella sp.	*Tetrarhynchia*? sp. A
Rhynchonella sp.	*Grandirhynchia* sp. (cf. *elii* n. sp.)

Rhynchonella sp.	*Venericardia*? aff. *liasina* (MOORE)
Waldheimia sp.	*Lobothyris* cf. *punctata* (SOW.)
Waldheimia sp.	*Lobothyris* sp. a malformation
Ostrea grönlandica LUNDGR.	*Gryphæa cymbium* LAM.
Ostrea cf. *sandalina* GOLDF.	*Liostrea irregularis* (MÜNST. em. QU.) & *Gryphæa* sp.
Placunopsis minuta LUNDGR.	*Placunopsis minuta* LUNDGR.
Plicatula cf. *spinosa* SOW.	*Plicatula pectinoides* LAM.
Limea duplicata SOW.	*Limea acuticosta* GOLDF.
Lima sp.	*Lima* (*Plagiostoma*) sp. an *eucharis* D'ORB.
Pecten stewartianus LUNDGR.	*Entolium frontale* DUM.
Pecten johnstrupi LUNDGR.	*Aequipecten priscus* (SCHLOTH.)
Pecten rinki LUNDGR.	*Chlamys substriata* (RÖM.) var. *Rinki* (LUNDGR.)
Pecten callosus LUNDGR.	*Entolium callosum* (LUNDGR.)
Avicula münsteri BRONN	*Oxytoma inæquivalve* (SOW.)
Perna sp.	*Perna* sp. indet.
Modiola ravni LUNDGR.	*Hippopodium ponderosum* SOW.
Modiola sp.	*Modiola scalprum* SOW. & *Modiola* aff. *lævis* SOW.
Myoconcha borealis LUNDGR.	*Myoconcha decorata* (MÜNST.) sp. juv.
Pinna sp.	*Pinna* cf. *folium* YOUNG & BIRD
Leda lacryma SOW.	*Nuculana zieteni* (BRAUNS)
Astarte bayi LUNDGR.	*Astarte bayi* LUNDGR. sp. juv.
Astarte wandeli LUNDGR.	*Astarte wandeli* LUNDGR.
Astarte hartzi LUNDGR.	*Cardinia hybrida* (SOW.)
Astarte? *amygdaloides* LUNDGR.	*Cardinia* cf. *attenuata* (STUTCHBURY)
Tancredia elongata LUNDGR.	*Tancredia johnstrupi* (LUNDGR.)
Cardium concinnum v. BUCH	*Cardium* (*Jurassicardium*?) *phillipianum* DUNK.
Cyprina cf. *cancriniana* D'ORB.	*Mactromya*? *groenlandica* n. sp.
Panopæa toulai LUNDGR.	*Pleuromya costata* YOUNG & BIRD
Panopæa sp.	*Hippopodium ponderosum* SOW.
Panopæa sp.	*Arcomya longa* BUV.
Pholadomya groenlandica LUNDGR.	*Pholadomya ambigua* (SOW.)
Lyonsia subaequilateralis LUNDGR.	*Gresslya lunulata* TATE
Turbo sp.	?
Pleurotomaria	*Ptychomphalus consobrinus* (TATE)
Straparollus	*Pleurotomaria* sp.
Ammonites sp.	*Uptonia jamesoni* (SOW.) (a malformation)
Belemnites sp.	*Belemnites* sp. indet.

The marine beds at Cape Stewart were considered by LUNDGREN to be of Callovian age. Only one species, *Plicatula* cf. *spinosa*, would seem to point towards a Liassic age, but LUNDGREN unfortunately does not attach much importance to the presence of this species. As was first pointed out by HAUG in 1926, and as has been fully confirmed by my investigations, LUNDGREN has made a mistake, the fauna being a typical Charmouthian fauna. As appears from the above list, LUNDGREN, by assuming the fauna to be of Callovian age, has had to erect a number of well-known Charmouthian forms as new species, and among these a species described by himself in 1879 from the Charmouthian of Bornholm (*Tellina johnstrupi* = *Tancredia elongata*).

Fresh investigations on the Liassic beds in Jameson Land were made by NATHORST in 1899 (17). Of special interest is a section measured in Nathorst Mountain north of Point Constable. About this NATHORST writes as follows (translation): "On the west side of Hurry Inlet, near Point Constable, the red and white mottled sandstone occurs fixed at the water's edge. At 71 m altitude the sandstone is white, kaolinised, and shaly, higher up of a brownish colour. At 120 m there occurs a projecting basalt bed. Still higher blocks of a greenish, probably fixed, sandstone were encountered, and such were still observed at an altitude of 231 m. Some distance higher up the slope there followed a rock very similar to the plant-bearing Rhætic one at Cape Stewart, and at 514 m a yellow sandstone with *Ostrea*, Belemnites, etc. The oysters occurred in vast numbers and lay partially weathered out, so that the shells were perfectly complete." NATHORST further records the finding of a peculiar block on the mountain slope, viz. a finely-laminated, shaly, dark sandstone with impressions of small *Pecten*-like mussels. NATHORST's section includes in the lower part a fairly thick series of strata older than the Rhætic, probably entirely of Triassic age and only incompletely exposed at Cape Stewart (the green sandstone). As I have been able to ascertain later, the *Ostrea* beds at 514 m altitude represent a horizon of the Upper Lias. As regards the age of these beds, NATHORST states nothing definite, and as far as I know, the material collected by NATHORST has never been closely studied.

During the Danish expedition to East Greenland in 1900 N. HARTZ made fresh collections of Liassic material from the following localities: the eastern part of Jameson Land, Dinosaurus Elv (9.4 km north of Cape Stewart), Varde Kløft, and Nathorst Mountain (NATHORST's *Ostrea* beds). In Varde Kløft richly plant-bearing Rhæto-Liassic beds were met with; the plant fossils were described by TOM HARRIS in 1926 (6). The marine fossils collected by the expedition have been worked out by VICTOR MADSEN (15). The *Ostrea* beds from Nathorst Mountain were referred to the Upper Bajocian or the Lower Bathonian. From loose-

lying blocks at Dinosaurus Elv and in Varde Kløft MADSEN determined a number of species belonging to the fauna previously described by LUNDGREN from Cape Stewart, and assumed, as has also subsequently been confirmed, that they belonged to beds in continuation of the Cape Stewart beds. Like LUNDGREN, MADSEN considered these forms to belong to the Callovian. From beds of a very micaceous clay shale near the top of Neill's Cliff in Varde Kløft MADSEN described a fauna of ammonites, which he referred to the Callovian, and the correctness of this determination has not been invalidated, whereas the previously mentioned faunas must be referred to the Lias. In the subjoined list the determinations made by MADSEN are given together with the revised names arrived at by me on looking through MADSEN's material.

VICTOR MADSEN 1906.	Revised Names.
Dinosaurus River.	Charmouthian.
Limea duplicata SOW.	*Limea acuticosta* MÜNST.
Ostrea sp. cf. *sandalina* GF.	*Gryphæa* sp. indet.
Varde Kløft.	
Astarte bayi LUNDGR.	*Astarte bayi* LUNDGR.
Astarte hartzi LUNDGR.	*Cardinia hybrida* (SOW.)
Pecten sp. (an *stewartianus* LUNDGR.)	*Entolium frontale* DUM.
Pecten sp. cf. *johnstrupi* LUNDGR.	*Æquipecten priscus* SCHLOTH.
Pecten sp. cf. *rinki* LUNDGR.	*Chlamys substriata* (RÖM.) var. *rinki* LUNDGR.
Nathorst Mountain.	Upper Lias.
Pentacrinus sp. cf. *andreæ* DE LOR.	*Pentacrinus* (*Isocrinus*?) sp.
Waldheimia sp.	*Loboidothyris*? sp.
Trigonia undulata FROMHERZ	*Trigonia literata* Y. & B.
Astarte sp. cf. *elegans* SOW.	*Astarte madseni* n. sp.
Tancredia sp. cf. *angulata* LYC.	*Tancredia* aff. *donaciformis* LYC.
Gresslya gregaria (ZIETEN)	*Gresslya rotundata* (PHILL.)
Gresslya abducta (PHILL.)	*Gresslya abducta* (PHILL.)
Gresslya peregrina (PHILL.)	*Gresslya* aff. *intermedia* (SIMPS.)
Pholadomya angustata (SOW.)	*Pholadomya* aff. *fidicula* (SOW.)
Pseudomonotis sp. (an *jacksoni* POMP.)	*Oxytoma inæquivalve* (SOW.) var.
Lima sp.	
Myoconcha grönlandica MADSEN	*Myoconcha decorata* MÜNST.[1])

[1]) In all probability this *Myoconcha* is derived from the Charmouthian beds (Dinosaurus Kløft, Varde Kløft, or possibly Nathorst Mountain), and has by a mistake been mixed among the Upper Liassic material from the top of Nathorst Mountain. The perfect agreement with the forms from the *Uptonia* beds as well as the nature of the rock material favours this supposition. During my collections in the beds at the summit of Nathorst Mountain or in beds of the same age in other localities no specimens of *Myoconcha* were found.

The fossils recorded by MADSEN from Dinosaurus River and Varde Kløft belong to the beds with *Uptonia jamesoni*. On looking through MADSEN's material from these two localities I ascertained the presence of the following species which are not mentioned by MADSEN:

Dinosaurus River.	Varde Kløft.
Lobothyris sp.	*Astarte* cf. *camertonensis* MOORE
Cardinia sp.	*Tancredia johnstrupi* (LUNDGR.)
Entolium frontale DUM.	*Arcomya* aff. *pelea* (D'ORB.)
Plicatula sp.	*Limea acuticosta* MÜNST.
	Plicatula pectinoides LAM.

The Danish expedition in 1900 brought back also two samples of vertebrate remains. They are mentioned in 1904 by E. FRAAS (3), and comprise a vertebra of an *Opthalmosaurus* (*Baptanodon*) sp. from the Callovian beds in Varde Kløft and a footprint in a loose slab of sandstone which was found on the slope of Neill's Cliffs near the mouth of Dinosaurus Elv, 9.4 km north of Cape Stewart. From the appearance of the rocks the footprint is referable to the Lias and possibly to the beds with trails, which will be described below. FRAAS is of opinion that the footprint is due to a small dinosaur, which, like the carnivorous dinosaurs, moved by leaps; the anatomy of the foot shows the greatest similarity to species of the genus *Allosaurus*. In spite of the very decided statement by this great authority on vertebrates I cannot refrain from expressing my doubts as to the origin of this "footprint". I do not feel at all convinced that it is a footprint, but rather regard the piece as a casual constellation of four grooves in the surface of the sandstone slab, probably depressions formed by clay galls or concretionary bodies. According to information furnished by N. HARTZ, the *Opthalmosaurus* vertebra is derived from the undoubted Callovian beds in the Varde Kløft (*tychonis* horizon). The rock in which the vertebra was found, however, is of such a nature as would seem not to exclude the possibility that it was taken from Upper Liassic beds. The presence of such beds in Varde Kløft was ascertained by me in 1926.

In 1907 OTTO NORDENSKJÖLD, who was a member of the Danish expedition in 1900, published a paper (18) on the Geology and Physical Geography of East Greenland, containing among other things a description of Jameson Land and Liverpool Land, which gives a very good impression of the topography of these regions. However, NORDENSKJÖLD had no opportunity of studying the East Greenland Lias, and fresh facts concerning these beds are not, therefore, included in his paper.

During the Danish colonising expedition to Scoresby Sound in

1924—25 the Liassic beds were investigated by BJERRING PEDERSEN, who among other things ascertained the presence of an area of sediments on the western side of Rosenvinge Bay (Liverpool Land), which, as was shown later by the author of the present paper, is largely made up of Liassic sediments. The death of BJERRING PEDERSEN during the expedition prevented him from publishing the results of his investigations himself, and since his collections as well as his notes have been partially lost, only sparse information can be given regarding BJERRING PEDERSEN's work (2). Liassic fossils were collected by BJERRING PEDERSEN in SCORESBY's locality at Cape Stewart, from a bed designated bed *c* by him. Unfortunately, however, all information about the position of this bed in the section is lacking, but the fossils preserved seem to show that the bed should be located near the *Tancredia* bed, a horizon younger than the bed whose fauna was described by LUNDGREN (see p. 38). The subjoined list of the fossils yielded by bed c includes two forms which have so far never been found by others, viz. *Oxytoma cygnipes* (Y. & B.) and *Plesiosaurus* sp., of which three rather big teeth are at hand.

Pleuromya cf. *costata* (Y. & B.)
Arcomya aff. *pelea* (D'ORB.)
(*Oxytoma inæquivalve* (SOW.)[1])
Oxytoma cygnipes (Y. & B.)
Aequipecten priscus (SCHLOTH.)
Aequipecten bjerringi n. sp.
Liostrea irregularis (MÜNST. em. Qu.)
Plesiosaurus sp. teeths.

and possibly from the same horizon:
Pholadomya ambigua SOW.
Pinna cf. *folium* (Y. & B.)
Lima succincta (SCHLOTH.)

From the *Uptonia* bed in the same locality are probably derived several fossils, which were kept in the colony of Scoresby Sound and stated to have been collected by BJERRING PEDERSEN. This collection comprises:

Tetrarhynchia sp. A.
Parallelodon cypriniformis (LUNDGR.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Venericardia? aff. *liasina* (MOORE)
Tancredia johnstrupi (LUNDGR.)

[1]) In a clay ironstone nodule.

Cardium (*Jurassicardium*?) *phillipianum* DUNKER
Arcomya longa BUV.
Oxytoma inæquivalve SOW.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Plicatula pectinoides LAM.
Gryphaea cymbium LAM.
Myoconcha decorata MÜNST.
Ptychomphalus consobrinus (TATE)
Uptonia jamesoni (SOW.)

In 1925 a French expedition under the leadership of Dr. CHARCOT visited Cape Stewart. A number of fossiliferous blocks were collected from the coast by Dr. CHARCOT and M. BAILLY, and were handed over to EMILE HAUG for study. In 1926 the latter (9) published a summary of the results arrived at, and established that the blocks contained the following fauna, which is characteristic of the lower part of the "Mesoliasique":

Spiriferina münsteri DAV.
Rhynchonella tetraedra SOW.
Oxytoma inæquivalve SOW.
Lima pectinoides SOW.
Chlamys prisca SCHLOTH.
Chlamys textoria SCHLOTH.
Entolium liasinum NYST.
Entolium frontale DUM.
Terquemia pectiniformis E. DESL.
Placunopsis sp.
Gryphæa cymbium LAM. var. *depressa* CHAP. & DEW.
Gryphæa n. sp.
Pycnodonta(?) n. sp.
Perna sp. indet.
Modiola n. sp.
Myoconcha decorata MÜNST.
Myoconcha n. sp.
Cardinia sp. indet.
Cardita sp.
Arcomya longa BUV.
Pholadomya ambigua SOW.
Cryptænia sp.
Patella papyracea GOLDF. (non Qu.)
Belemnites (*Passaloteuthis*) sp. indet.

B. (*Prototeuthis*) sp. indet.
Polymorphites jamesoni SOW.
Tropidoceras stahli OPP.

HAUG further ascertained that the fauna described by LUNDGREN must belong to the same horizon as the new blocks. Among the specimens figured by LUNDGREN, HAUG identifies *Pecten stewartianus* with *Entolium frontale* (DUM.), and has some doubt as to the correctness of LUNDGREN's determinations: *Limea duplicata* SOW., *Avicula münsteri*, and *Leda lacryma* SOW., which are typical Dogger forms. The ammonite fragment not determined by LUNDGREN may possibly, according to HAUG, belong to *Polymorphites jamesoni*.

By the courtesy of Professor Dr. CH. JACOB, La Sorbonne, Paris, I have been enabled to re-examine the fossils from Cape Stewart collected by Dr. CHARCOT in 1925. The result of this examination is given in the succeeding list:

Spiriferina münsteri DAV.
Tetrarhynchia sp. A.
Tetrarhynchia sp. B.
Stolmorhynchia n. sp.
Cardinia cf. *hybrida* (SOW.)
Tancredia johnstrupi (LUNDGR.)
Cardium (*Jurassicardium*?) *phillipianum* DUNKER
Venericardia? aff. *liassina* (MOORE)
Arcomya aff. *pelea* D'ORB.
Mactromya? *groenlandica* n. sp.
Pholadomya cf. *ambigua* SOW.
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Aequipecten priscus (SCHLOTH.)
Aequipecten cf. *æquivalvis* (SOW.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textorius* (SCHLOTH.)
Entolium frontale (DUM.)
Plicatula pectinoides LAM.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. Qu.)
Gryphæa cymbium LAM.
Isognomon aff. *lugdunensis* (DUM.)[1])
Terquemia pectiniformis E. DESL. (*arietis* Qu.)
Myoconcha decorata (MÜNST.)

[1]) Presumably from the *Beaniceras* horizon (see p. 48).

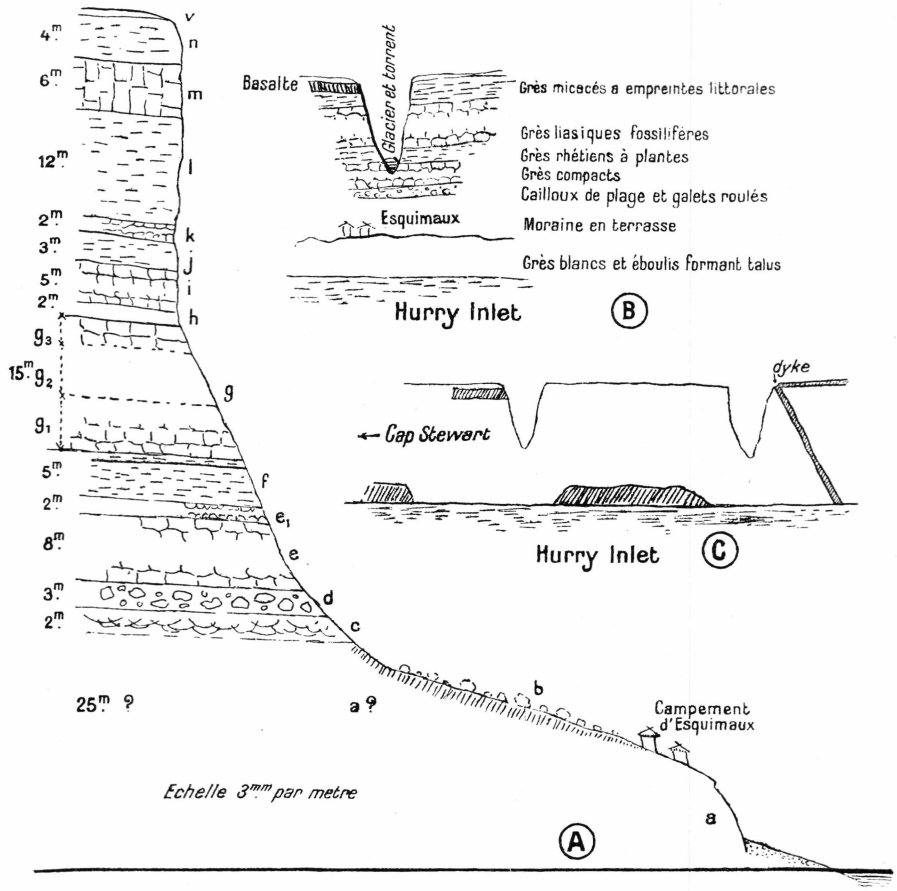

Fig. 3. (After LACOSTE).

v. Mince couche de terre végétale (toundra).
n. 4 m Grès micacés à grain fin à empreintes littorales.
m. 6 m Basalte.
l. 12 m = n.
k. 2 m Grès gris compacts sans fossiles.
j. 3 m = n.
i. 5 m = k.
h. 2 m Sorte de grauwacke.
g^3 } Grès à gros éléments à *Bélemnites* et à *Entolium frontale* DUM. formant dallage supérieur.
g^2 } 15 m Grès gris calcaires à *Polymorphites*.
g^1 } Zone de grès non fossilifères.
f. 5 m Grès noires feuilletés (rhétiens) avec empreintes de plantes et banc de lignite.
e_1 2 m Grès blancs compacts.
e. 8 m Grès roses compacts.
d. 3 m Poudingues, cailloux de plage, galets roulés avec végétaux.
c. 2 m Grès friables roses à stratification entrecroisée.
a. 25 m Grès blancs covered by b. Moraine et alluvions.
B. Schéma montrant la région de la coupe A.
C. Schéma montrant les positions du basalte dans la falaise des Neills Klippers

Hippopodium ponderosum SOW.
Ptychomphalus consobrinus (TATE)
Scurriopsis? *vendæensis* COSSMAN
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)
?*Prototeuthis* sp.
Uptonia jamesoni (SOW.)

As will be evident from a comparison of the two lists, there is a disagreement in the determinations of the species at various points and some further species have been added by me. However, it need only be mentioned here that I cannot accept HAUG's determination of *Tropidoceras stahli* (OPPEL), the specimen thus designated being in my opinion a much flattened specimen of *Uptonia jamesoni*. It is embedded in a rock that has yielded the following species: *Tancredia johnstrupi*, *Oxytoma inæquivalve*, *Entolium frontale*, and *Ptychomphalus consobrinus*, and agrees in every respect with the rocks of the *jamesoni* zone.

A new French expedition in 1926 made investigations at Cape Stewart, and a brief description of the geology of this locality was given in 1927 by J. LACOSTE (12). In a small ravine (Ræve Kløft) LACOSTE measured the rather detailed section given above (fig. 3).

As to this section LACOSTE says as follows: "Il n'existe que deux couches fossilifères: celle des plantes rhétiennes dans les grès noirs feuillettés et celle caractérisée par les zones à Polymorphites Jamesoni Sow. et à Entolium frontale Dum., qui en très grande abondance, forme un véritable dallage à la partie supérieure de ces grès liasiques. Ces grès très épais, non fossilifères à leur base, le deviennent progressivement, en même temps que leurs éléments deviennent plus grossiers.

Les blocs fossilifères trouvés sur le rivage par L'expédition Charcot de 1925 proviennent évidemment de ces grès."

During the period 1926—27 the present author made an investigation of the sedimentary deposits within the Scoresby Sound area, principally of the Lias. A preliminary account was published in 1929 (21). In that paper the series of strata from and including SCORESBY's *pectinites* beds to and including NATHORST's *Ostrea* beds is comprised in one formation: Neill's Cliff Formation, which proves to belong altogether to the Lias: "The Neills Cliff formation forms the most conspicuous part of Neills Cliff from Cape Stewart to and including Nathorst Mountain. It outcrops in the valleys north hereof and in the northern continuation of Neills Cliff, from the Skansen to the head of Carlsberg Fjord. In the region round Cape Hope it forms the main constituent of the faulted sediments, being especially predominant in the northern part of the area. The thickness of this formation is about 200 meters. The strata are chiefly made up of marine shallow water deposits consisting of sand-

stone, often cross-bedded and interstratified with arenaceous shales and bands of clay-ironstone. Also conglomeratic rocks (mud cake conglomerates) are of some importance, and several horizons of impure limestone occur in the lower portion. Fossiliferous beds occur in the upper as well as in the lower portions of the formation, while the central part contains only few and indeterminable fossils. The formation comprises the following fossil horizons, taken in ascending order:—

The Pecten limestone series comprises a lower division characterised by the presence of *Dumortieria Jamesoni* and containing a Middle Liassic fauna of about 150 species, and an upper division carrying *Ægoceras* and a fauna comprising about 20 species. To the south this series includes the lowermost 10 meters of the formation, which beds are distinctly separated from the Rhætic strata. It decreases in thickness towards the north until, in Nathorst Mountain, it has a thickness of 5 meters only. Round the Skansen and north thereof marine fossils have not been observed. The age is middle Liassic and the fauna is of a distinct West European aspect.

In a series of strata, about 100 meters thick, overlying the *Pecten* limestone series, indeterminable marine fossils have been found at two levels only, whereas the uppermost 50 meters of the formation contain several marine horizons.

The *Gervilleia* horizon. In the southern part of the area, 150 meters above the base of the formation, there is a horizon with concretions which contains a fauna with only few species but an abundance of specimens. The predominant species belong to *Gervilleia* and *Pseudomonotis*. The age has not been definitely determined, but the beds belong to the middle of the upper Lias. This horizon has been observed as far north as Varde Kløft, but disappears in the northern part of the area.

The Oyster bank series. About the uppermost 30 meters of the formation contain numerous marine horizons, being as follows in ascending order:—

Beds with *Dactylioceras* and numerous belemnites, lamellibranchiates (*Ostrea* and *Greslya* very abundant) etc.

Beds with *Pseudolioceras aff. compactile* Simpson, *Coeloceras*, and a large fauna comprising belemnites, lamellibranchiates, gastropods, etc. (about 60 species).

Beds with *Pseudomonotis*, only known from the vicinity of Dinosaurus River, where they occur as the uppermost horizon. Numerous specimens of a single species of *Pseudomonotis*, but practically no other fossils occur.

The age of these three beds is upper Liassic and the aspect of the fauna is West European."

The distribution of the Liassic deposits in Jameson Land and Liverpool Land is shown on a map accompanying the paper. To the west these beds are covered with constantly thicker beds of Jurassic sediments, the age of which, as far as it has been possible to ascertain, is intermediate between Bathonian and Volgian.

On the Danish expedition in 1926—27 Dr. TOM HARRIS subjected the Rhæto-Liassic beds to a very thorough investigation. Large parts of the flora collected by him have already been described in the Meddelelser om Grønland (Bd. 85, Nos. 2, 3, and 5), and a detailed description by HARRIS of the stratigraphy of the beds will be published later.

In various papers by LAUGE KOCH (the most important of which is Stratigraphy of Greenland, M. o. Gr. Bd. 73), the present author, and others, my above-mentioned results have been recorded, but no new facts have been set forth. Hence there is hardly any reason to enter further into these works, whereas in conclusion some treatises will be briefly mentioned in which the Liassic fauna of the Scoresby Sound area or some of its elements are dealt with.

In 1900 POMPECKJ (19) comments as follows on the material described by LUNDGREN: "In the fauna, which LUNDGREN described from Cape Stewart in East Greenland, there are possibly species of older zones, besides those of the Callovian. No affinity to our Bajocian, however, is discernible. The *Lingula* sp. described by LUNDGREN is certainly not *Lingula Beani* Phill., and Lundgren's *Avicula Münsteri* is different from our *Pseudomonotis Jacksoni*."

In 1911 RAVN (20) gives a brief summary of the available investigations of the Jurassic formations in Scoresby Sound, but attaches no critical remarks to it. Under *Tancredia Jarneri* RAVN from the Sequanian-Kimeridge of Northeast Greenland RAVN writes as follows (p. 476): "During the Danish Expedition to the east coast of Greenland in 1891—92 a single cast of a left valve of the same or a very nearly related species was found at Cape Stewart. The incompleteness of the material does not permit of a certain determination. Lundgren, who worked up the Jurassic fossils brought by the Expedition from Cape Stewart, does not mention this specimen." As will appear from the subsequent description of the lamellibranchs, the study of the newly collected material from the Liassic beds in Scoresby Sound has shown that the specimen from Cape Stewart mentioned by RAVN is not referable to *T. Jarneri*, but to a new species, which is closely related to *Tancredia broliensis* BUV.

In a paper on the Mesozoic beds on And Island, Norway, SOKOLOV recorded in 1912 (23) the occurrence of *Pecten Stewartianus* LUNDGR. (= *Entolium frontale* DUM.) from beds belonging to the Oxford-Sequanian. This is no doubt an erroneous determination.

In his large monograph: Die Pectiniden des schwäbischen Jura

(1926) STAESCHE (26) writes at p. 50 about *Aequipecten priscus* SCHLOTHEIM: "Die Art findet sich ebenso in den Alpen, in den Arietenzone von Ungarn, im Lias von Bornholm, Schonen und Grönland (Pecten Johnstrupi Lundgren)." Thus, without knowing HAUG's determination of the same year of the Cape Stewart beds as Middle Lias, STAESCHE has been able to ascertain by means of the said Lias-Pecten that the beds mentioned by LUNDGREN belong to the Lias and not to the Callovian.

A small part of my collections from 1926 comprising Crustacean remains from the upper part of the Lias in Jameson Land were kindly worked out in 1929 by Professor VICTOR VAN STRAELEN, director of the Musée royal d'histoire naturelle à Bruxelles (27). Two species of the genus *Glyphea* were ascertained, viz. *Glyphea rosenkrantzi* VAN STRAELEN and a *Glyphea* sp. which could not be more closely identified, but differed specifically from the former species. In a letter to Professor VAN STRAELEN I pointed out that the beds from which the *Glyphea* species were taken should, according to the ammonites found by me, be referred to the Upper Lias, but that they were further identical with the beds described by VICTOR MADSEN as Upper Bajocian or Lower Bathonian. Unfortunately these remarks are not cited in VAN STRAELEN's paper, in which the Crustacean remains, in accordance with VICTOR MADSEN's determination of the age, are erroneously referred to the Dogger. I take the opportunity to point out here that *Glyphea rosenkrantzi* seems to be closely related to *Glyphea prestwichi* WOODS from the Blea Wyke beds (Upper Toarcian) of the Yorkshire coast; however, the two species can hardly be regarded as entirely identical, since, among other things, their ornamentation presents minor points of difference.

DESCRIPTIONS OF LOCALITIES AND FAUNAS

I. Jameson Land.

Jameson Land is built up of sediments cut through by subordinate dykes and sills of basalt. Faults of any importance have not been observed. Wherever I was able to study the sediments, the beds dipped slightly towards the southwest. To the north and northeast the land attains its greatest altitude, over 1000 m, while it is quite low along the south and west coasts, from which it rises gradually towards the north (fig. 5). Jameson Land is separated from Liverpool Land by Hurry Inlet, the Klitdalen, and Carlsberg Fjord. Along its eastern edge it descends abruptly, forming a steep cliff, Neill's Cliff, traceable from Cape Stewart to Canning Land along the above-mentioned fjords and the Klitdalen. The cliff increases evenly in height from Cape Stewart, where it is only 10 m, to the region round Astarte Kløft and Musk-ox Kløft, where it is over 600 m. North of this point the cliff decreases in height, Harris Mountain being 470 m and Nathorst Mountain 565 m (see fig. 8). The continuation of the cliff along the eastern edge of the Klitdal shows an increase from 500 m to over 1000 m at the head of Carlsberg Fjord. In several places the cliff is intersected by broad valleys, dividing it into isolated mountains, to which special names have been applied. The most important valleys are formed by the rivers Hare Elv, Gaase Elv, Ugle Elv, Ryder Elv, and Lejr Elv. A tolerably large, still unnamed, river cuts through the cliff midway between the head of Carlsberg Fjord and the low spit of land that connects Canning Land with Jameson Land. Along the west coast of Hurry Inlet the Liassic beds constitute the most conspicuous part of Neill's Cliff, and hence in 1929 I included these beds under the term Neill's Cliff Formation. The beds are traceable from the cliff up through the river beds to the west until they are covered by younger sediments. In Dusén Mountain the top is made up of Liassic beds; round the Skansen the Liassic beds play a similar part as along the west coast of Hurry Inlet, whereas at the west coast of Carlsberg Fjord they can only be expected to appear in the river valleys at a fairly

large distance from the coast. Fossiliferous marine Liassic beds were ascertained northward as far as the head of Carlsberg Fjord in 1926—27, but they no doubt extend much farther northward, and judging from some of the fossils brought back by LAUGE KOCH in 1927, there is some reason to suppose that they can be traced as far as Antarctic Harbour.

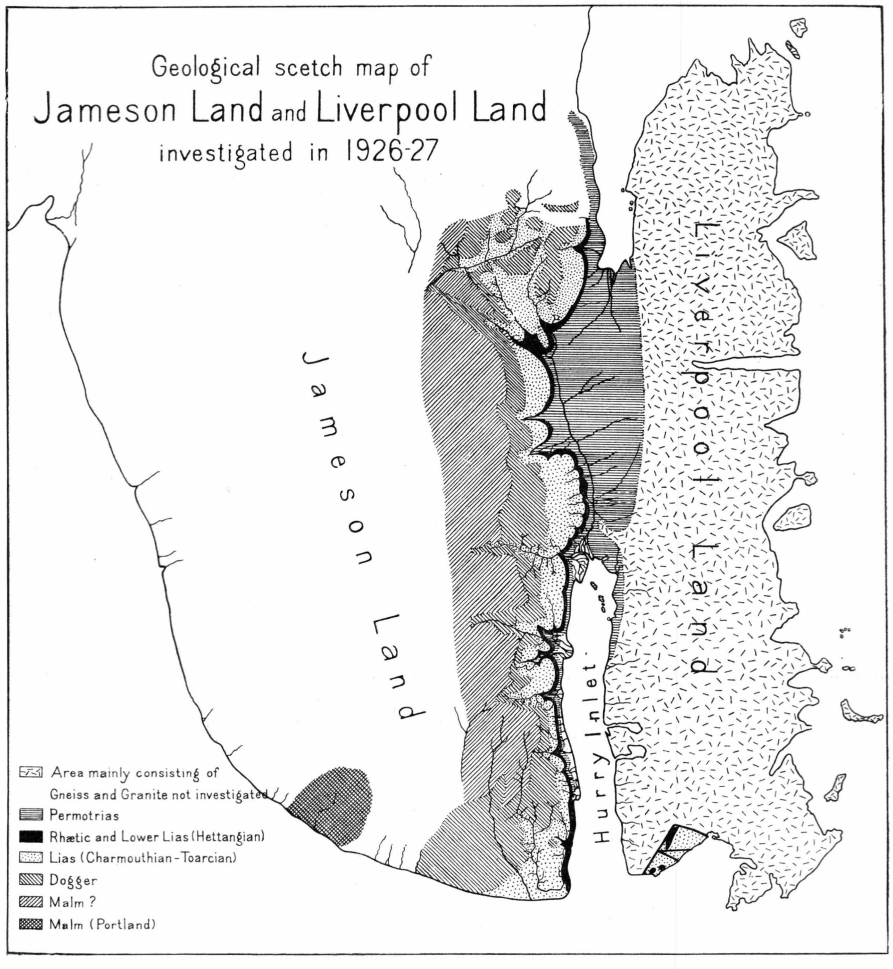

Fig. 4.

The strata that form the substratum of the marine Liassic beds are treated in my paper from 1929. The oldest beds observed in Jameson Land are formed by the so-called Klitdal Formation, in the rocks of which we did not succeed in finding any fossils. The lowermost beds are built up of coarse conglomerates, passing gradually upwards into a red, finer-grained arkose sandstone. Above follows a series of limestone and dolomite with intermediate beds of mud cake conglomerates, which

contain lumps of gypsum at several levels (fig. 6). This series is overlain by beds, up to 225 m thick, of purple marl interstratified with limestone (fig. 7). In the upper part these beds alternate with a white kaolin sandstone with red felspar grains. The aggregate thickness of the three members of the Klitdal Formation, viz. the arkose member, the gypsum member, and the red marl member, could not be exactly determined. In the southern part of the Klitdalen the total thickness must be estimated at at least 350 m. From this point the arkose member increases considerably in thickness towards the north, while the thickness of the

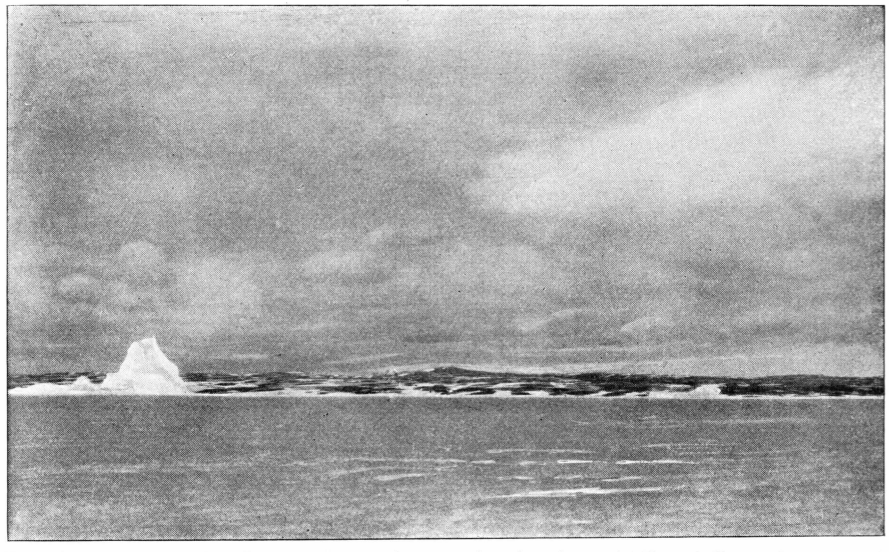

Fig. 5. Jameson Land seen from the sea ice in the middle of Scoresby Sound. The highest point is Mt. J. P. Koch Fjæld. — 11.-6.-1927.

two uppermost members seems to be more constant. Along the west coast of Carlsberg Fjord, Neill's Cliff is, as far as can be judged, exclusively built up of beds belonging to the Klitdal Formation. The lack of fossils renders it difficult to determine the age of the Klitdal Formation. It is overlain by Rhætic beds, and hence may be entirely, or partially, of Triassic age. Quite lithologically there is good agreement between the red marl member and the Northwest European Keuper beds, as already pointed out by NATHORST (17).

The Klitdal Formation is overlain by the so-called Cape Stewart Formation, comprising a series of strata about 175 m thick. The formation is mainly composed of grey, yellow, and green sandstones at times containing coarse quartzitic conglomerates. The uppermost 90 m at certain levels contain plant-bearing shales, the fossils of which have been described by HARTZ (8) and HARRIS (6). In a paper from 1931 (7) the latter has stated the flora of the uppermost 60 m to belong to the

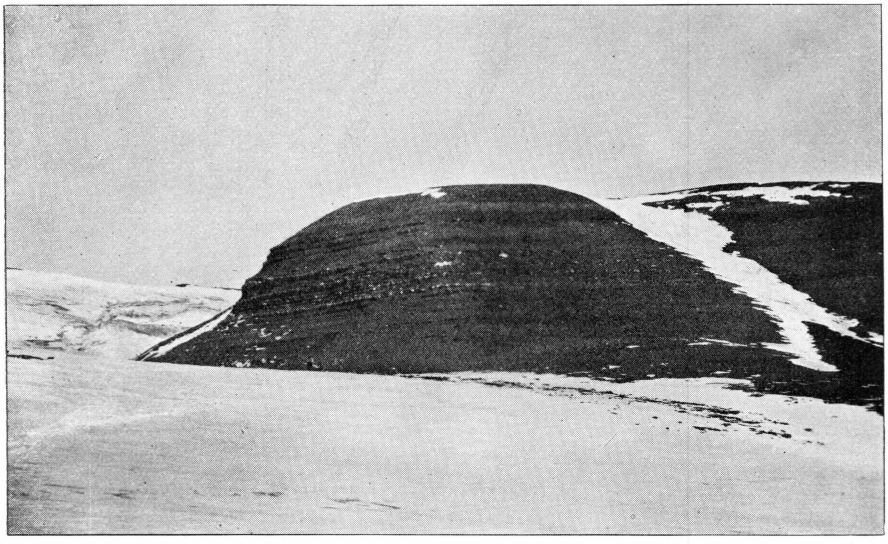

Fig. 6. Beds of the Klitdal Formation containing gypsum.
Height of section about 25 m. East side of Klitdalen. — 30.-4.-1927.

Lias, while the lowermost 30 m are of Rhætic age. According to HARRIS, the Liassic plant beds are equivalent to the *pre-planorbis* and *planorbis* zones of the Hettangian.

The Cape Stewart Formation is overlain by the Neill's Cliff Formation, the lower portion of which is made up of marine beds belonging to the *jamesoni* zone of the Charmouthian. The fossiliferous Char-

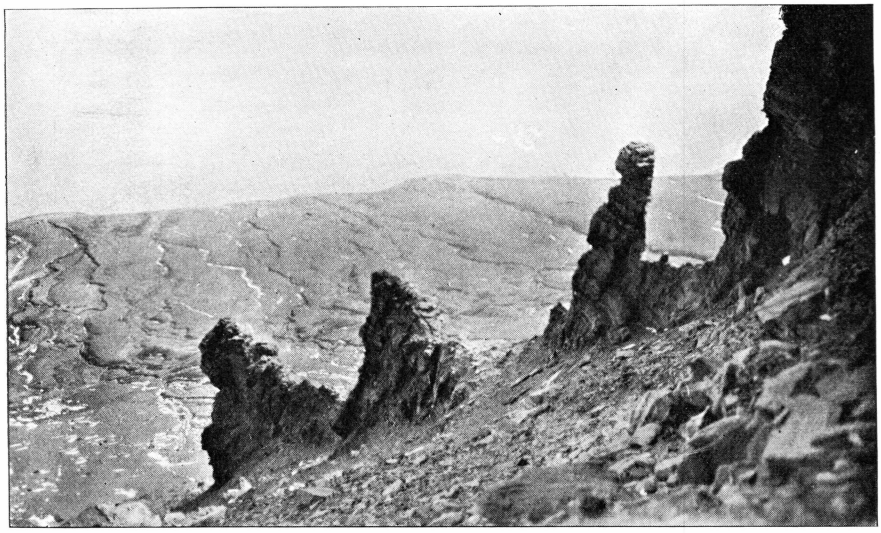

Fig. 7. The foreland of Mt. Nathorst Fjæld consisting of red marl of the Klitdal Formation, seen from an altitude of 430 m. — 13.-9.-1926.

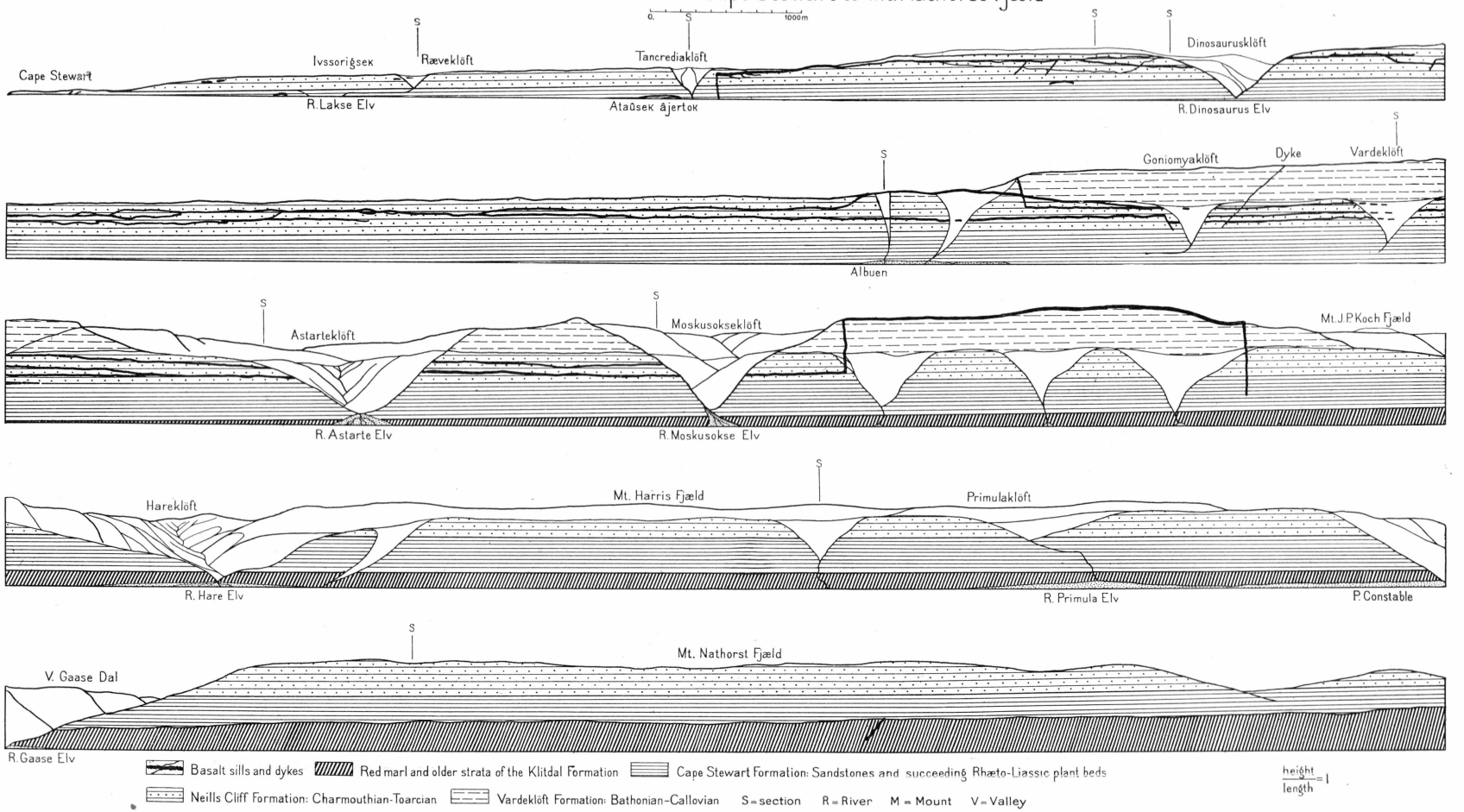
The Neills Cliff section from Cape Stewart to Mt. Nathorst Fjæld
0.
S
1000m
Cape Stewart
Ivssorigsek
Ræveklöft
Tancrediaklöft
Dinosaurusklöft
R. Lakse Elv
Ataûsek âjertok
R. Dinosaurus Elv
Goniomyaklöft
Dyke
Vardeklöft
Albuen
Astarteklöft
Moskusokseklöft
Mt. J. P. Koch Fjæld
R. Astarte Elv
R. Moskusokse Elv
Hareklöft
Mt. Harris Fjæld
Primulaklöft
R. Hare Elv
R. Primula Elv
P. Constable
Mt. Nathorst Fjæld
V. Gaase Dal
R. Gaase Elv
Basalt sills and dykes
Red marl and older strata of the Klitdal Formation
Cape Stewart Formation: Sandstones and succeeding Rhæto-Liassic plant beds
Neills Cliff Formation: Charmouthian-Toarcian
Vardeklöft Formation: Bathonian-Callovian
S = section
R = River
M = Mount
V = Valley
height / length = 1

Fig. 8.

mouthian beds are in certain places only separated some few metres from the uppermost plant beds, and the boundary between the more or less conglomeratic basal beds of the Neill's Cliff Formation and the plant-bearing series beneath, therefore, according to HARRIS, represents a considerable gap comprising the upper half of the Hettangian, the whole Sinemurian, and the Lower Charmouthian. The possibility cannot be entirely disregarded, however, that a *Thaumatopteris* flora equivalent to younger zones too than the *planorbis* zone has existed in East Greenland.

The Neill's Cliff Formation comprises a series of strata more than 200 m thick. The boundary towards the substratum rises evenly from Cape Stewart (the southeastern point of Jameson Land), where it is practically at sea-level, to the southern part of Dusén Mountain, where it occurs 490 m above sea-level. Farther northward the boundary could not be ascertained, since here the *jamesoni* horizon seemed to wedge out entirely. It should, however, be noted here that the investigation of the northern part of the area, which was carried out in April, 1927, was much impeded by snow. Judging from the fossils collected, the Neill's Cliff Formation includes the part of the Liassic formation that below comprises the Charmouthian *jamesoni* zone and above the Upper Toarcian or possibly even the Aalensis zone of the Aalenian. Only the lower and upper portions of the formation include ammonite-bearing beds. In the intermediary series, the thickness of which far exceeds the aggregate thickness of the above-mentioned beds, only sparse fossils have been found. Portions of this series seem to have been deposited under similar conditions to those under which the fresh water Rhæto-Liassic beds were deposited.

The Neill's Cliff Formation is overlain by the Vardekløft Formation, whose age, according to SPATH (25), covers Upper Bathonian, Lower and Middle Callovian. Hence the boundary between the two formations represents a considerable gap comprising the whole or most of the Aalenian, Bajocian, and Lower Bathonian.

A. The area of Cape Stewart.

My investigations within this classical area comprised, in addition to the ravine (Ræve Kløft) immediately west of the settlement Ivssorigsek visited by earlier expeditions, two other outcrops of the fossiliferous Charmouthian beds which were not known before, and further I collected numerous fossils from these beds in loose blocks that lay round the said settlement at the foot of Neill's Cliff.

Coast section at Cape Stewart.

The southeastern corner of Jameson Land is built up of the plant-bearing beds of the Cape Stewart Formation, which extend in a low

coast cliff up along Hurry Inlet to the mouth of Lakse Elv and also form the coast section a short way towards the interior of Scoresby Sound. West of this I discovered, on September 16th, 1926, a beautiful section, which for a length of about 900 m exhibited a series of fossiliferous Charmouthian beds; this section is represented in pl. 9. The series of beds here contains several hard bands, in which the fossils are, as a rule, well preserved. About 350 m from the eastern end of the section the beds are intersected by a fault, which has brought about a downward shifting of the eastern part of the series. This fault was concealed by scree in the section, but its presence seems probable on account of the sudden appearance of bed 2 and the agreement of this bed with bed c east of the fault. Fossils were collected at various places in the section, viz. in.

Bed a, the oldest bed visible. Dark, greyish-green arkose sandstone carrying scattered, flattened, poorly preserved fossils. The bed contains some conglomeratic portions with big quartz and felspar grains, and is rich in mica and iron. The following fossils were collected:

Serpula sp. cf. *torquata* QU.
Lobothyris sp.
Nuculana subovalis (GF.)
Nuculana zieteni (BRAUNS)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte bayi LUNDGR.
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya costata (Y. et B.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Limea acuticosta MÜNST.
Aequipecten æquivalvis (SOW.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Modiola lævis SOW.
Modiola scalprum SOW.
Prototeuthis cf. *pennicillata* (DUM.)

Bed b, 200 m from the eastern end of the section. A hard bed of coarse, calcareous arkose-sandstone with big mica flakes and scattered fossils. Here the following fossils were collected:

Cardinia hybrida (SOW.)
Venericardia? aff. *liasina* (MOORE)

Tancredia n. sp. A.
Oxytoma inæquivalve (Sow.)
Lima (*Pseudolimea*) *boonei* Cossman
Chlamys substriata (Röm.) var. *rinki* (Lundgr.)
Plicatula pectinoides Lam.
Gryphæa cymbium Lam.

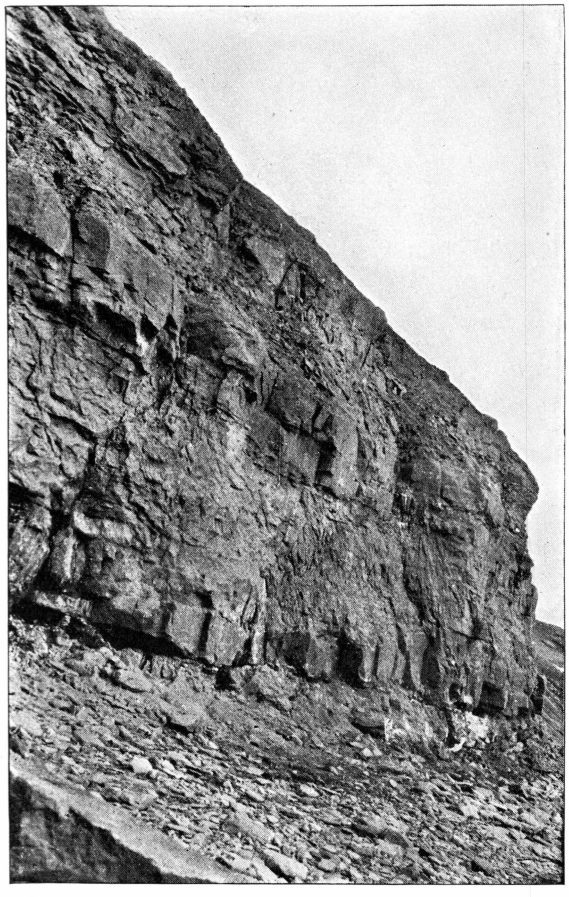

Fig. 9. Eastern part of the coast section west of Cape Stewart. Beds b and c. — 17.-9.-1926.

Bed c, like bed b investigated 200 m from the eastern end of the section (fig. 10). Light-grey, hard, rather fine-grained, arkose-like calcareous sandstone with large mica flakes and scattered fossils. The surface of the bed covered with thin dark shales with *Scolithus*-like tubes filled with light-coloured sand. This bed is overlain by a greenish sandstone. From bed c the following fossils have been determined:

"Ophiomorpha"
Grandirhynchia sp.
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte scanensis? MBG.
Venericardia? aff. *liasina* (MOORE)
Tancredia johnstrupi (LUNDGR.)
Quenstedtia? sp.
Gresslya lunulata TATE
Arcomya longa (BUV.)?
Goniomya hybrida (MÜNST.)
Oxytoma inæquivalve (SOW.)
Limea acuticosta MÜNST.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Terquemia pectiniformis E. DESL. (*arietis* QU.)
Hippopodium ponderosum SOW.
Ptychomphalus consobrinus (TATE)

Bed 1, about 625 m from the eastern end of the section. A hard bed of a dark-grey, coarse arkose limy sandstone with a greenish lustre and cracks filled with calcite. On the bedding planes there are great accumulations of big shells: *Lima succincta*, *Isognomon* sp. nov., and *Gryphæa cymbium*. In addition were found:

Spiriferina münsteri DAV.
Grandirhynchia n. sp.
Grandirhynchia elii n. sp.
Cardinia aff. *attenuata* (STUTCHBURY)
Trigonia lingonensis DUM.
Astarte scanensis? MBG.
Astarte wandeli LUNDGR.
Venericardia? aff. *liasina* (MOORE)
Tancredia johnstrupi LUNDGR.
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)

Gresslya lunulata TATE
Arcomya aff. *pelea* (D'ORB.)
Oxytoma inæquivalve (SOW.)
Oxytoma n. sp.
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Isognomon aff. *infraliassica* (QU.)
Lima succincta (SCHLOTH.)
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Plagiostoma*) *punctata* SOW.
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Plicatula pectinoides LAM.
Plicatula cf. *lævigata* (D'ORB.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Ptychomphalus n. sp.

Bed 2, about 400 m west of the eastern end of the section. Very hard dark-grey calcareous sandstone with some few coarse grains. Considerable accumulations of well preserved fossils at different levels. At the top of the bed there is a veritable pavement with *Entolium frontale*. Above this bed there occur vertical *Scolithus*-like light-coloured sandstone pipes in thin beds of dark shales (fig. 10). From this bed the following fossils were collected:

Lingula sacculus CHAP. et DEW.
Grandirhynchia n. sp.
Stolmorhynchia n. sp.?
Nuculana aff. *complanata* (GF.)
Nuculana zieteni (BRAUNS)
Cardinia hybrida (SOW.)
Cardinia aff. *attenuata* (STUTCHBURY)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma a TATE
Astarte striato-sulcata RÖM. forma b TATE
Astarte scanensis? MBG.
Astarte obsoleta DUNKER

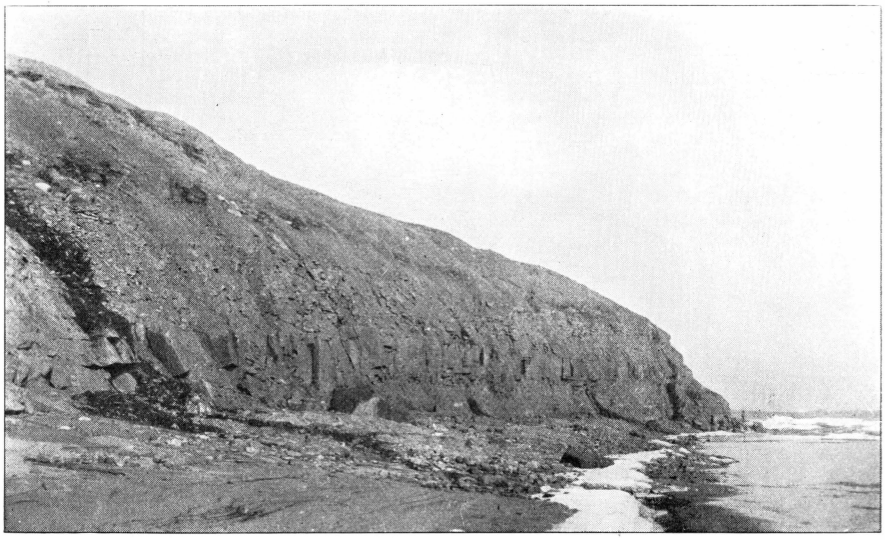

Fig. 10. The Coast section west of Cape Stewart. Bed c. — 17.-9.-1926.

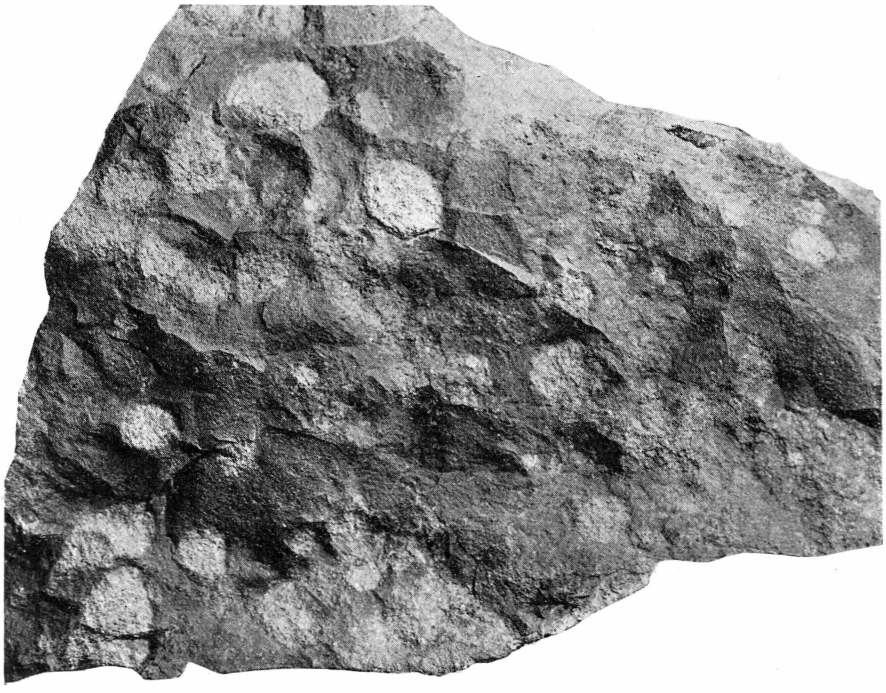

Fig. 11. Scolithus-like formations in bed 2. Coast section west of Cape Stewart. Nat. size. Chr. Halkier phot.

Astarte bayi LUNDGR.
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia johnstrupi (LUNDGR.)
Quenstedtia? n. sp.
Mactromya? *groenlandica* n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya costata (Y. et B.)
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Oxytoma inæquivalve (SOW.)
Oxytoma n. sp.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Modiola scalprum SOW.
Ptychomphalus consobrinus (TATE)
cf. *Aulacotrochus nitens* DUM.

Bed 2 a, about 675 m from the eastern end of the section. A hard bed of coarse, dark-grey to lighter-grey, calcareous arkose-sandstone with numerous *Entolium frontale* and other scattered, well preserved fossils. The following fossils have been determined:

"*Ophiomorpha*"
Grandirhynchia n. sp.
Tetrarhynchia sp. A.
Nuculana zieteni (BRAUNS)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma a TATE
Astarte scanensis? MBG.
Astarte bayi LUNDGR.
Tancredia n. sp. A.

Tancredia johnstrupi (LUNDGR.)
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pleuromya costata (Y. et B.)
Arcomya aff. *pelea* (D'ORB.)
Oxytoma inæquivalve (SOW.)
Oxytoma n. sp.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Plicatula cf. *lævigata* (D'ORB.)?
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Dentalium parvulum (J. BUCKMAN) RICH.
Pleurotomaria sp.

In the western part of the section bed 2 is overlain by a series of highly alternating beds in which we failed to find any fossils. From the base upwards this series comprises: 3: green sandstone, slightly more than 3 m thick, overlain by 4: 1 m of shales with big lenticular sandstone lumps. Above follow 5: 75 cm of fine-grained shales, succeeded by 6: hard, finely laminated sandstones. Farther west the section is completely covered by Quaternary deposits.

Lakse Elv.

Immediately north of the above-mentioned coast section fossiliferous beds crop out for a short stretch in the northern bank of Lakse Elv. The beds are made up of a hard, rather fine-grained, light-grey calcareous sandstone with scattered fossils and fairly large mica scales. *Limea acuticosta* occurs in large number. In addition the following species were found:

Mactromya? *groenlandica* n. sp.?
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)?
Oxytoma inæquivalve (SOW.)
Oxytoma n. sp.
Limea acuticosta MÜNST.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)?
Plicatula sarcinula MÜNST.
Myoconcha sp.

From two large blocks occurring in the river bed of Lakse Elv a large number of fossils were brought back. The blocks were found at the last bend of the river before it debouches into Hurry Inlet. The rock of block 1 was a hard, greyish, rather fine-grained calcareous sandstone teeming with big shells. Certain beds are made up of a rather coarse arkose. In block 1 numerous shells of oysters, *Chlamys substriata rinki*, *Æquipecten priscus*, and *Entolium frontale*, were found, all lying with the convex side "upwards". In block 2, which consisted mainly of a coarce calcareous arkose-sandstone, numerous specimens of *Myoconcha decorata* were found. The fossil contents of the blocks were as follows:

Block 1. *Tancredia* n. sp. A.
Pholadomya ambigua (Sow.)
Oxytoma inæquivalve (Sow.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Lima succincta (Schloth.)
Entolium callosum Lundgr.
Aequipecten priscus (Schloth.)
Chlamys substriata (Röm.) var. *rinki* Lundgr.
Plicatula pectinoides Lam.
Placunopsis minuta Lundgr.
Liostrea irregularis (Münst. em. Qu.)
Gryphæa arcuata Lam.
Gryphæa cymbium Lam.
Myoconcha decorata (Münst.)
Hippopodium ponderosum Sow.

Block 2. *Spiriferina münsteri* Dav.
Tetrarhynchia sp. B.
Cardinia hybrida (Sow.)
Trigonia lingonensis Dum.
Tancredia n. sp. A.
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)
Arcomya aff. *pelea* (d'Orb.)
Pholadomya ambigua (Sow.)
Oxytoma inæquivalve (Sow.)
Isognomon n. sp.
Lima (*Pseudolimea*) *boonei* Cossman
Aequipecten priscus (Schloth.)
Chlamys substriata (Röm.) var. *rinki* (Lundgr.)
Liostrea irregularis (Münst. em. Qu.)
Gryphæa arcuata Lam.

Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.

Ræve Kløft.

In this small ravine, through which flows Storgaard Elv, an insignificant tributary to Lakse Elv, the section represented in pl. 9 was measured on September 16th, 1926. It was in the same place in which LACOSTE measured his section in 1926 (see p. 20). A comparison of the two sections does not show very great disagreements, mention should merely be made here of the *Tancredia* bed (g.) ascertained by me, but which entirely escaped LACOSTE's attention. The section in pl. 9 exhibits the following series of strata:

a. Shaly, yellowish-brown, fine-grained sandstone with pebbles of shale.
b. Basalt, underlain by dark clay shales.
c. Micaceous shales with lenticular bedding. The shales alternate with thin, light-grey beds and lenses of sandstone. On the surfaces of the sandstone beds numerous trails may be observed (fig. 12). The beds are uncalcareous and very ferruginous.
d. Fine, shaly, micaceous sandstone with small irregular hard bands and trails on the bedding planes.
e. A rather hard, brownish-grey sandstone bed without fossils.
f. Loose, shaly sandstones, in the upper part sandy clay shales.
g. Very hard, dark-grey, rather fine-grained, ferruginous, calcareous sandstone with abundant large mica flakes. Contains numerous fossils, in the main in an excellent state of preservation. Many shells have been transformed into a white calcareous mass, while others are quite fresh and of a dark-brown colour. In this bed the following fossils were found:

Nucula cf. *cordata* GF.
Parallelodon cypriniformis (LUNDGR.)
Cardinia hybrida (SOW.)
Trigonia cf. *lingonensis* DUM.
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)?
Tancredia (*Corbicellopsis*?) n. sp.
Arcomya aff. *pelea* (D'ORB.)
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten bierringi n. sp.
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Amberleya cf. *imbricata* (SOW.)
Belemnites sp. ind.

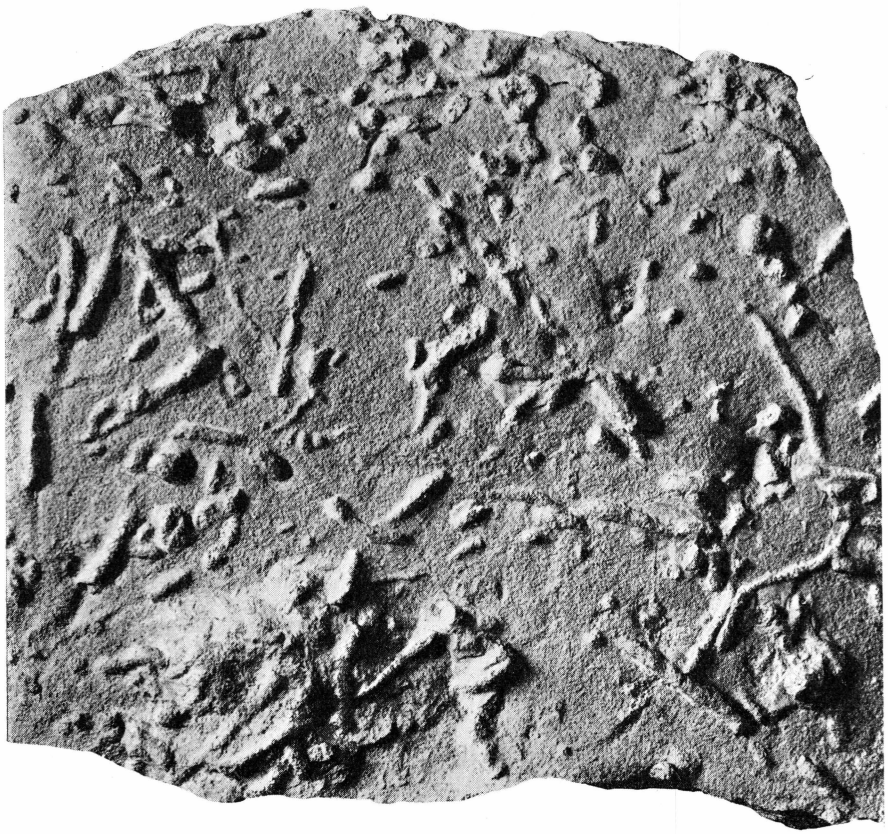

Fig. 12. Sandstone with trails. Ræve Kløft. Nat. size. — Chr. Halkier phot.

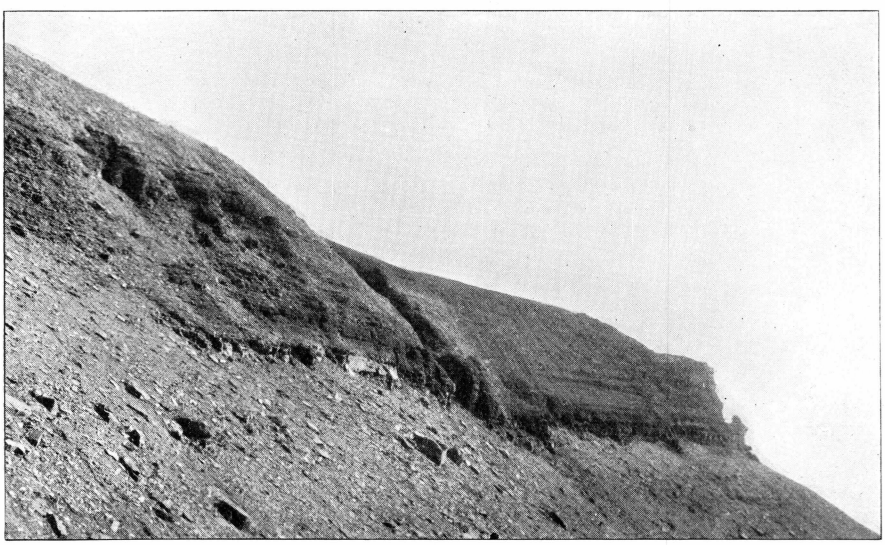

Fig. 13. The north side of Ræve Kløft. At the top, the beds with trails and lenticular bedding. On the slope covered with scree below, pieces of the *Uptonia* bed are seen. In the middle of the picture a small fault. The beds to the right thereof have been lowered about 5 m. — 16.-9.-1926.

h. Fine, shaly, medium-grained, micaceous sandstone with small, irregularly hard bands.

i. A hard bed with numerous fossils, made up of alternating strata of a coarse arkose (= the rock of block 1 in Lakse Elv) and finer-grained, very micaceous, shaly beds. At several levels pavements with *Entolium frontale* could be observed. At the top of the bed Scolithus-like formations were observed similar to those mentioned from beds 2 and 3 in the coast section. Specimens of *Uptonia jamesoni* were encountered at the top as well as at the base of this bed. Otherwise the fauna is composed as follows:

Tetrarhynchia sp. A.
Nuculana galathea (D'ORB.)
Parallelodon cypriniformis (LUNDGR.)
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Trigonia lingonensis DUM.
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia n. sp. B.
Quenstedtia? n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Ceratomya petricosa (SIMPS.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Oxytoma n. sp.
Pinna cf. *folium* (Y. et B.)
Velata hartzi n. sp.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Camptonectes n. sp.
Plicatula pectinoides LAM.
Plicatula sarcinula MÜNST.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Hippopodium ponderosum SOW.

Dentalium parvulum (J. Buckman) Rich.
Ptychomphalus n. sp.
Trochopsis? sp.
Uptonia Jamesoni (Sow.)

j. Conglomeratic, loose sandstone with fragments of fossils, underlain by a hard, medium-grained sandstone bed, which must be assumed to belong to the Rhæto-Liassic plant series following immediately below.

Large block at the shore north of Ivssorigsek.

Immediately south of the low coast section through the green sandstone already mentioned by Hartz (fig. 14), which is traceable as far

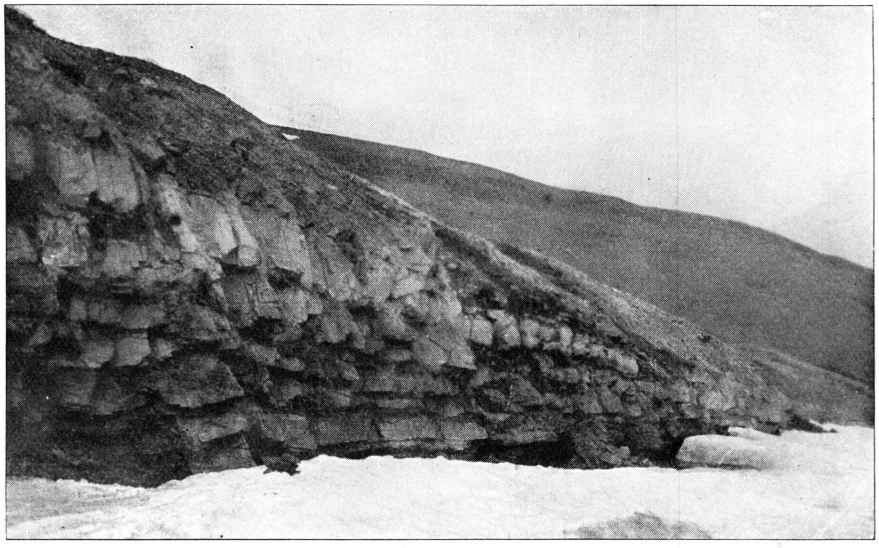

Fig. 14. Green sandstone of the Cape Stewart Formation in the coast cliff north of Ivssorigsek. — 11.-7.-1927.

as Nathorst Mountain, a huge block of a hard, dark-grey, nearly black rock was found, composed mainly of coarse arkose with a great accumulation of small shells in certain beds, and penetrated by burrows filled with a dark clayey substance. From this block the fossils are no doubt derived which were described by Lundgren from his dark limestone. The material worked up by Haug likewise includes pieces that may be derived from this block. The block contains specimens of *Uptonia jamesoni*, and its exceedingly rich fauna therefore gives a good idea of the fossil contents of this zone. The fauna comprises:

"*Ophiomorpha*"
Discinisca n. sp.
Tetrarhynchia sp. A.

Stolmorhynchia n. sp.
Lobothyris aff. *punctata* (SOW.)
Ornithella sp.
Nuculana aff. *complanata* (GF.)
Nuculana zieteni (BRAUNS)
Parallelodon sp. A. aff. *buckmani* (RICH.)
Parallelodon cypriniformis (LUNDGR.)
Cardinia hybrida (SOW.)
Cardinia aff. *attenuata* (STUTCHBURY)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma b TATE
Astarte scanensis? MBG.
Astarte aff. *obsoleta* DUNKER
Astarte bayi LUNDGR.
Astarte wandeli LUNDGR.
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia cf. *elegans* MBG.
Tancredia johnstrupi LUNDGR.
Quenstedtia? n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Tellina? n. sp.
Mactromya? *groenlandica* n. sp.
Gresslya lunulata TATE
Arcomya aff. *pelea* (D'ORB.)
Goniomya hybrida (MÜNST.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Cultriopsis n. sp.
Lima succincta (SCHLOTH.)
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Plagiostoma*) *punctata* SOW.
Limea acuticosta MÜNST.
Velata hartzi n. sp.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Camptonectes n. sp.
Plicatula pectinoides LAM.
Plicatula cf. *lævigata* (D'ORB.)

Plicatula sarcinula MÜNST.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Terquemia pectiniformis E. DESL. (*arietis* QU.)
Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Modiola aff. *subcancellata* BUV.
Hippopodium ponderosum SOW.
Tornatellaea cf. *fontis* (DUM.)
Uptonia jamesoni (SOW.)

From other blocks found in the territory round the settlement IVSSORIGSEK the following fossils were collected, all of which must be assumed to belong to the *Jamesoni* zone.

Spiriferina münsteri DAV.
Tetrarhynchia sp. A.
Tetrarhynchia sp. B.
Stolmorhynchia n. sp.
Rhynchonella cf. *scalpellum* QU.
Lobothyris aff. *punctata* (SOW.)
Lobothyris cf. *subpunctata* (DAV.)
Parallelodon cf. *buckmani* (RICH.)
Parallelodon cypriniformis (LUNDGR.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Tancredia n. sp. A.
Tancredia johnstrupi LUNDGR.
Quenstedtia? n. sp.
Mactromya lindhammeri ROLLIER
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pseudomonotis cf. *papyria* (QU.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Lima succincta (SCHLOTH.)
Lima (*Plagiostoma*) *eucharis* D'ORB.

Lima (*Pseudolimea*) *boonei* COSSMAN
Limea acuticosta MÜNST.
Velata hartzi n. sp.
Entolium frontale (Dum.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Camptonectes n. sp.
Plicatula pectinoides LAM.
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.
Pleurotomaria aff. *singularis* SIEBERER
Ptychomphalus n. sp.
Scurriopsis? *vendæensis* COSSMAN
Striactæonina booni COSSMAN
Uptonia jamesoni (SOW.)

B. The area between Ivssorigsek and Albuen.

Tancredia Kløft.

Midway between Cape Stewart and Dinosaurus Elv there occurs in Neill's Cliff a conspicuous ravine, which was called Tancredia Kløft. Here the section represented in pl. 9 and in fig. 15 was measured on September 29th, 1926. It comprises the following beds:

a. Black clay shales with plant remains in the river some distance inland.
The section through the coast cliff:
b. Quaternary gravel.
c. Brown sandstone with big concretionary formations.
d. Shaly sandstone and sandy shales (lenticular bedding) with annelid trails on the bedding planes.
e. Half a metre of a hard, rather fine-grained, light-grey ferruginous arkose-sandstone with very few badly preserved fossils, among which *Tancredia* cf. n. sp. A.
f. Shales, sandy at the base.
g. Loose sandstone.
h. Hard bed, 1 m thick, very coarse, greyish-brown arkose rich in quartz grains. Typical pavement with entire shells of *Entolium frontale*. In addition *Uptonia jamesoni* and the following fossils were found:

Cardinia sp.
Tancredia n. sp. A.
Mactromya? *groenlandica* n. sp.
Arcomya? n. sp.
Oxytoma inæquivalve (Sow.)
Isognomon n. sp.
Lima (*Pseudolimea*) *boonei* Cossman
Entolium frontale (Dum.)
Entolium callosum (Lundgr.)

Fig. 15. Hurry Inlet, seen from the top of Neill's Cliff at Tancredia Kløft. To the right Liverpool Land. The hard beds exposed in the lower part of the ravine to the left is the *Uptonia* limestone. — 29.-9.-1926.

Aequipecten priscus (Schloth.)
Chlamys substriata (Röm.) var. *rinki* (Lundgr.)
Liostrea irregularis (Münst. em. Qu.)
Gryphæa cymbium Lam.
Myoconcha decorata (Münst.)
Modiola lævis Sow.
Hippopodium ponderosum Sow.

i. Loose, coarse sandstone, resting upon a hard bed, 1.5 m thick, corresponding to bed h. Here, too, *Entolium frontale* and a fragment of *Uptonia* were observed, but otherwise no fossils were collected here, the bed being much obscured by débris. For the same reason the superposition on the plant-bearing Rhæto-Liassic series could not be closely studied.

In a loose piece of rock found above the *Uptonia* horizon and consisting of a conglomerate composed of shaly pebbles, gneiss, and other pebbles coated with clay, were found some shells of *Plicatula* cf. *lævigata*, probably originating from the uppermost bed of the section.

Ravine south of Dinosaurus Kløft.

On the shore between Tancredia Kløft and Dinosaurus Kløft there often occur large blocks remarkable for their rich content of fossils. They are huge concretionary formations, sometimes thinly laminated. The

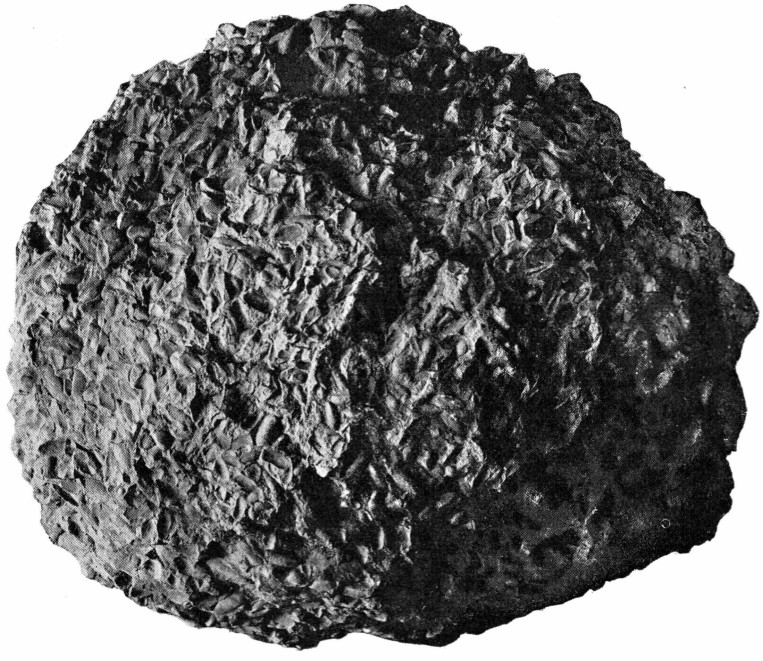

Fig. 16. Concretion from the "Gervillia" horizon, crowded with shells of *Gervillia* vel *Pteria*. Width of the concretion 60 cm. Second ravine south of Dinosaurus Kløft. Chr. Halkier phot.

rock varies from fine-grained, dark-grey calcareous sandstone with abundant mica on the bedding planes, to coarse, dark-coloured arkose-sandstone. In order to determine the place of this rock in the sequence of strata, an ascent of Neill's Cliff was made in the second ravine south of Dinosaurus Kløft. The base of the Charmouthian here occurred at an altitude of 125 m above sea level, and above it followed the series of strata represented in pl. 10. The series will not be dealt with in detail here, as it is practically identical with the section on the south side of Dinosaurus Kløft, and on account of scree was not very exactly measured However, below the uppermost basalt layer, which forms the top of the

cliff, there occur a number of younger beds not visible in the cliff at Dinosaurus Kløft. In these upper beds, occurring between 220 and 280 m and consisting mainly of sandstones with subordinate beds of shale, several horizons of cone marl were observed. Here, at an altitude of 275 m, that is, 150 m above the base of the Charmouthian, the fossiliferous rock sought for was found in the form of a number of large concretions. The fauna embedded in these concretions is exceedingly rich in individuals (fig. 16), but rather poor in species. In some concretions a *Gervillia* (or possibly a *Pteria*) predominates, others contain numerous specimens of *Pseudomonotis substriata*, and others again numerous shells of a *Cyrena*-like form. The fauna collected from this horizon, which I have formerly termed the *Gervillia* horizon, includes the following species:

Cyrena? sp.
Pleuromya sp. indet.
Pseudomonotis substriata (MÜNST.)
Gervillia? sp. nov. A.
Liostrea irregularis (MÜNST.)
Mytilus n. sp.
Ceratomya sp.

The south side of Dinosaurus Kløft.

Here the following section was measured on September 10th, 1926 (plate 10).

Up to 140 m alternating arenaceous and argillaceous beds belonging to the Rhæto-Liassic plant series, sharply bounded upwards, were overlain by the following beds:

140 —140.45 m Conglomerate with pebbles of the size of a nut.

140.45—142.5 m Shaly, greyish-yellow arkose-sandstone with subordinate coarse-grained beds.

142.5 —144 m Hard bed of a very coarse, greyish-brown arkose-lime-sandstone with numerous fossils and pavements of *Entolium frontale*. Here the following fossils were collected:

Spines of *Echinoidea*
Serpula sp. cf. *torquata* QU.
Grandirhynchia n. sp.
Grandirhynchia elii n. sp.
Lobothyris aff. *punctata* (SOW.)
Nuculana zieteni (BRAUNS)
Cardinia hybrida (SOW.)
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pleuromya costata (Y. et B.)

Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Entolium frontale (DUM.)
Aequipecten priscus (SCHLOTH.)
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Pleurotomaria (*Sissenna*) *procera* D'ORB.
Ptychomphalus nodosus (SIEBERER)
Amberleya cf. *polytaenia* COSSMAN

144—146 m Loose, rather fine-grained, shaly sandstones.

146—147.5 m Hard bed of a greyish-green, rather fine-grained limy sandstone, richly micaceous. Numerous fossils. The matrix of this rock contains numerous angular quartz grains and only occasional felspar grains. The cement is highly ferruginous. Rocks very nearly identical with this are the *Tancredia* bed in the Ræve Kløft and the upper shaly limestones at Igterajivit (Liverpool Land). This bed has yielded the following fauna:

Spines of *Echinoidea*
Lobothyris sp.
Nucula cf. *cordata* GF.
Parallelodon cf. *cypriniformis* (LUNDGR.)
Mactromya? *groenlandica* n. sp.
Oxytoma inæquivalve (SOW.)
Isognomon aff. *lugdunensis* (DUM.)
Gervillia cf. *lævis* J. BUCKMAN
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Pseudolimea*) *boonei* COSSMAN
Lima cf. *succincta* (SCHLOTH.)
Aequipecten priscus (SCHLOTH.)
Aequipecten bierringi n. sp.
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Modiola cf. *scalprum* SOW.
Hippopodium ponderosum SOW.
Amberleya cf. *polytænia* (COSSMAN)
Lytoceras fimbriatum (SOW.)
Beaniceras sp.
Androgynoceras? sp.

147.5—149 m Loose, shaly sandstone.

149	—150 m	Hard, brown bed of a rock reminiscent of the *Beaniceras* bed, but somewhat coarser-grained. In this bed badly preserved shells of *Parallelodon* cf. *cypriniformis* (LUNDGR.) and other species were found.
150	—151.5 m	Loose, shaly, greyish-yellow sandstone.
151.5	—152 m	Hard, brown sandstone bed.
152	—160 m	Shales with subordinate sandstone lenses and beds with trails.
160	—172 m	Sandstone with subordinate shaly beds and trails. As in the subjacent bed, lenticular bedding can be observed.
172	—176 m	Shaly, greyish-yellow sandstone with mud cakes and fossil wood.
176	—178 m	Brown, hard, coarse sandstone with big concretions.
178	—184 m	White, rather coarse, shaly sandstone.
184	—184.5 m	Basalt sill.
184.5	—185 m	Black clay shales.
185	—190 m	Alternating white, fine-grained sandstones and shales.
190	—195 m	Coarse, shaly sandstone, in the upper part interstratified with brown, hard beds containing concretions and wood.
195	—210 m	Sandstone beds alternating with thin bands of clay ironstone.
210	—220 m	Alternating beds of sandstone and shales.
220	—233 m	Scree.
233	—247 m	Basalt sill.

From the top of this basalt sill the land rises slightly towards the west. At a distance of some hundred metres from the edge of the coast cliff fossiliferous sandstones much obscured by scree and solifluction soil are met with. Here the following species were collected:

Trigonia cf. *literata* Y. et B. (big form)
Lima (*Pseudolimea*?) sp.
Liostrea cf. *erina* (D'ORB.)

This sparse fauna proves the strata to be connected with the oyster-beds in Nathorst Mountain. Further, they are younger than the *Gervillia* beds in ravine 2 south of Dinosaurus Kløft.

Round Dinosaurus Elv the oyster beds constitute the surface layers of the plateau, and fossils were encountered in many places. Almost due west of the ravine 2 just mentioned, the surface of the plateau is made up of thinly laminated sandstones, the bedding planes of which are entirely covered with shells of *Pseudomonotis substriata* (MÜNST.). In

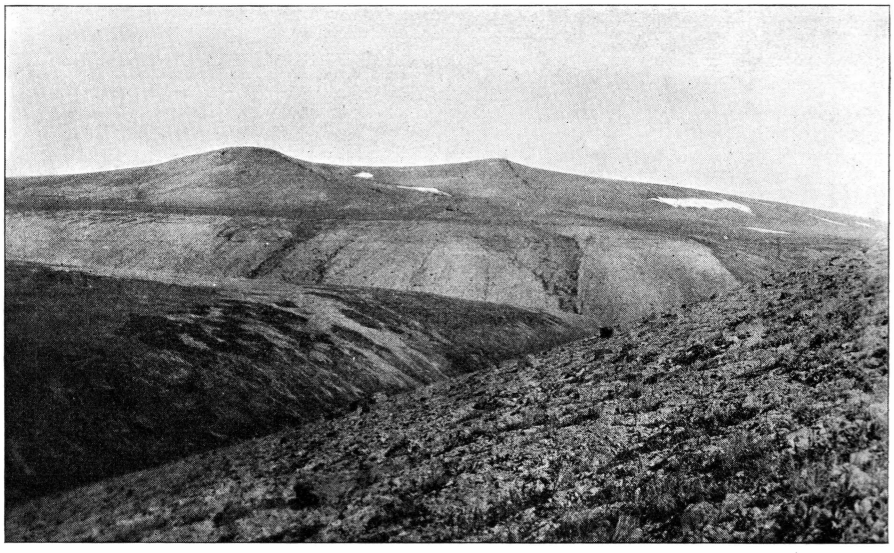

Fig. 17. The junction of Modiola Elv and Lakse Elv. The light-coloured slope in the middle of the picture consists of the Upper Lias Oyster beds, which in the background are overlain by shales and clay of the Vardekløft Formation. The two marked summits are due to the presence of two basalt dykes. — 14.-7.-1927.

beds underlying the *Pseudomonotis* bed some hundred metres farther south the following species were found:

Loboidothyris sp.
Trigonia cf. *literata* Y. et B. (big form)
Liostrea cf. *erina* (D'ORB.)

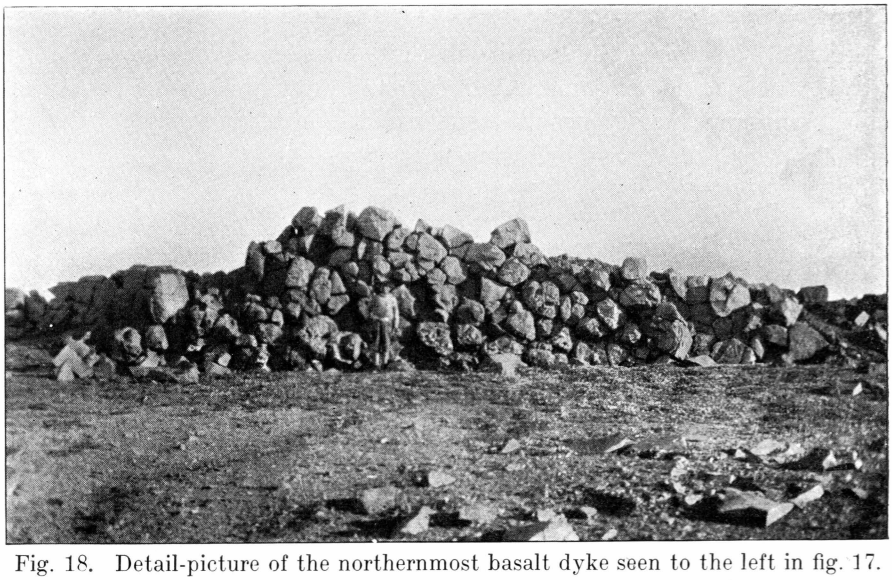

Fig. 18. Detail-picture of the northernmost basalt dyke seen to the left in fig. 17. 14.-7.-1927.

In the river valleys inland the oyster beds crop out in several places, and collections of fossils were made in two places, viz.

Modiola Elv.

In the eastern valley side near the place where this river empties into Lakse Elv, yellow, coarse, micaceous sandstone cropped out (fig. 17). Here the following species were collected:

Loboidothyris sp.
Pleuromya aff. *elongata* (MÜNST.)
Gresslya sp.?
Oxytoma cf. *cygnipes* Y. et B.
Isognomon cf. *isognomoides* (STAHL.)
Lima (*Plagiostoma*) cf. *toarcensis* DESL.
Lima (*Plagiostoma*) n. sp.
Lima (*Pseudolimea*) cf. *boonei* COSSMAN
Variamussium n. sp.
Camptonectes aff. *sublævigatus* (ERNST)
Placunopsis n. sp.
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
Amberleya cf. *capitanea* (MÜNST.)

Peculiar for this locality is the occurrence of a very big *Placunopsis*.

Trigonia Elv.

On the south side of this river, an insignificant tributary to Lakse Elv (fig. 19), oyster beds appeared at the surface, which was strewn with fossiliferous concretions. The following important fauna was collected:

Loboidothyris n. sp.
Trigonia literata Y. et B.
Gresslya donaciformis (PHILL.)
Gresslya rotundata (PHILL.)
Arcomya n. sp.?
Pinna cf. *opalina* QU.
Isognomon cf. *isognomoides* (STAHL.)
Variamussium n. sp.
Camptonectes aff. *sublævigatus* (ERNST)
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
Pseudolioceras compactile (SIMPS.)
Pseudolioceras cf. *württembergeri* (DENCKM.)

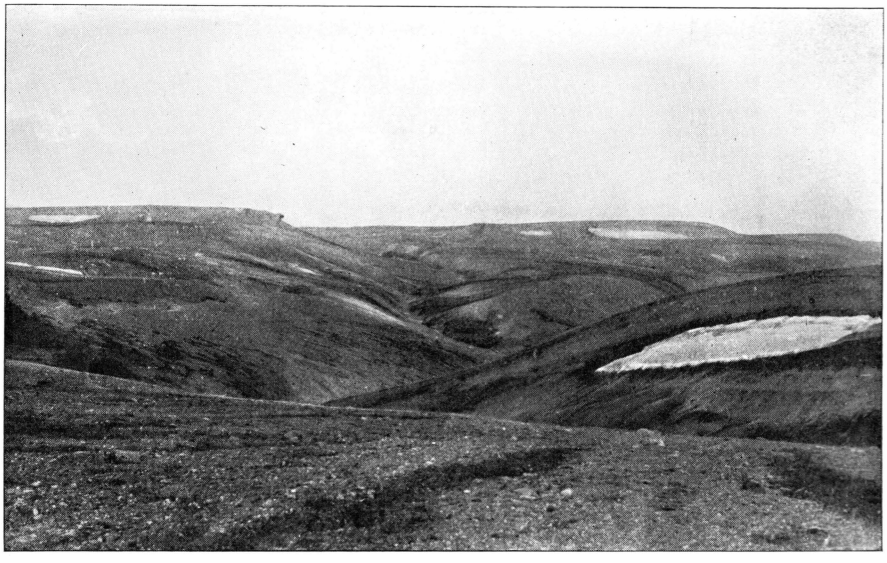

Fig. 19. Outfall of Trigonia Elv into Lakse Elv. In the foreground Upper Liassic strata with numerous fossiliferous concretions. The upper part of the mountains in the background consists of yellow sandstone resting on micaceous clay shales, both belonging to the Varde Kløft Formation. — 21.-9.-1928.

big belemnite-phragmocones
Glyphea rosenkrantzi VAN STRAELEN

The ammonites found warrant the reference of the beds to the Upper Toarcian. Very frequently the concretions had formed round remains of *Glyphea*.

Ostrea Elv.

At the mouth of Ostrea Elv in Scoresby Sound oyster beds may also be found. Personally I did not investigate conditions there, but my Greenlandish assistant, MIKAEL KUNAK, brought back the following species from this locality:

Loboidothyris sp.
Gresslya abducta (PHILL.)
Liostrea cf. *erina* (D'ORB.)

Neill's Cliff between Dinosaurus Kløft and Albuen.

Between the southeastern point of Jameson Land (Cape Stewart) and Tancredia Kløft a narrow, low foreland extends between Neill's Cliff and the shore. It tapers towards the north, and disappears entirely at Tancredia Kløft. Between this latter and Dinosaurus Kløft the cliff

extends right out to the shore line. On following the cliff north of this point, the foreland appears again, but not until the small hooked spit, Albuen (the elbow), does it attain any considerable width. Along the stretch from Dinosaurus Kløft to Albuen, the lower portions of Neill's Cliff are much covered with débris, and the *Jamesoni* horizon was not observed fixed until opposite Albuen. Blocks originating from this bed are rather frequently found on the foreland and along the coast, testifying that the beds are concealed beneath the scree. In blocks consisting of rather fine-grained calcareous sandstone containing big shells of *Entolium frontale* and other scattered fossils, the following fauna was found:

Calcirhynchia? sp.
Lobothyris cf. *punctata* (Sow.)
Ornithella cf. *sartacensis* (d'Orb.)
Trigonia lingonensis Dum.
Mactromya? *groenlandica* n. sp.
Oxytoma inæquivalve (Sow.)
Entolium frontale (Dum.)
Aequipecten priscus (Schloth.)
Camptonectes n. sp.
Plicatula pectinoides Lam.
Liostrea irregularis (Münst. em. Qu.)
Pleurotomaria sp.
Ptychomphalus consobrinus (Tate)

Neill's Cliff opposite Albuen.

Just opposite Albuen the following section was measured in a small, very steep ravine (plate 10 and fig. 20) on September 7th, 1926:

Up to 207.5 m Scree.

207.5—208 m Loose, shaly, coarse-grained sandstone.

208 —210 m Hard bed of a rather fine-grained calcareous sandstone with pavement of *Entolium frontale* at 209 m and scattered fossils at three other levels. Alternating with this fine-grained limestone are beds of a coarse, conglomeratic, calcareous arkose-sandstone. From this bed the following fossils were collected:

Serpula sp. cf. *torquata* Qu.
Grandirhynchia n. sp.
Lobothyris aff. *punctata* (Sow.)
Cardinia hybrida (Sow.)
Trigonia lingonensis Dum.
Tancredia n. sp. A.

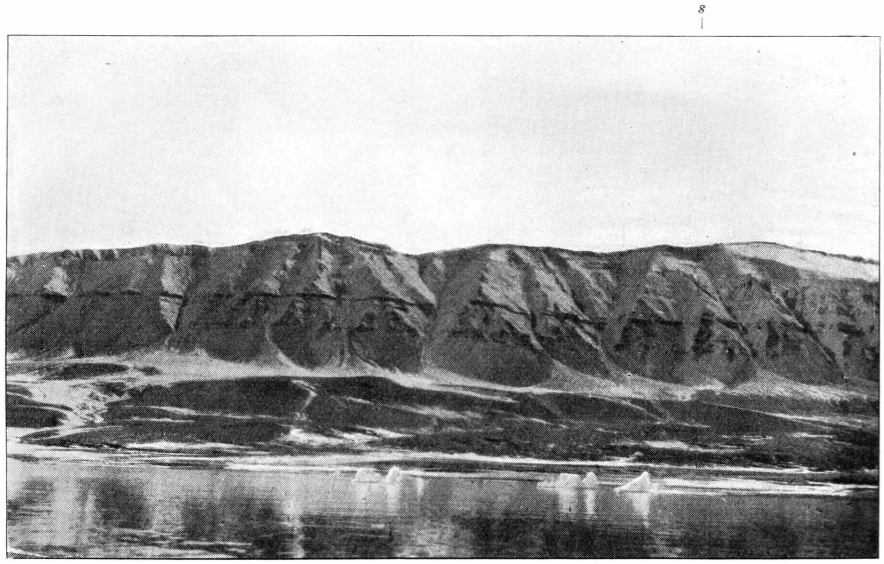

Fig. 20. Neill's Cliff opposite Albuen. The dark bed is a basalt sill. At *s* the ravine is found in which the section given in p. 53 was measured. — 7.-9.-1926.

Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (SOW.)
Pinna cf. *folium* (Y. et B.)
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)

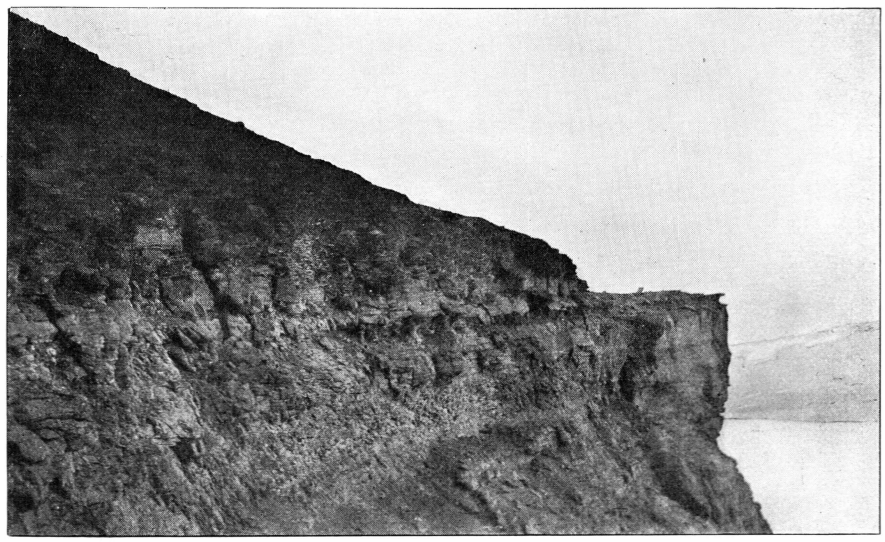

Fig. 21. The contact between the Neill's Cliff Formation (below) and the Vardekløft Formation. Alt. 408 m. Section opposite Albuen. — 7.-9.-1926.

Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)

210 —212 m Shales with sandstone lenses.
212 —218 m Grey shales.
218 —226 m Shaly sandstones alternating with shales.
226 —234 m Yellow, rather fine-grained sandstone beds alternating with thin beds of clay ironstone.
234 —248 m Fine-grained, beautifully stratified sandstone.
248 —272 m Beds of sandstone with concretions, alternating with thin shaly beds.
272 —277 m Dark, micaceous, sandy shales.
277 —280 m Basalt sill.
280 —290 m Hard, greyish-yellow shales penetrated by basalt dykes.
290 —290.5 m Basalt sill.
290.5—295 m Hard, greyish-yellow clay shales.
295 —325 m Yellowish, medium- to fine-grained sandstone beds alternating with sandy shales, which are particularly numerous in the upper part. At 310 m well defined cross-bedding.
325 —332 m Sandy shales.
332 —340 m Shaly sandstones.
340 —343 m Alternating beds of sandstone and sandy shales.
343 —343.5 m Sandstone containing indeterminable oysters. At the top a bed of cone marl 10—20 cm thick.
343.5—408 m Grey, shaly sandstone bed with fossils at several levels.

At 358 m big specimens of *Belemnite phragmocones* were collected.

At 370 m a bed crowded with spongeliomorphic fucoids (fig. 22).

At 390 m numerous specimens of *Liostrea* cf. *erina* (D'ORB.)

At 394 m *Pinna* sp. and numerous bivalved specimens of *Liostrea* cf. *erina* (D'ORB.) were collected.

At 408 m the *Ostrea* sandstone was very sharply demarcated from the overlying black Bathonian shales (fig. 21).

408—425 m Black, micaceous, much crumbled clay shales.
425—426 m Basalt sill.
426—447 m Black, micaceous clay shales.
447—456 m Basalt sill.

In the black shales no fossils were found, but according to their stratigraphical position they must be referred to the lower, Bathonian, part of the Vardekløft Formation.

C. Neill's Cliff between Albuen and Point Constable.

Along this stretch the foreland attains its greatest width opposite Albuen, but decreases gradually in width northward to Hare Elv. From this river to the delta of Gaase Elv (Goose River) at Point Constable

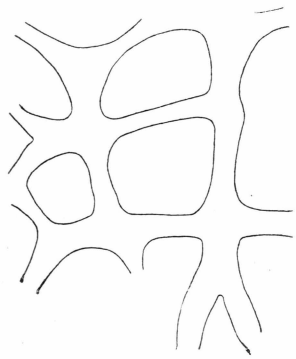

Fig. 22. Spongeliomorphic fucoids. Section opposite Albuen. 370 m. Ab. $^1/_{20}$.

the foreland is quite narrow. It is in part made up of Quaternary deposits, in which a fairly considerable quantity of red marl of the Klitdal Formation enters as a component in many places. The largest hills attain a height of 100—150 m, and seem to contain a nucleus of Mesozoic sandstones. Along this stretch the cliff is intersected by two large rivers, Hare Elv and Gaase Elv, and by numerous smaller rivers, the more important of which are Varde Elv, Astarte Elv, Moskusokse Elv, and Primula Elv, which have carved out deep ravines. The Liassic beds were investigated in a number of localities along this stretch, namely from south to north:

Goniomya Kløft.

A small ravine in Neill's Cliff immediately north of Albuen was given this name. No section was measured there, the beds being greatly covered with débris. At an altitude of 218 m a hard, fossiliferous bank cropped out, mainly built up of coarse, conglomeratic, calcareous arkose-sandstones of a greyish-green colour and with a brownish weathering crust. Pavement with *Entolium frontale* was observed. In some subordi-

nate beds there occurred, in a finer-grained matrix, a large accumulation of small fossils, corresponding entirely to the large block found north of Ivssorigsek. From this bed the following fossils were collected:

Lingula sacculus Chap. et Dew.
Grandirhynchia n. sp.
Squamirhynchia n. sp.
Lobothyris aff. *punctata* (Sow.)
Ornithella sp.
Parallelodon cf. *buckmani* (Rich.)
Parallelodon cypriniformis (Lundgr.)
Cardinia concinna (Sow.)
Cardinia hybrida (Sow.)
Venericardia? aff. *liasina* (Moore)
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia johnstrupi (Lundgr.)
Tancredia? n. sp.
Quenstedtia? n. sp.
Mactromya aspasia (d'Orb.)
Mactromya? *groenlandica* n. sp.
Cardium (*Jurassicardium*?) *phillippianum* Dunker
Pleuromya costata (Y. et B.)
Ceratomya petricosa (Simps.)
Arcomya aff. *pelea* (d'Orb.)
Arcomya? n. sp.
Goniomya hybrida (Münst.)
Pholadomya ambigua (Sow.)
Oxytoma inæquivalve (Sow.)
Pseudomonotis cf. *papyrica* (Qu.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Lima succincta (Schloth.)
Lima (*Pseudolimea*) *boonei* Cossman
Limea acuticosta Münst.
Velata hartzi n. sp.
Entolium frontale (Dum.)
Entolium callosum (Lundgr.)
Aequipecten priscus (Schloth.)
Chlamys substriata (Röm.) var. *rinki* (Lundgr.)?
Chlamys cf. *textoria* (Schloth.)
Plicatula pectinoides Lam.
Liostrea irregularis (Münst. em. Qu.)

Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.
Dentalium cf. *elongatum gracile* MOORE
Ptychomphalus n. sp.
Amberleya cf. *polytaenia* COSSMAN
Proconulus (*Epulotrochus*) *epulus* (D'ORB.)
Tornatellaea sp. cf. *fontis* (DUM.)
Procerithium? sp.
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)

As especially characteristic of this locality should be mentioned the large number of shells of *Lingula sacculus* and the rather numerous specimens of *Goniomya hybrida*.

Varde Kløft.

Sections were measured in this ravine (fig. 23) on August 22nd and 29th, 1926. The entire series of strata could not be measured, the sides of the ravine being much obscured by débris. The results arrived at are given in pl. 11. The course of the main section follows the main river, Varde Elv, while the other measurement was made at the first left hand tributary to Varde Elv passing up through the ravine.

The main section, measured on August 29th and September 2nd, 1926.

The base of the Neill's Cliff Formation is cut through by Varde Elv at a height of 185.5 m.

185.5—188.7 m Loose, coarse-grained conglomeratic sandstone.

188.7—191 m Hard bed of greyish-green, conglomeratic, calcareous arkose-sandstone with a brownish weathering crust. Pavement with *Entolium frontale*. In addition the following fossils were collected:

Grandirhynchia sp.
Lobothyris aff. *punctata* (SOW.)
Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Astarte striato-sulcata RÖM. forma a TATE
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Limea acuticosta MÜNST.

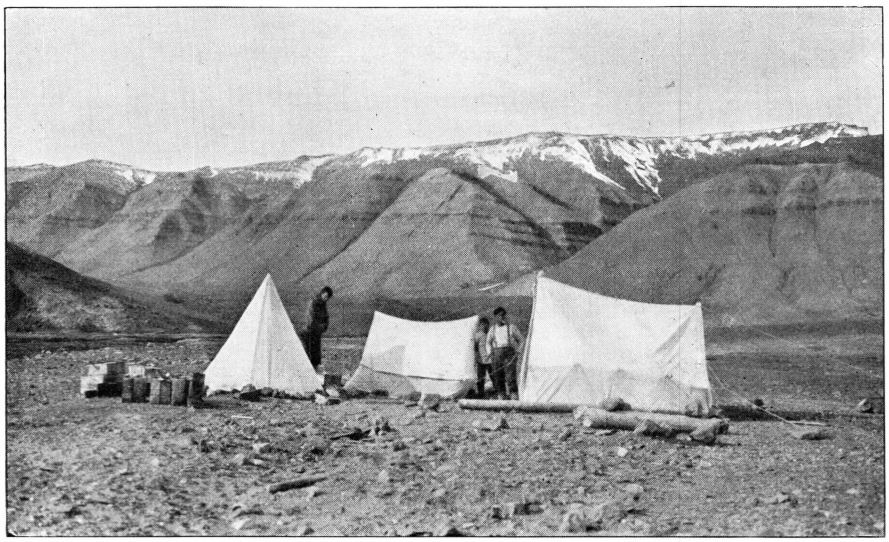

Fig. 23. Neill's Cliff at Varde Kløft. The Neill's Cliff Formation marked by basalt sills and dykes. The snow-capped top of the cliff consists of the Vardekløft Formation. — 6.-9.-1926.

Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Modiola lævis SOW.
Ptychomphalus consobrinus (TATE)
Passalotheutis cf. *apicurvata* (DE BLAINVILLE)

191—193 m	Greyish-green loose sandstone with poorly preserved fossils. At the top a somewhat harder greyish-green bed yielding *Aequipecten bierringi*. The rock entirely recalls the *Beaniceras* horizon in Dinosaurus Kløft and the *Tancredia* bed in Ræve Kløft.
193—195 m	Grey clay shales.
195—207 m	Sandy shales.
207—210 m	Looser sandstones interbedded with hard bands.
210—212 m	Sandy shales.
212—218 m	Compact sandstone beds alternating with thinner beds of clay ironstone.
218—226 m	Scree.
226—237 m	Basalt sill with slabs of sandstone.

237 —239.5 m Coarse-grained, calcareous arkose-sandstone, of a grey to yellowish-grey colour and containing flat pebbles of micaceous shale and kaolinised felspar grains. The rock is more fine-grained upwards.

239.5—241.5 m Alternating sandstones and shales.

241.5—245.5 m Basalt sill.

245.5—251 m Sandy shales with small concretions without fossils.

251 —253 m Basalt sill.

253 —258 m Sandy shales.

258 —264 m Dark-brown clay shales with lenses of fine-grained white sandstone. Abundant mica on the bedding-planes. The rock is highly ferruginous.

264 —272 m Scree.

272 —290 m Cross-bedded sandstone interstratified with thin, sandy beds of shale, which contains plant remains at 273 m.

290 —321 m Scree.

321 —324 m Basalt sill.

324 —330 m Black, crumbling shales.

330 —340 m Basalt sill.

340 —394 m Coarse, yellowish to whitish, calcareous arkose-sandstones often containing big quartz grains. Looser beds alternate with hard, projecting beds (fig. 24). Fossils occur at several levels within this series, namely:

at 342 m

Trigonia literata Y. et B.
Pleuromya aff. *elongata* (MÜNST.)
Gresslya rotundata (PHILL.)
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.

at 352 m

Trigonia literata Y. et B.
Astarte madseni n. sp.
Pleuromya aff. *elongata* (MÜNST.)
Gresslya donaciformis (PHILL.)
Gresslya abducta (PHILL.)

at 362 m

Oxytoma inæquivalve (SOW.) var.
Variamussium n. sp.
Liostrea cf. *erina* (D'ORB.)
Dactylioceras sp.

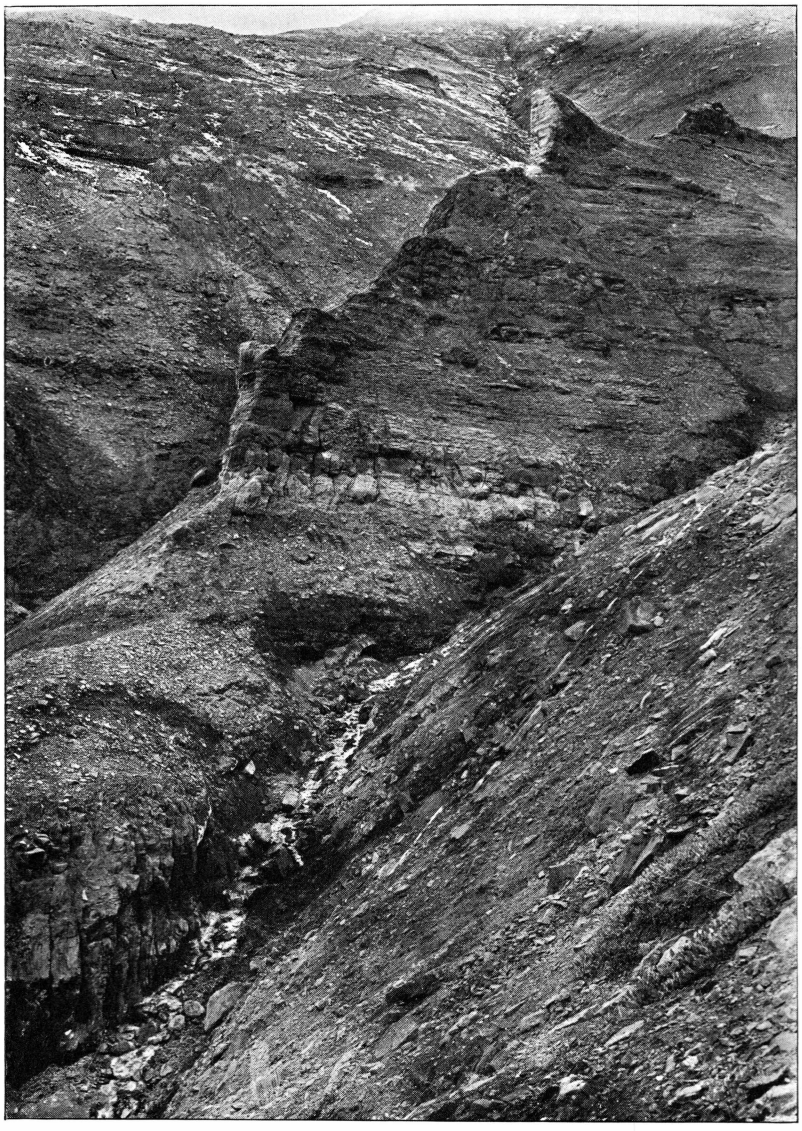

Fig. 24. Fossiliferous Upper Liassic beds in Varde Kløft, resting on a basalt sill. 1.-9.-1926.

at 380 m
Trigonia cf. *literata* Y. et B.
Gresslya abducta (PHILL.)
Pinna cf. *opalina* QU.
Liostrea cf. *erina* (D'ORB.)

at 382 m
cf. *Rhynchonella lineata* Y. et B.
Loboidothyris n. sp.

Ornithella cf. *sarthacensis* (D'ORB.)
Astarte madseni n. sp.
Pleuromya aff. *elongata* (MÜNST.)
Arcomya aff. *longa* (BUV.)
Oxytoma inæquivalve (SOW.) var.
Pinna cf. *opalina* QU.?
Gervillia n. sp.
Lima (*Pseudolimea*) cf. *boonei* COSSMAN
Entolium demissum (PHILL.)
Camptonectes aff. *sublævigatus* (ERNST)
Placunopsis aff. *gingensis* QU.
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
Trochus aff. *torulosus* QU.
Patella sp.
Megateuthis sp.
big belemnite-phragmocones

at 394 m

"*Ophiomorpha*"
Oxytoma inæquivalve (SOW.) var.
Lima (*Plagiostoma*) cf. *toarcensis* DESL.
Lima (*Plagiostoma*) n. sp.
Entolium demissum (PHILL.)
Camptonectes aff. *sublævigatus* (ERNST)
Liostrea cf. *erina* (D'ORB.)

At 394 m a hard band of grey sandstone with occasional big quartz grains, slightly micaceous. Some beds crowded with crinoid stems and arm plates.

394	—395 m	Coarse, greenish-yellow sand with thin shaly beds in the upper part.
395	—400 m	Hard, sandy shales.
400	—400.25 m	Black shales.
400.25	—401 m	Coarse, greenish-yellow sand.
401	—401.25 m	Coarse sandstone bed.
401.25	—402.5 m	Coarse greenish-yellow sand.
402.5	—403 m	Dark shales interstratified with thin sandstone bands, in which are embedded poorly preserved plant remains.
403	—403.5 m	Basalt sill, overlain by black clay shales with thin sandstone beds in the lower part. At 420 m the black shales are covered by scree.

The beds above 402.5 m belong to the Vardekløft Formation.

Section in the first side ravine, measured on August 22nd, 1926.

This section leads across some passages greatly obscured by scree, still it is possible to distinguish some few beds which supplement the section from Varde Elv given above. From Varde Elv to the top of the first large basalt sill the same series of strata was observed as is recorded from Varde Elv.

249 —252 m	Medium-grained, kaolinised arkose-sandstone with shaly pebbles.
252 —257 m	Scree.
257 —258 m	Micaceous sandstone.
258 —260 m	Grey shales with annelid trails.
260 —282 m	Scree.
282 —286 m	Micaceous shales with plant remains and three small basalt sills, 30 cm thick.
286 —290 m	Shaly sandstone.
290 —291 m	Hard, light-grey, micaceous, calcareous sandstone with scattered shells and annelid trails. In this bed *Pseudomonotis substriata* and *Pecten* sp. indet. were found, and further a loose piece of greyish-black cone marl.
291 —308 m	Scree.
308 —310 m	Coarse, thin-bedded sandstone with coal fragments.
310 —312 m	Highly crumbling, coarse sandstone with thin beds of shale.
312 —312.5 m	Fine-grained sandstone containing fossil wood.
312.5—320 m	Scree.
320 —326 m	Basalt dyke.
326 —348 m	Scree. At 337 m a band of dark, unfossiliferous, thinly-laminated limestone, 0.25 m thick.
348 —355 m	Basalt sill.
355 —368 m	Brown, conglomeratic, much weathered, sandstone, with numerous fragments of *Belemnites* lying loose on the surface at 360 m.
368 —368.5 m	Basalt sill.
368.5—370 m	Compact brown sandstone with small concretions, in some cases containing fossils. From this bed remains of *Glyphea rosenkrantzi* were brought home.

Above this point the cliff recedes considerably, and the even slope is covered with sandstone scree.

First ravine north of Varde Kløft.

Between Varde Kløft and Astarte Kløft Neill's Cliff is much covered with scree (fig. 25), and fossils were therefore collected in a single place

only. In the first small ravine north of Varde Kløft HARRIS, on August 29th, 1926, at an altitude of 375 m collected the following fossils, corresponding to the fauna of the lower part of the oyster beds in Varde Kløft:

Astarte madseni n. sp.
Megateuthis aff. *conoidea* (OPPEL)
Megateuthis sp.

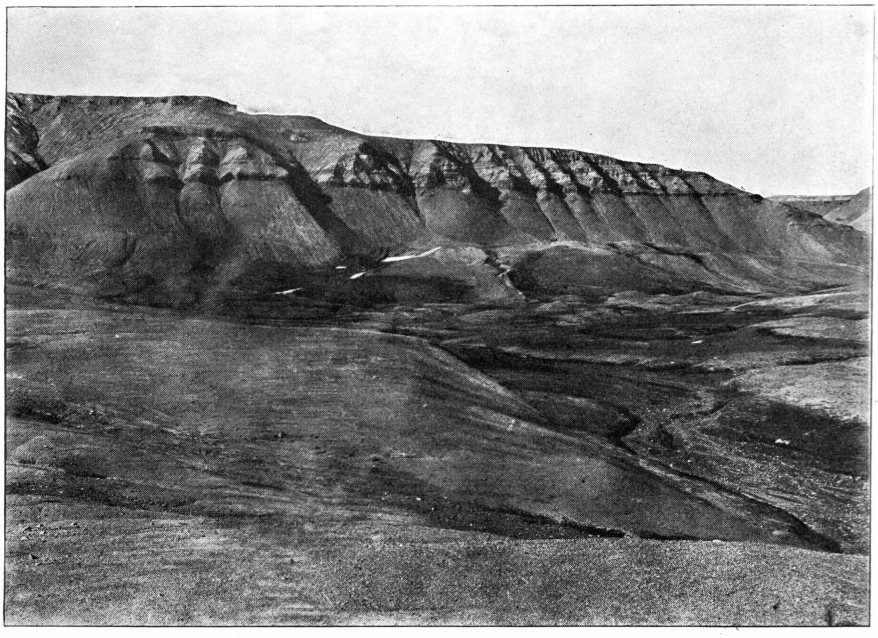

Fig. 25. Neill's Cliff between Varde Kløft and Astarte Kløft. In the foreground Varde Elv. — 26.-8.-1926.

The mouth of Astarte Kløft.

On the south side of this large ravine the section shown in pl. 12 and fig. 34,1 was measured on August 28th, 1926. The base of the Neill's Cliff Formation is here at an altitude of 247 m.

247—252 m Bed 1 (fig. 28). Loose, coarse-grained sandstone, in the lower parts conglomeratic with occasional larger pebbles made up of various sediments: coarse arkose-sandstone, fine-grained calcareous sandstone, and further stones of various metamorphic rocks. Only indeterminable fragments of fossils were found in this bed.

252—253 m Bed 2. Greyish-green, very coarse-grained arkose-sandstone with accumulations of angular pebbles and many fossil fragments. This bed is fairly compact and

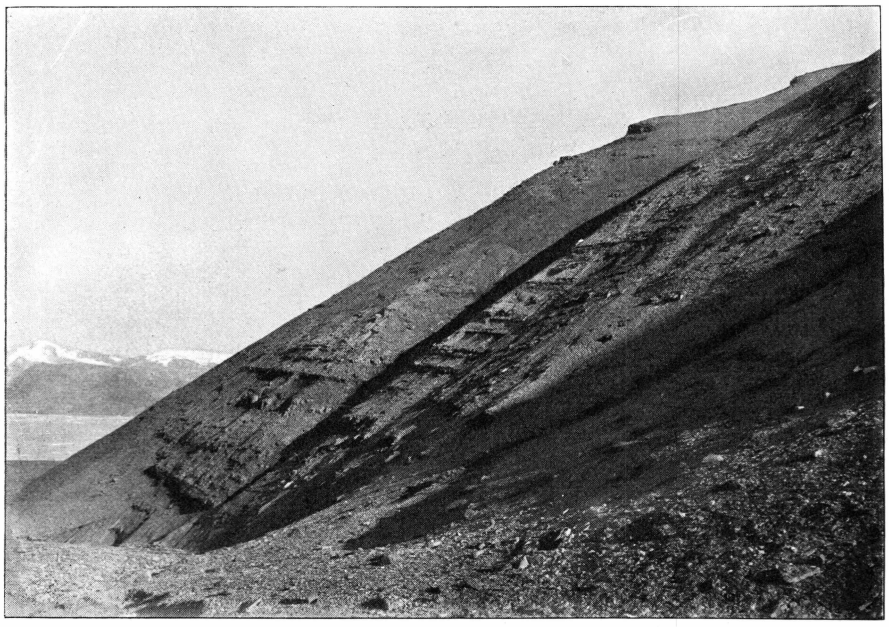

Fig. 26. Rhæto-Liassic plant beds at the mouth of Astarte Kløft. At the top, right, two hard beds, belonging to the Neill's Cliff Formation. The lower bed is the Jamesoni horizon. — 25.-8.-1926.

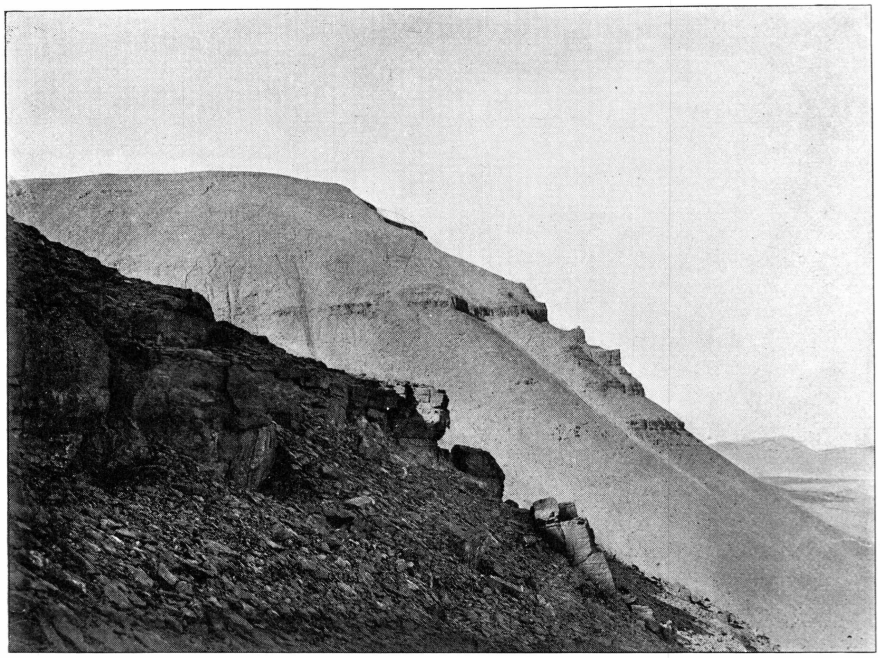

Fig. 27. Mouth of Astarte Kløft. In the foreground hard Jamesoni beds. 25.-8.-1926.

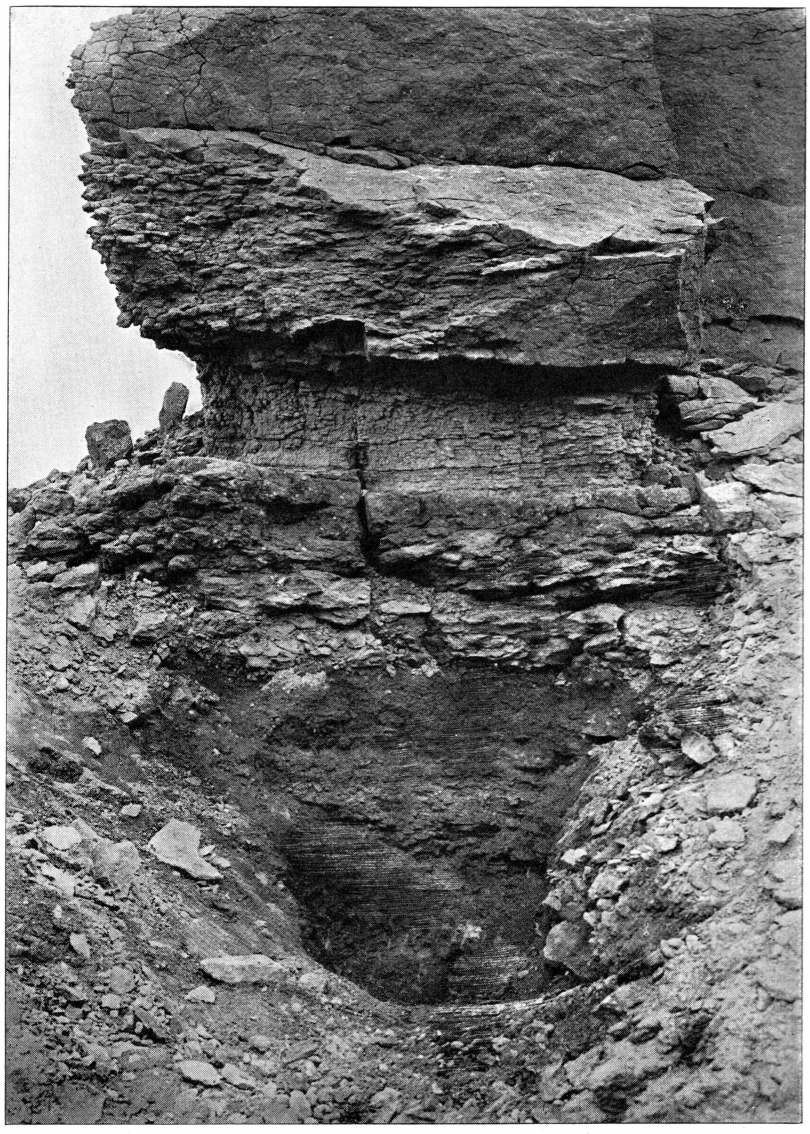

Fig. 28. The lowermost beds of the Neill's Cliff Formation. Mouth of Astarte Kløft. 28.-8.-1926.

very badly sorted, fine-grained portions alternating with coarse ones. The matrix is ferruginous.

253 —253.10 m Bed 3. Hard, very coarse, calcareous, badly sorted, arkose containing many fossils. Pavement with *Entolium frontale*. Ferruginous matrix.

253.10—253.60 m Bed 4. Very compact, brown, rather fine-grained calcareous arkose-sandstone with thin stripes of coarse-

grained arkose with a sparse fossil content. The groundmass contains many angular quartz and felspar grains cemented together by a ferruginous matrix.

253.60—253.75 m Bed 5. Coarse arkose-limestone, very unassorted, similar matrix to that of bed 4. The bed is quite crowded with fossils. Pavement with *Entolium frontale* and some few specimens of *Isognomon* n. sp. and *Cardinia concinna*. In this bed a fragment of *Uptonia jamesoni* was found.

253.75—254 m Bed 6. Rather fine-grained, better assorted calcareous sandstone (arkose) with many quartz and felspar grains and some mica. The bed is pierced by burrows filled with a green clayey substance.

254 —254.20 m Bed 7. Rather fine-grained, brown limestone, with several conglomeratic portions and pavement with *Isognomon* n. sp. in the lower part of the bed. The upper part is looser, and consists of uncalcareous greyish-green arkose-sandstone with scattered, blunt-edged quartz stones. In the matrix numerous angular quartz grains in a ferruginous cement.

254.20—255.20 m Bed 8. Coarse, uncalcareous arkose-sandstone without fossils but with occasional big, angular quartz grains and a ferruginous matrix.

In this locality a large material of fossils was collected, chiefly from bed 5. The fossil content of this bed does not deviate from that of bed 3, and the fossils derived from the two beds are therefore enumerated in the succeeding list:

Pentacrinus sp. cf. *scalaris* Gf.
Serpula limax Gf.
Filograna solitaria Terq. et Piette
Spiriferina münsteri Dav.
Grandirhynchia n. sp.
Lobothyris aff. *punctata* (Sow.)
Parallelodon sp. B.
Cardinia concinna (Sow.)
Cardinia hybrida (Sow.)
Cardinia listeri (Sow.)
Trigonia lingonensis Dum.
Astarte obsoleta Dunker
Venericardia? aff. *liasina* (Moore)
Tancredia n. sp. A.
Tancredia johnstrupi (Lundgr.)

Fig. 29. Coarse sandstone containing pebbles of shale and clay ironstone. Nat. size. Mouth of Astarte Kløft, 275 m. — Chr. Halkier phot.

Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Gresslya lunulata TATE
Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Lima succincta (SCHLOTH.)

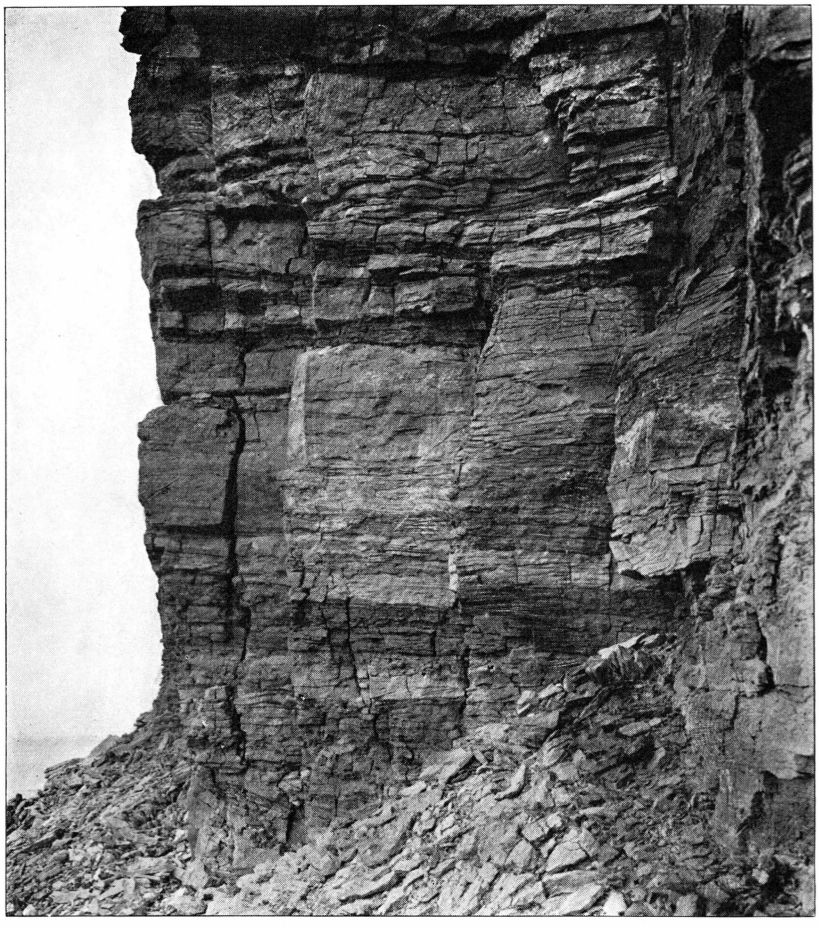

Fig. 30. Sandstone alternating with clay ironstone. Mouth of Astarte Kløft, 280—283 m. — 28.-8.-1926.

Lima (*Pseudolimea*) *boonei* COSSMAN
Velata hartzi n. sp.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Plicatula pectinoides LAM.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.

Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Modiola scalprum SOW.
Hippopodium ponderosum SOW.
Ptychomphalus nodosus (SIEBERER)
Ptychomphalus consobrinus (TATE)
Uptonia jamesoni (SOW.)
Prototheuthis cf. *pennicillata* (DUM.)
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)

From bed 7, the *Isognomon* horizon, the following fossils were collected:

Serpula limax GF.
Spiriferina münsteri DAV.
Grandirhynchia n. sp.
Stolmorhynchia n. sp.
Venericardia? aff. *liasina* (MOORE)
Tancredia johnstrupi LUNDGR.
Arcomya longa (BUV.)?
Oxytoma inæquivalve (SOW.)
Isognomon n. sp.
Lima succincta (SCHLOTH.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Camptonectes n. sp.
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Modiola scalprum SOW.
Hippopodium ponderosum SOW.
Prototeuthis cf. *pennicillata* (DUM.)

255.20—273 m Very micaceous shales and sandstones with lenticular bedding and trails on the bedding planes. The sandstone lenses are yellowish-green, the shales greyish-black with a brownish tint.

273 —280 m Fairly loose, coarse-grained, yellowish to greyish-green sandstone with occasional scattered pebbles consisting of quarts, green shaly clay, and clay ironstone (fig. 29). In the lower parts of this bed a couple of indeterminable *Belemnites* (*Passalotheutis* sp.) were found. The matrix of this sandstone is very ferruginous, and in

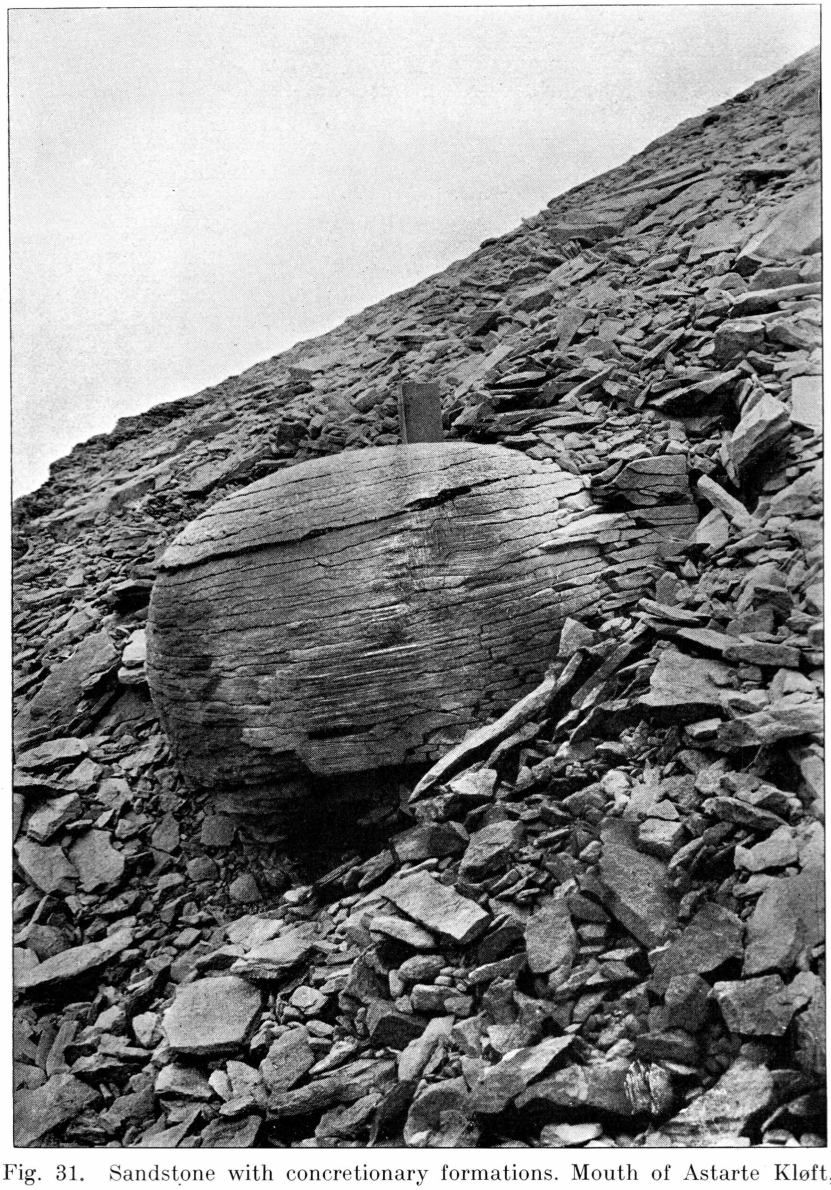

Fig. 31. Sandstone with concretionary formations. Mouth of Astarte Kløft, 283—312 m. The height of the note book 16.5 cm. — 28.-8.-1926.

certain parts of the bed there occur quite thin, clayey bands, which give rise to lenticular bedding.

280—283 m Coarse, yellowish green, irregularly bedded arkose-sandstone with concretions and beds of clay ironstone (fig. 30). This bed has yielded one specimen of *Oxytoma inæquivalve*.

283—312 m Thinly laminated, yellowish-grey to yellowish-green

medium-grained sandstone, often with numerous mica flakes on the bedding planes. Some beds are coloured by reddish-brown iron compounds, and spherical concretionary bodies up to 1.5 m in diameter may be met with (fig. 31).

312—314 m Grey shales.

314—323 m Loose, coarse sandstone.

323—324 m Dark shales with numerous unfossiliferous concretions.

324—335 m Shales with subordinate beds of sandstone and clay ironstone within the uppermost seven metres.

335—345 m Basalt sill with spherical segregations.

Above this point the section was much covered with scree.

Astarte Elv.

On following Astarte Elv up through Astarte Kløft, numerous blocks originating from the *Uptonia* horizon are seen to be scattered over a long distance. From two of these blocks a number of fossils were collected, namely:

Block A. Hard, conglomeratic arkose-limestone holding the following fossils:

"Ophiomorpha"
Spines of *Echinoidea*
Lingula sacculus CHAP. et DEW.
Grandirhynchia elii n. sp.
Parallelodon sp. B.
Lima (*Pseudolimea*) *boonei* COSSMAN
Limea acuticosta MÜNST.
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Modiola cf. *hillana* SOW.

Block B. A similar, somewhat less conglomeratic rock, which has yielded the following fossils:

"Ophiomorpha"
Lingula sacculus CHAP. et DEW.
Stolmorhynchia n. sp.
Nuculana subovalis (GF.)
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Tancredia johnstrupi (LUNDGR.)
Arcomya longa (BUV.)

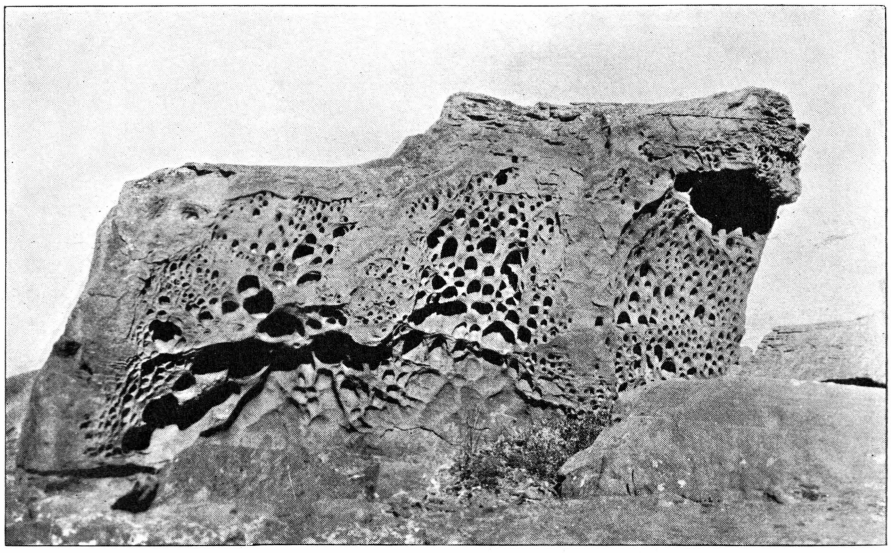

Fig. 32. Reticulate weathering in sandstone from the middle part of the Neill's Cliff Formation. Neill's Cliff between Varde Kløft and Astarte Kløft. 10.-7.-1927.

Arcomya aff. *pelea* (D'ORB.)
Arcomya? n. sp.
Aequipecten priscus (SCHLOTH.)

Fig. 33. Section through the Jamesoni beds, Astarte Elv. — 25.-8.-1926.

Section in Astarte Kløft.

Some hundred metres from the mouth of Astarte Kløft, Astarte Elv cuts through the fossiliferous Charmouthian beds, exposing a large beautiful section (figs. 33 and 34, 2a, b). Here the sequence of strata is as follows in descending order:

Bed a. More than 10 m of highly ferruginous brown shales with lenticular bedding and trails on the bedding planes.

Bed b. Half a metre to one metre of very ferruginous and micaceous sandstone, occurring as lenses among thin beds of shale. The green

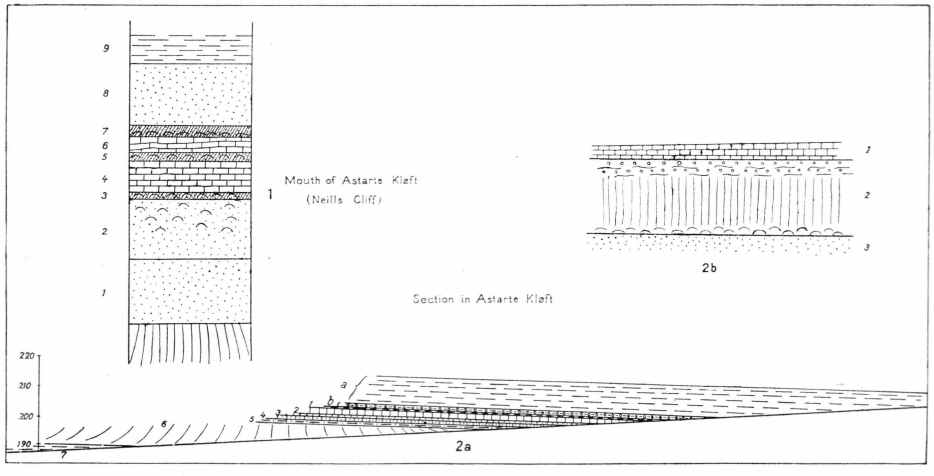

Fig. 34.

mineral to which the rock owes its colour is probably glauconite. Fossils are of exceedingly rare occurrence, however, a single specimen of *Nuculana subovalis* has been found.

Bed 1. Up to half a metre of grey, more or less compact, slightly calcareous, conglomeratic arkose-sandstone with kaolinised felspar. In this bed poorly preserved fossils were found, among which the following may be mentioned:

Grandirhynchia n. sp.
Grandirhynchia elii n. sp.
Cardinia concinna (Sow.)
Cardinia listeri (Sow.)
Cardinia hybrida (Sow.)
Tancredia n. sp. A.
Mactromya lindhammeri ROLLIER
Gresslya lunulata TATE
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.

Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Aequipecten priscus (SCHLOTH.)
Placunopsis minuta LUNDGR.
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)

Bed 2. 1.75 m thick, the upper part conglomeratic calcareous sandstone with many fossils. The coarser components are arranged in thin beds. In the middle, compact limestone with only few fossils. Near the surface of the bed there occurs a pavement with *Entolium frontale*. From the upper part of the bed the following fossils have been brought back:

Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Mactromya lindhammeri ROLLIER
Mactromya aspasia (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Chlamys cf. *textoria* (SCHLOTH.)
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)

Bed 3. 1 m yellowish-green, rather coarse-grained, loose arkose-sandstone, slightly calcareous and with kaolinised felspar grains. The bed is penetrated by dark, thin, clayey beds. No fossils met with.

Bed 4. 1 m hard greyish-green, calcareous, conglomeratic arkose-sandstone holding some few, indeterminable fossils.

Bed 5. At least 1.20 m micaceous shales containing big lenses of coarse, greyish-green, arkose-like sandstones with shaly pebbles. This bed is sharply demarcated from bed 4.

Below this bed the section is obscured by scree, and the next bed that is exposed is

Bed 7. Grey, fine-grained, micaceous, shaly sandstone containing plant remains belonging to the Rhæto-Liassic plant series.

Moskusokse Kløft.

On the south side of this big ravine I collected, on September 9th, 1926, a number of fossils from a hard bed of greyish-green, conglomeratic arkose-limestone with a brownish weathering crust. In the upper part

of the bed, pavement with *Entolium frontale*. Otherwise the following fossils were found:

Serpula limax GF.
Lingula sacculus CHAP. et DEW.
Spiriferina münsteri DAV.
Grandirhynchia n. sp.
Nuculana aff. *complanata* (GF.)
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Astarte camertonensis MOORE
Venericardia? aff. *liasina* (MOORE)
Arcomya aff. *pelea* (D'ORB.)
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Hippopodium ponderosum SOW.
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)

Neill's Cliff south of Hare Elv.

In this place TOM HARRIS collected some fossils in loose blocks fallen down from an altitude of 210 m above sea-level. The rock is a reddish-brown to greyish-green conglomeratic calcareous sandstone with big, rolled quartz grains and scattered fossils. The following fossils were collected:

Cardinia hybrida (SOW.)
Oxytoma inæquivalve (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)?
Plicatula pectinoides LAM.
Gryphæa cymbium LAM.

Mt. Harris Fjæld.

The part of Neill's Cliff situated between Hare Elv and Primula Elv I have named after TOM HARRIS, who ascended the mountain on September 2nd, 1926, and brought back the first fossils from it. Midway between the two rivers the mountain is cut through by a small

ravine, in which I measured the following section (pl. 12) on July 21st, 1927:

0—235 m Scree.

235—275 m Highly alternating beds of varicoloured sandstones, conglomerates, and shales as well as thin coal seams belonging to the Cape Stewart formation and sharply delimited from the overlying Neill's Cliff Formation.

275—276 m Hard bed of reddish-brown conglomeratic arkose-lime-sandstone with pavement of *Entolium frontale* in the middle, and accumulations of small forms in certain bands in the lower part of the bed. From this horizon the following fossils were collected:

Pentacrinus sp. cf. *scalaris* GF.
Spiriferina münsteri DAV.
Grandirhynchia sp.
Lobothyris aff. *punctata* (SOW.)
Nuculana subovalis (GF.)
Parallelodon sp. B.
Cardinia concinna (SOW.)
Cardinia hybrida (SOW.)
Cardinia aff. *attenuata* (STUTCHBURY)
Astarte striato-sulcata RÖM. forma a TATE
Astarte obsoleta DUNKER
Astarte camertonensis MOORE
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)
Tellina? n. sp.
Oxytoma inæquivalve (SOW.)
Cultriopsis n. sp.
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Limea cf. *cristata* DUM.
Entolium frontale (DUM.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)?
Plicatula cf. *lævigata* (D'ORB.)
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Ptychomphalus consobrinus (TATE)

276 —276.5 m Looser, shaly, coarse, reddish-brown sandstone with greenish-coloured parts.

276.5—277.5 m Greyish-green to brownish, hard bed, containing many fossils, especially accumulated in the middle and the upper parts of the bed. On a bedding-plane within the upper part of the bed pavements with big shells belonging to *Isognomon* n. sp., *Pinna* cf. *folium*, and some few shells of *Entolium frontale* were observed. Otherwise the following species were found:

Serpula sp. cf. *torquata* QU.
Lingula sacculus CHAP. et DEW.
Grandirhynchia n. sp.
Lobothyris aff. *punctata* (SOW.)
Nuculana graphica (TATE)
Parallelodon cf. *buchmani* (RICH.)
Parallelodon sp. C.
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma b TATE
Astarte scanensis? MBG.
Astarte camertonensis MOORE
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia johnstrupi (LUNDGR.)
Quenstedtia? n. sp.
Mactromya aspasia (D'ORB.)
Mactromya? *groenlandica* n. sp.
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya costata (Y. et B.)
Ceratomya petricosa (SIMPS.)
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Lima succincta (SCHLOTH.)
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Pseudolimea*) *boonei* COSSMAN

Limea cf. *cristata* DUM.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Camptonectes n. sp.
Plicatula pectinoides LAM.
Plicatula cf. *lævigata* (D'ORB.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola scalprum SOW.
Hippopodium ponderosum SOW.?
Ptychomphalus consobrinus (TATE)
cf. *Aulacotrochus nitens* DUM.
Trochopsis? sp.
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)

277.5 —278.25 m Greyish-white shaly sandstone with mud cakes.
278.25—278.75 m Hard bed of greyish-green conglomeratic arkose-lime-sandstone with very few, indeterminable fossils.
278.75—285 m Loose yellowish-white sandstone.
285 —295 m Greyish-green beds of sandstone and shale with trails.
295 —470 m Mainly yellow sandstones alternating with shales. Cone marl at several levels. Here the section is rather much obscured by scree. At 460 m the following fossils were collected:

Astarte madseni n. sp.
Dactylioceras sp.

On the top of the mountain the following fossils were collected:

Pentacrinus (*Isocrinus*?) sp.
Trigonia cf. *literata* Y. et B.
Pleuromya aff. *elongata* (MÜNST.)
Pseudomonotis substriata (MÜNST.)
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
Glyphea rosenkrantzi VAN STRAELEN

Primula Elv.

On the southern river bank, at an altitude of about 280 m, several fossils were collected from a bed made up of hard, conglomeratic arkose sandstone. The collection, which was made on September 2nd, 1926, by TOM HARRIS, comprises the following species:

Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte camertonensis MOORE
Mactromya aspasia (D'ORB.)?
Pleuromya sp.
Oxytoma inæquivalve (SOW.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Aequipecten priscus (SCHLOTH.)
Plicatula pectinoides LAM.
Myoconcha decorata (MÜNST.)

D. Outcrops north of Point Constable.

Mt. Nathorst Fjæld.

This mountain was first investigated by NATHORST in 1899, and the ensuing year fresh collections of fossils were made by HARTZ. In 1926 and in 1927 I visited the mountain, and fossils were collected, chiefly in three localities, which are indicated on the sketch in pl. 12. Further a section was measured in locality 2, which is represented in pl. 12.

Locality 1. Presumably NATHORST's old locality. Here a number of fossils were collected on September 13th, 1926, at an altitude of 525 m, personally I visited the locality on July 19th, 1927. The mountain was much covered with scree, still I succeeded in ascertaining two fossil horizons:

520 m Greyish-yellow sandstone with calcareous concretions, in which the following fossils were found:

Trigonia literata Y. et B.
Astarte madseni n. sp.
Gresslya abducta (PHILL.)
Arcomya n. sp.?
Dactylioceras spp.

525 m Similar sandstone crowded with fossils, mostly oyster (= NATHORST's Oyster bed). Here the following fossils were collected:

Discinisca n. sp.
Rhynchonella sp. indet.

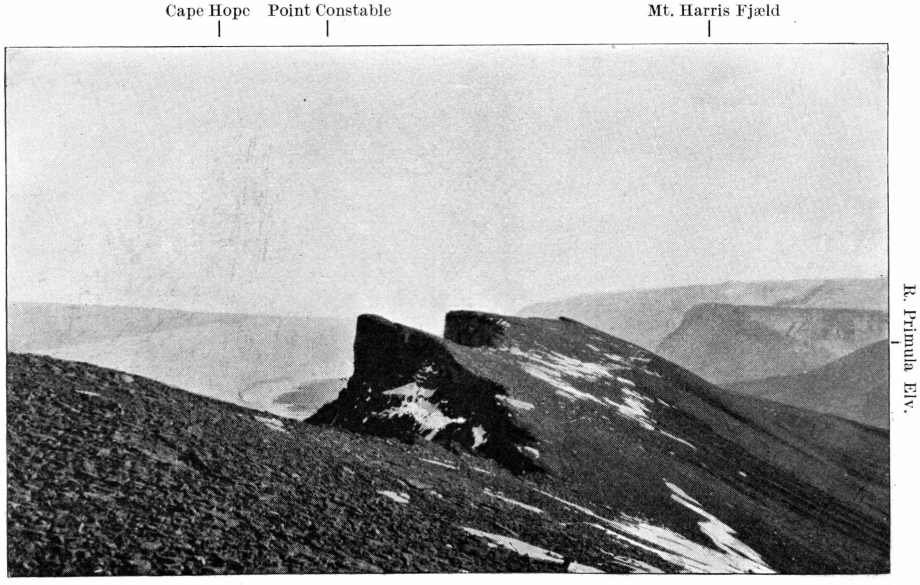

Fig. 35. Top of Mt. Nathorst Fjæld, looking towards the south. — 14.-9.-1926.

Cucullaea? sp.
Trigonia sp. (*Glabrae*)
Tancredia aff. *donaciformis* LYC.
Tancredia cf. *dionvillensis* TERQ.
Pleuromya aff. *elongata* (MÜNST.)
Gresslya donaciformis (PHILL.)

Fig. 36. Sandstone alternating with thin layers of clay ironstone, forming a perfectly vertical cliff surface, 430—486 m. Mt. Nathorst Fjæld, loc. 2. — 13.-9.-1926.

Gresslya abducta (PHILL.)
Gresslya rotundata (PHILL.)
Arcomya aff. *longa* (BUV.)
Pholadomya aff. *fidicula* SOW.
Oxytoma inæquivalve (SOW.) var.
Inoceramus aff. *polyplocus* ROEM.
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
Pseudolioceras dumortieri (BUCKMAN)
Megateuthis sp.
big belemnite-phragmocones.

Fig. 37. Concretions and thin layers of clay ironstone in sandstone, Mt. Nathorst Fjæld. Loc. 3, 358—368 m. — 13.-9.-1926.

Locality 2. Section sketched on plate 12. This section was measured on September 13th, 1926.

0—120 m Red marl.

120—300 m Scree. At 290 m a loose block derived from the *Uptonia* bed. The rock was a greyish-green, conglomeratic arkose-limestone containing many rounded quartz grains. Here the following fossils were found:

Cardinia sp.
Venericardia? aff. *liasina* (MOORE)
Oxytoma inæquivalve (SOW.)
Aequipecten æquivalvis (SOW.)?
Aequipecten priscus (SCHLOTH.)
Gryphæa cymbium LAM.

300—302 m Basalt sill.

302—304 m Shaly sandstone, in certain beds rather hard, upwards shaly. The sandstone contained fossil wood.

304—350 m Scree, covering sandstone with trails.

350—358 m Coarse, stratified sandstone.

358—368 m Sandstone alternating with beds and concretions of clay ironstone. In the sandstone fossil wood (fig. 37).

368—373 m Coarse, cross-bedded sandstone.

373—390 m Scree.

390—410 m Reddish, highly cross-bedded sandstone, interstratified with thin shaly bands.

410—430 m Hard, finely laminated sandstone alternating with thin beds of clay ironstone (fig. 36).

430—468 m Yellow, coarse, strongly cross-bedded sandstone, which forms an almost vertical cliff.

468—511 m Rather soft calcareous sandstone, unassorted, with conglomeratic bands (quartz pebbles) and several fossil horizons:

494 m Grey sandstone with concretions, which contained the following species:

Trigonia literata Y. et B.
Astarte madseni n. sp.
Megateuthis sp.
Dactylioceras sp.
Ichtyosaurus sp. (vertebra)

498 m Overlying 1 m sandstone with wavy beds of shale and cross-bedding there occurred a bed of calcareous sandstone, which has yielded the following fossils:

Trigonia literata Y. et B.
Astarte madseni n. sp.
Tancredia n. sp.?
Gresslya rotundata (PHILL.)

500 m Separated from the subjacent fossil horizon by 0.75 m of unfossiliferous sandstone there occurred a horizon with *Liostrea* cf. *erina* (D'ORB.)

504 m Bed containing numerous bivalved specimens of *Liostrea* cf. *erina* (D'ORB.)

508—511 m Bed carrying many oysters in addition to the following fauna:

Rhynchonella sp. indet.
Trigonia literata Y. et B.

Astarte madseni n. sp.
Tancredia aff. *donaciformis* LYC.
Tancredia n. sp.
Pleuromya aff. *elongata* (MÜNST.)
Gresslya donaciformis (PHILL.)
Gresslya abducta (PHILL.)
Gresslya rotundata (PHILL.)
Pholadomya aff. *intermedia* (SIMPS.)
Oxytoma inæquivalve (SOW.) var.
Lima (*Plagiostoma*) cf. *toarcensis* DESL.
Liostrea cf. *erina* (D'ORB.)
Modiola n. sp.
cf. *Passaloteuthis subaduncata* (VOLTZ)
Megateuthis sp.

511—530 m Scree.
530—540 m Very hard, rather fine-grained, greyish-yellow sandstone with concretions. Exhibits a nearly vertical cliff. The bed contained indeterminable *Belemnites*.
540—542 m Shaly sandstone.

Locality 3. On September 14th, 1926, another ascent of Nathorst Mountain was made about 1.5 km north of section 2. The section was greatly obscured by scree, only near the top was the sandstone exposed, and here, at an altitude of 548 m, several loose-lying slabs of crinoid sandstone were found, corresponding to the crinoid bed (at 394 m) in Varde Kløft and the crinoid sandstone mentioned by VICTOR MADSEN and collected in 1900 by HARTZ on Nathorst Mountain. At the top of Nathorst Mountain and in the plateau surface behind the edge of the cliff there occurs in locality 3 at an altitude of 550 m a horizon very rich in fossils, which was observed by Mr. HØEGH, the manager of the colony at Scoresby Sound, on September 13th, 1926. The fossils are embedded in concretions, which are often phosphoritisised. A large collection comprising the following fossils was made:

Lingula beani PHILL.
Trigonia sp. (*Glabrae*)
Astarte madseni n. sp.
Tancredia cf. *dionvillensis* TERQ.
Sphæriola? cf. *onesimi* (DUM.)
Protocardia substriatulum (D'ORB.)
Quenstedtia? sp.?
Gresslya donaciformis (PHILL.)

Gresslya abducta (PHILL.)
Gresslya rotundata (PHILL.)
Arcomya n. sp.?
Pholadomya aff. *fidicula* SOW.
Oxytoma inæquivalve (SOW.) var.
Gervillia cf. *acuta* SOW.
Lima (*Plagiostoma*) n. sp.
Entolium demissum (PHILL.)?
Variamussium n. sp.
Camptonectes aff. *sublævigatus* (ERNST)
Pseudolioceras beyrichi (SCHLOENB.)
[*Pseudolioceras lythense* (Y. et B.)]
Megateuthis rhenana (OPPEL)
Glyphea sp.
Ichtyosaurus sp. (fragment of a skull).

This horizon was traceable some distance southwards along the edge of the cliff. North of locality 3 the sandstone is overlain by a thin bed of black shale, probably belonging to the Vardekløft Formation, which in Nathorst Mountain has otherwise been completely removed by erosion.

Neill's Cliff round the mouth of Ugle Elv (Owl River).

Fig. 38 and pl. 12.

In May, 1927, TOM HARRIS stayed in the territory north of Nathorst Mountain. He has kindly given me various information about the marine Liassic beds within this area, accompanied by a sketch map (fig. 38).

Coll Mountain. Top at 360 m.
Base of blue clay 320 m (Vardekløft Formation).
Fixed Oyster bed (Upper Liassic) seen at 250 m.
Foot of Mountain at 50 m.
No fossils collected.

Mole Mountain. 250 m high. Near the top many loose blocks of the *Entolium frontale* rock. No fossils brought back.

Mount Eli Fjæld ("Ammonite Mountain"[1])). 390 m high.

In the southern portion of this mountain HARRIS measured the following section:

Top (flat) ..... 390 m
Entolium frontale beds..... 370 m (Charmouthian)

[1]) The name Ammonite Mountain was given by NORDENSKIÖLD in 1900 to a mountain near the head of Hurry Inlet, where he found a great many Bathonian ammonites. However, according to HARRIS's investigations, this locality is situated far inland. The coast mountain was therefore named Mt. Eli Fjæld.

Highest plant bed	365 m	Rhæto-Lias
Lowest plant bed	315 m	
Top of red marl series	195 m	Keuper?

As to the Charmouthian beds HARRIS states that they are rather unusually developed, and gives the following detailed section:

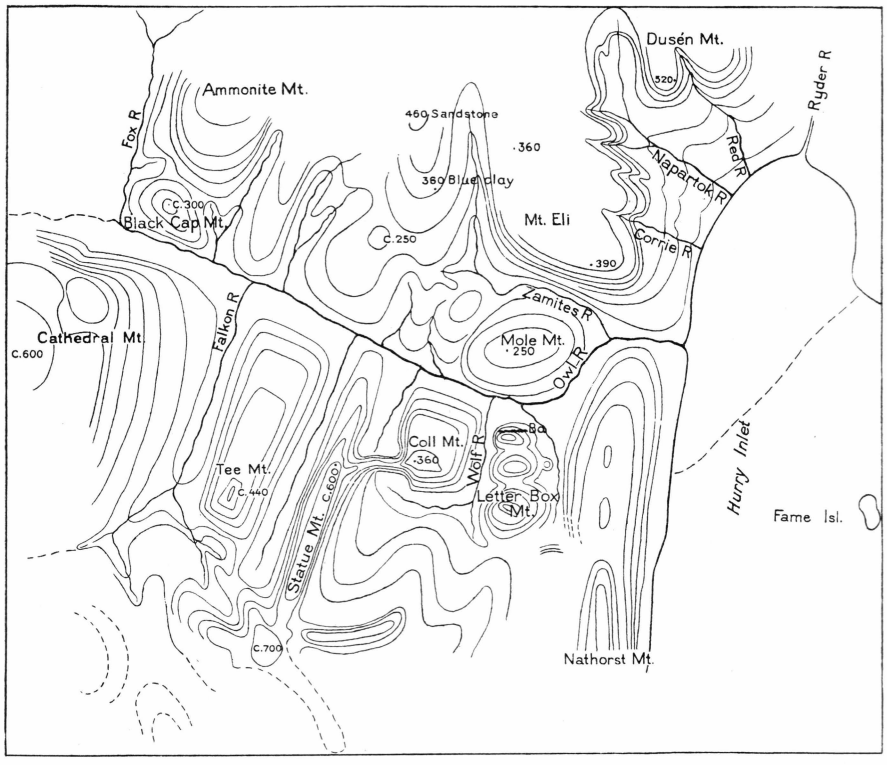

Fig. 38. Scetch map showing the area round Owl River (Ugle Elv). Drawn by TOM HARRIS 1926.

White shaly sandstone

A. 50 cm red sandstone with *Pecten* limestone fauna
80 cm soft sandstone

B. 20 cm red sandstone with oysters
5 m fairly loose gravel
1 m yellow sandstone

C. 1 m soft grey sandstone with *Pecten* limestone fauna
2 m white sandstone
2 cm coal
1.5 m grey marl
2 m shale with *Neocalamites*.

On top of the plateau HARRIS further found many loose-lying pieces with *Entolium frontale.*

Bed A (of the above section) is made up of greyish-brown to reddish-brown, fairly loose, coarse calcareous sandstone, which may be quite conglomeratic. From this sandstone the following fossils were brought back:

Cardinia concinna (SOW.)?
Gresslya cf. *intermedia* (SIMPS.)
Oxytoma inæquivalve (SOW.)
Camptonectes n. sp.

Bed B contains shells of *Gryphæa cymbium* LAM.

Bed C is a greyish-green, micaceous and ferruginous, calcareous arkose-sandstone with scattered, poorly preserved fossils:

Grandirhynchia sp.
Cardinia concinna (SOW.)
Mactromya lindhammeri ROLLIER
Pholadomya ambigua (SOW.)
Lima succincta (SCHLOTH.)
Lima (*Plagiostoma*) *eucharis* D'ORB.?
Limea acuticosta MÜNST.
Aequipecten priscus (SCHLOTH.)
Camptonectes n. sp.
Plicatula pectiniodes LAM.
Gryphæa arcuata LAM.

Lying loose on the south slope of Mt. Eli Fjæld HARRIS found the following species embedded in a greyish-brown, very calcareous and micaceous, conglomeratic sandstone:

Grandirhynchia n. sp.
Cardinia concinna (SOW.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Tancredia n. sp. A.
Pleuromya costata (Y. et B.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Gervillia lævis J. BUCKMAN
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)

Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Gryphæa cymbium LAM.
Amberleya cf. *polytaenia* COSSMAN.

Also loose-lying, but probably originating from the plateau, he collected:

Grandirhynchia n. sp.
Lobothyris aff. *punctata* (SOW.)
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Gryphæa cymbium LAM.
Protcteuthis cf. *pennicillata* (DUM.)

Mt. Dusén Fjæld. In the southern part of this mountain west of Red River HARRIS measured the following section:

Top	520 m
Pecten limestone	490 m
Coal in plant series	440 m
Sandstone	320—440 m
Red marl series	95—320 m

The *Pecten* limestone is 5 m thick and consists of greyish-brown, very micaceous, conglomeratic calcareous sandstone. The following fossils were collected:

Parallelodon cypriniformis (LUNDGR.)?
Mactromya aspasia (D'ORB.)
Gresslya n. sp.
Oxytoma inæquivalve (SOW.)
Gervillia lævis J. BUCKMAN
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Chlamys cf. *textoria* (SCHLOTH.)
Gryphæa cymbium LAM.

The latter locality is the northernmost place in which Charmouthian beds have so far been ascertained. Probably they occur throughout Dusén Mountain and some distance farther north, but I failed to detect them along the upper course of Ryder Elv. The Upper Liassic "oyster beds" were, however, fairly well developed, and were ascertained in the following localities:

Mt. Umimmak Fjæld at Ryder Elv.

At an altitude of about 345—360 m Ryder Elv cuts down through grey sandstone (fig. 39), in which are embedded a large number of richly

Fig. 39. Upper Liassic beds, Umimmak Fjæld, 345—360 m. In the valley the river Ryder Elv. — 29.-4.-1927.

fossiliferous, pyritic limestone concretions. The section, which I measured on April 29th, 1927, was as follows:

360 m Concretions with *Pseudolioceras* n. sp.

355 m Richly fossiliferous concretions with *Dactylioceras groenlandicum* in addition to the following species:

Discinisca n. sp.
Rhynchonella spp. indet.
Nuculana ovum (D'ORB.)
Parallelodon sp.
Oxytoma inæquivalve (SOW.) var.
Pseudomonotis substriata (MÜNST.)
Inoceramus cf. *substriatus* MÜNST.
Liostrea cf. *erina* (D'ORB.)
Trochus aff. *torulosus* QU.
Dactylioceras groenlandicum n. sp.
Dactylioceras sp.
Megateuthis rhenana (OPPEL).

345—355 m Greyish-green sandstone with scattered Belemnites.

Lejr Elv (Camp River).

On following this river westward from the Klitdalen, it will be seen to have cut a canyon, first through Rhæto-Liassic beds (fig. 41), then through younger beds of very variable composition (fig. 42), often

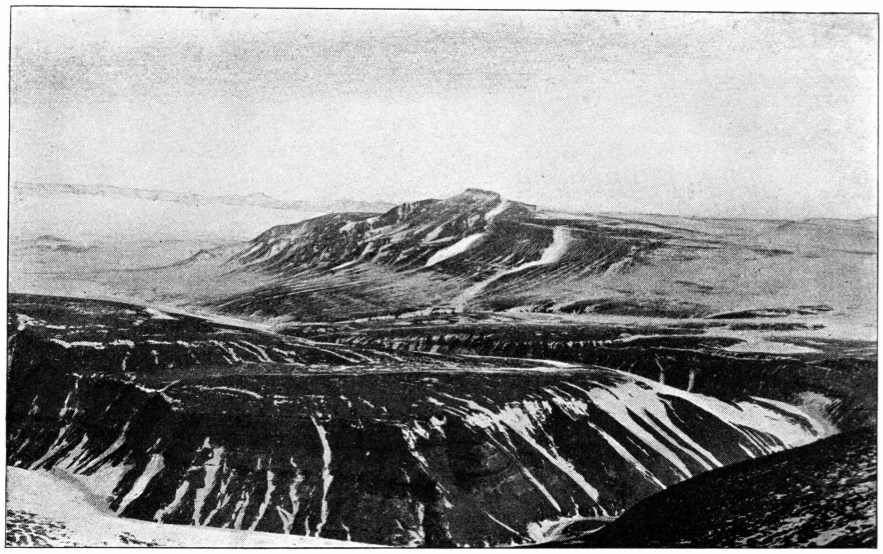

Fig. 40. The canyon of Lejr Elv. In the foreground Domerian? strata. In the background the mountain Skansen and the valley Klitdalen. — 1.-5.-1927.

strongly cross-bedded (fig. 43) but without fossils, and finally through fossiliferous Upper Liassic and still younger beds (figs. 44 and 45).

In the river bed a couple of blocks of a peculiar, fossiliferous, hard, brown calcareous sandstone were found, but I failed to find the rock in situ. The fossil contents of the blocks comprise the following species:

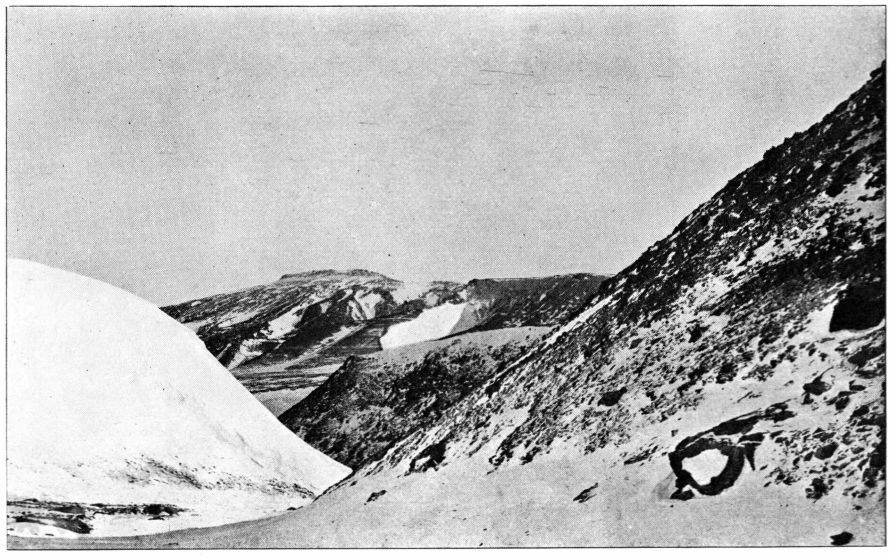

Fig. 41. Rhæto-Liassic plant beds in the Lejr Elv canyon. In the background the mountain Skansen. — 1.-5.-1927.

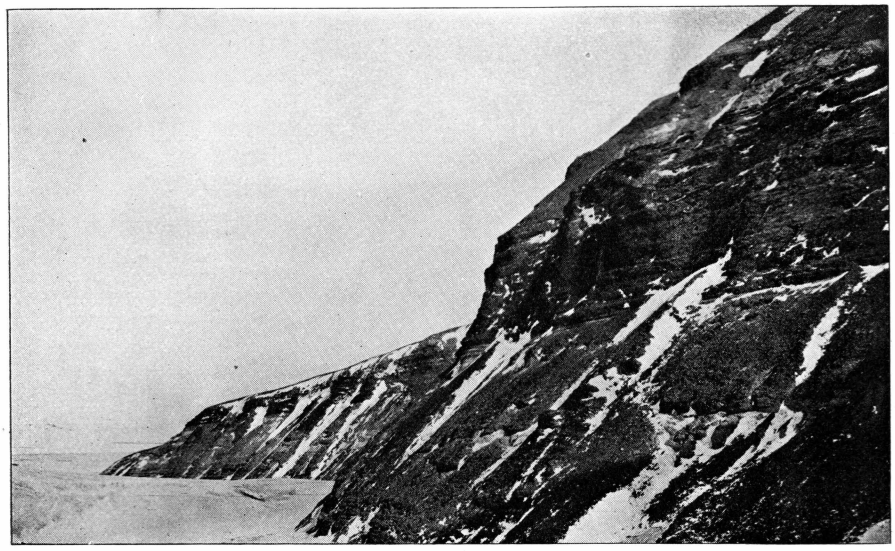

Fig. 42. Domerian? beds in the canyon of Lejr Elv. — 1.-5.-1927.

Homæorhynchia aff. *cynocephala* (Dav.)
Stolmorhynchia sp. n. B.
Lobothyris aff. *punctata* (Sow.)
Ornithella cf. *sarthacensis* (d'Orb,)
Isognomon aff. *lugdunensis* (Dum.)
Liostrea irregularis Münst.

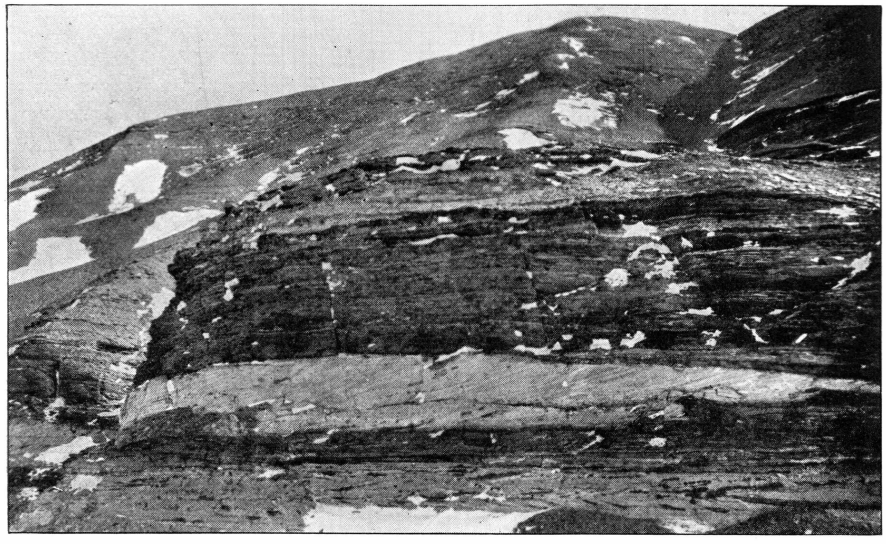

Fig. 43. Cross-bedded strata below the Upper Liassic oyster bed. Lejr Elv. 1.-5.-1927.

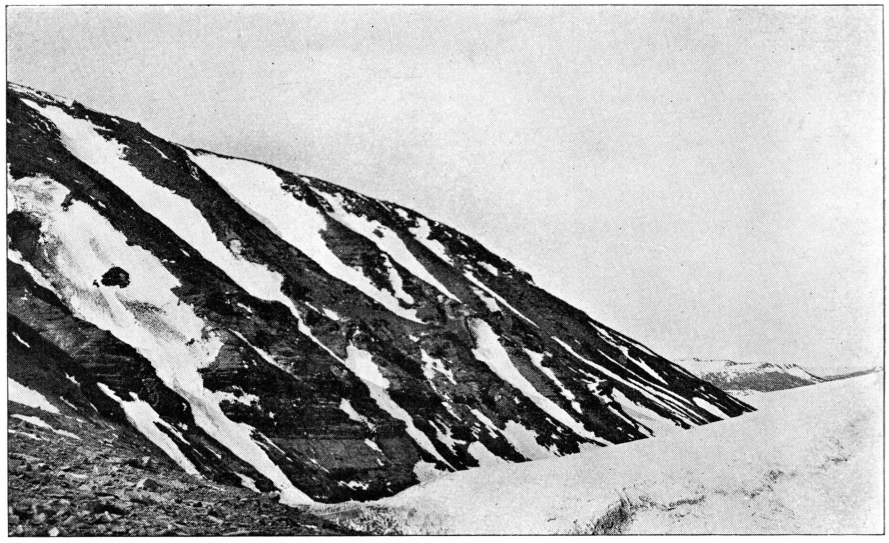

Fig. 44. Mt. Hjørnefjæld. At the base, fossiliferous Upper Lias beds overlying Domerian? sandstones and shales. Above yellow sandstones and micaceous shales of the Varde Kløft Formation (see fig. 45). — 1.-5.-1927.

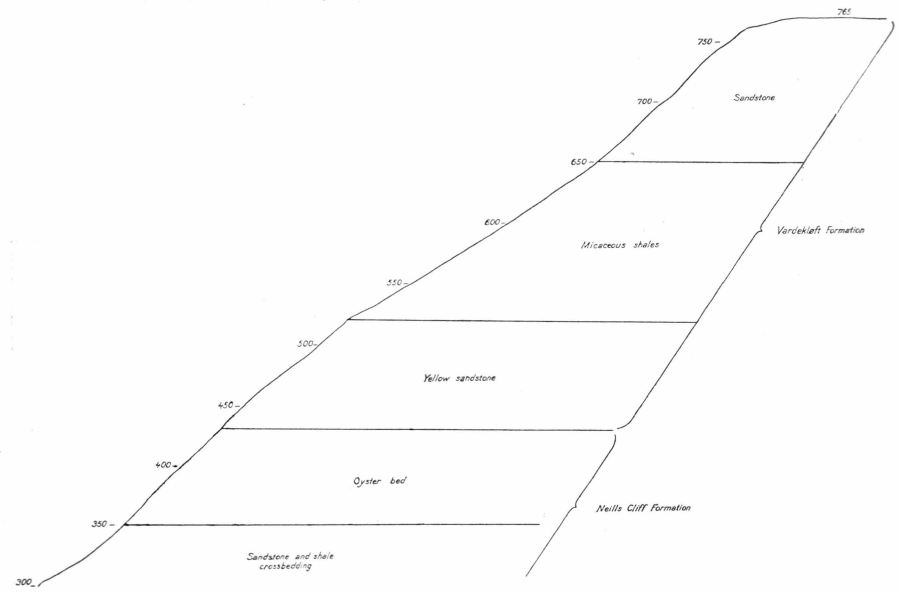

Fig. 45. Diagrammatic section of Mt. Hjørnefjæld. The following fossil horizons were found:

760 m	Arctocephalites bed	Bathonian.
740 m	Cranocephalites bed	—
700 m	Entolium demissum bed	—
(630 m)	loose-lying Xenocephalites	—
450 m	Indet. Belemnite	?
400 m	Pseudolioceras and Catacoeloceras beds	Toarcian.

Near the point where Lejr Elv falls out into Klitdalen I made an ascent of the high mountain on the north side of the valley on May 2nd, 1927. The mountain was much covered with scree and snow, still I succeeded in finding a number of loose-lying Upper Liassic fossils at an altitude of 550—625 m:

Serpula limax Gf.
Cucullaea? sp.
Trigonia literata Y. et B.
Trigonia sp. (*Glabrae*)
Tancredia n. sp.
Pleuromya cf. *unioides* (Röm.)
Oxytoma inæquivalve (Sow.) var.
Pseudomonotis n. sp.

Here, at an altitude of 660 m, the fossiliferous beds, greyish-yellow calcareous sandstones with concretions, were overlain by reddish-brown sandstone containing a few indeterminable Belemnites.

Hjørnefjæld (Corner Mountain). Here the section given in figs. 44 and 45 was measured at the beginning of May, 1927.

Up to 350 m Scree, covering alternating beds of sandstone and shale.
350—425 m Greyish-green calcareous sandstone with concretions, often pyritic.

Here several loose-lying fossils were collected:

Pholadomya aff. *fidicula* Sow.
Oxytoma inæquivalve (Sow.) var.
Inoceramus aff. *polyplocus* Röm.
Catacoeloceras n. sp.
Pseudolioceras sp.
Megateuthis cf. *quenstedti* (Oppel)
Megateuthis sp.

II. Liverpool Land. The Sediment Area at Rosenvinge Bay. (The Cape Hope Area).

(Map, Fig. 46).

As stated above, this area of sediments was discovered by the late Bjerring Pedersen (2), who considered the sediments to be of Mesozoic age, which view has been fully confirmed. The first fossiliferous deposits within this area was discovered by Lauge Koch on September 20th, 1926, at Igterajivit and Kumâit. The age of the fossils found

was shortly afterwards ascertained by me to be Liassic, and the faunas from both localities corresponded to that described by LUNDGREN from Cape Stewart (Charmouthian, zone of *Uptonia jamesoni* Sow.). Later I have encountered beds yielding the same fauna at various other points within the area, and have also found plant-bearing Rhæto-Liassic deposits.

Within this area the Mesozoic sediments are lowered in relation to

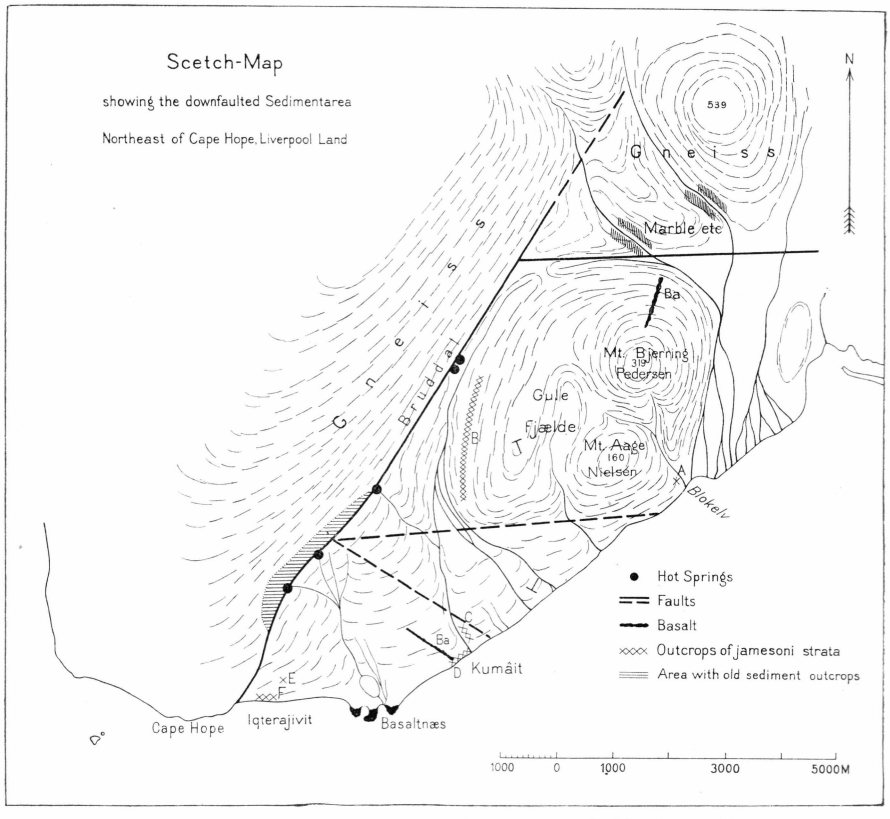

Fig. 46. A—F occurences of Jamesoni rocks. A and E big loose blocks. B, C, D and F fixed rocks.

the surrounding metamorphic rocks. The fault forming the western boundary of the area is marked, as was already pointed out by BJERRING PEDERSEN, by a series of hot springs. Such have not yet been ascertained along the northern fault running east and west, where, however, conditions have been but slightly investigated. Morphologically the area falls into two parts: a northern area, in which the sediments rise to over 300 m altitude, forming the mountains Gule Fjælde, and a southern area, appearing as a level plain, where the older sediments are concealed by Quaternary deposits and are exposed in the low coast cliffs and the

river valleys only. The Gule Fjælde are bounded on the east by a large river valley draining the glaciers to the north. East of this valley no sediments have been met with.

The Mesozoic sediments within this area are penetrated by basalt dykes in several places.

The Gule Fjælde are built up of a tilted sediment block in which the beds dip slightly towards the south or southeast. This part of the area is but sparsely investigated, still it may be stated with certainty that the main part of the visible sediments belong to the Lias. In two places I succeeded in finding marine fossils.

1. Bruddalen (the Fault Valley).

Between the Gule Fjælde and the gneiss to the west of them there runs along the fault a river bed in the eastern side of which the sediments are occasionally exposed (plate 1, fig. 1). On April 9th, 1927, I observed here, at the base of the section and resting upon purple clay, a coarse, cross-bedded, reddish conglomerate with boulders of metamorphic rocks embedded in an arkose cement of a thickness of about 10 m. For the next 40 m the section was covered with débris, but 50 m above the bottom of the valley there appeared a hard bed consisting of a highly disintegrated shell breccia with many coarse quartz and felspar grains. Sometimes the bed was developed like a coarse calcareous arkose with scattered shell fragments. Higher up this fossiliferous horizon was overlain by coarse, shaly sandstones without fossils. The following fossils were found in the arkose:

Pentacrinus sp. cf. *scalaris* Gf.
Cardinia hybrida (Sow.)?
Trigonia lingonensis Dum.
Astarte bayi Lundgr.
Venericardia? aff. *liasina* (Moore)
Quenstedtia? n. sp.
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)
Arcomya longa (Buv.)
Oxytoma inæquivalve (Sow.)
Oxytoma n. sp.
Entolium frontale (Dum.)
Entolium callosum (Lundgr.)
Aequipecten æquivalvis (Sow.)
Aequipecten priscus (Schloth.)
Plicatula pectinoides Lam.

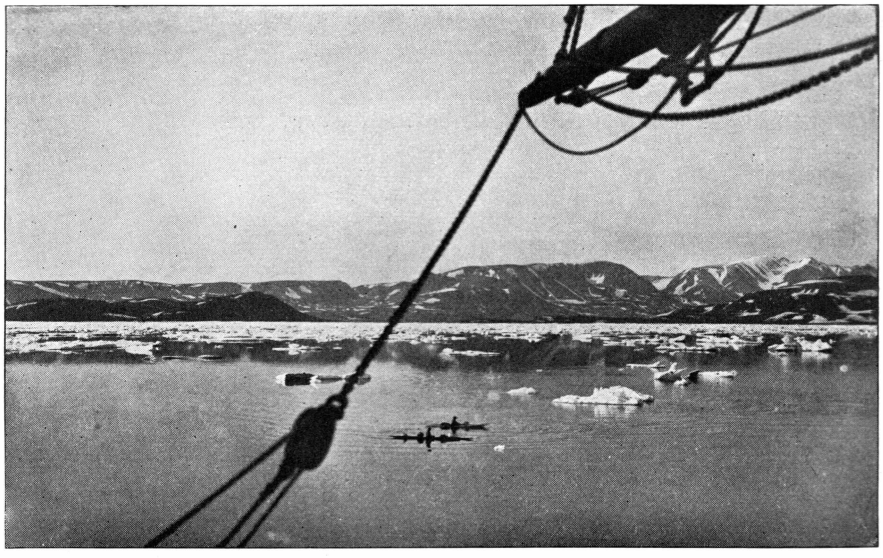

Fig. 47. Rosenvinge Bay. In the background Gneiss mountains. The low dark mountains to the left are the Gule Fjælde (Mesozoic sediments). — 5.-8.-1926.

Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.

Rhætic plant-bearing deposits must be assumed to occur between the coarse conglomerates and the marine horizon.

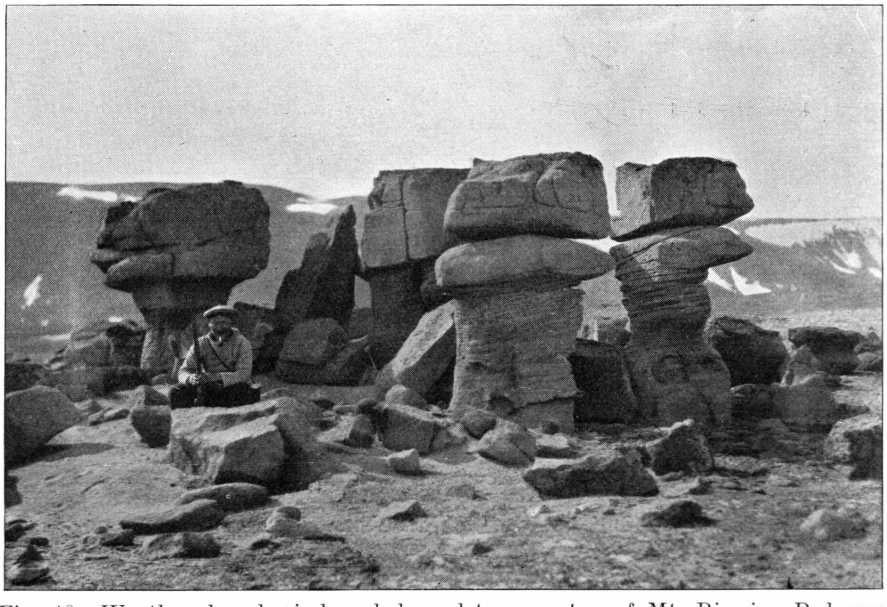

Fig. 48. Weathered and wind-eroded sandstone on top of Mt. Bjerring Pedersen (Gule Fjælde). — Hansen phot. 1929.

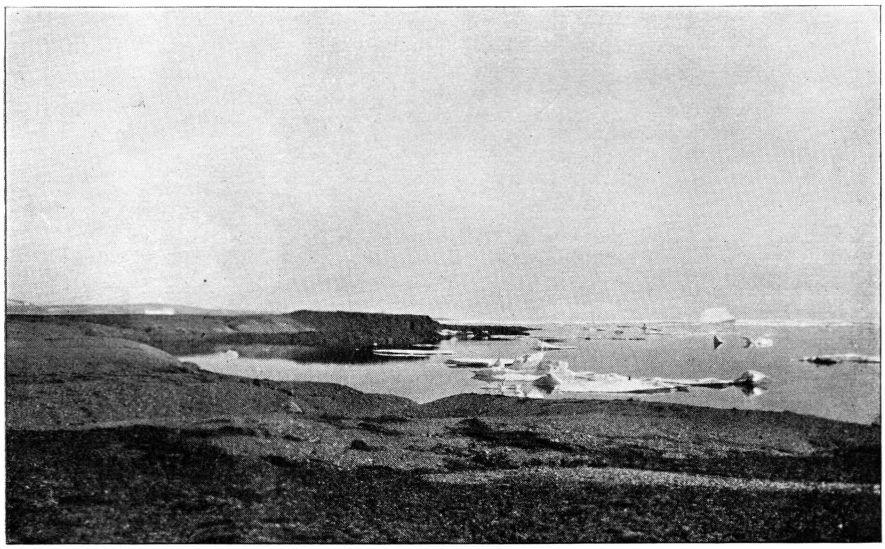

Fig. 49. Basaltnæs, east of Cape Hope, Liverpool Land. — 31.-7.-1927.

2. Blok Elv (Block River).

Near the mouth of the small river that separates the two Gule Fjælde (Yellow Mountains), I found on October 23rd, 1926, two large blocks containing Charmouthian fossils. As far as can be made out from the exposed rocks and from the rocks of the scree that covers the mountain side, the beds of the Gule Fjælde belong to horizons that are younger than the marine *Uptonia* horizon. Judging from the blocks

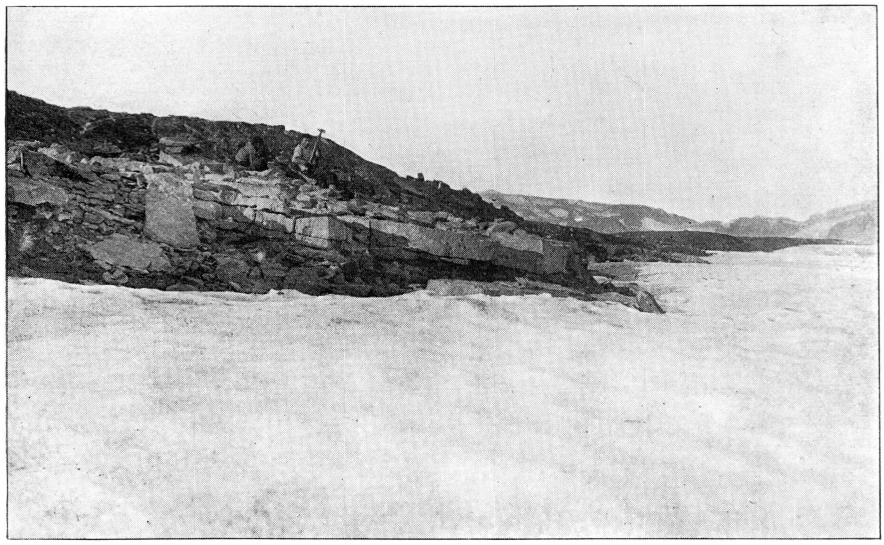

Fig. 50. The Jamesoni beds at Kumâit. — 31.-7.-1927.

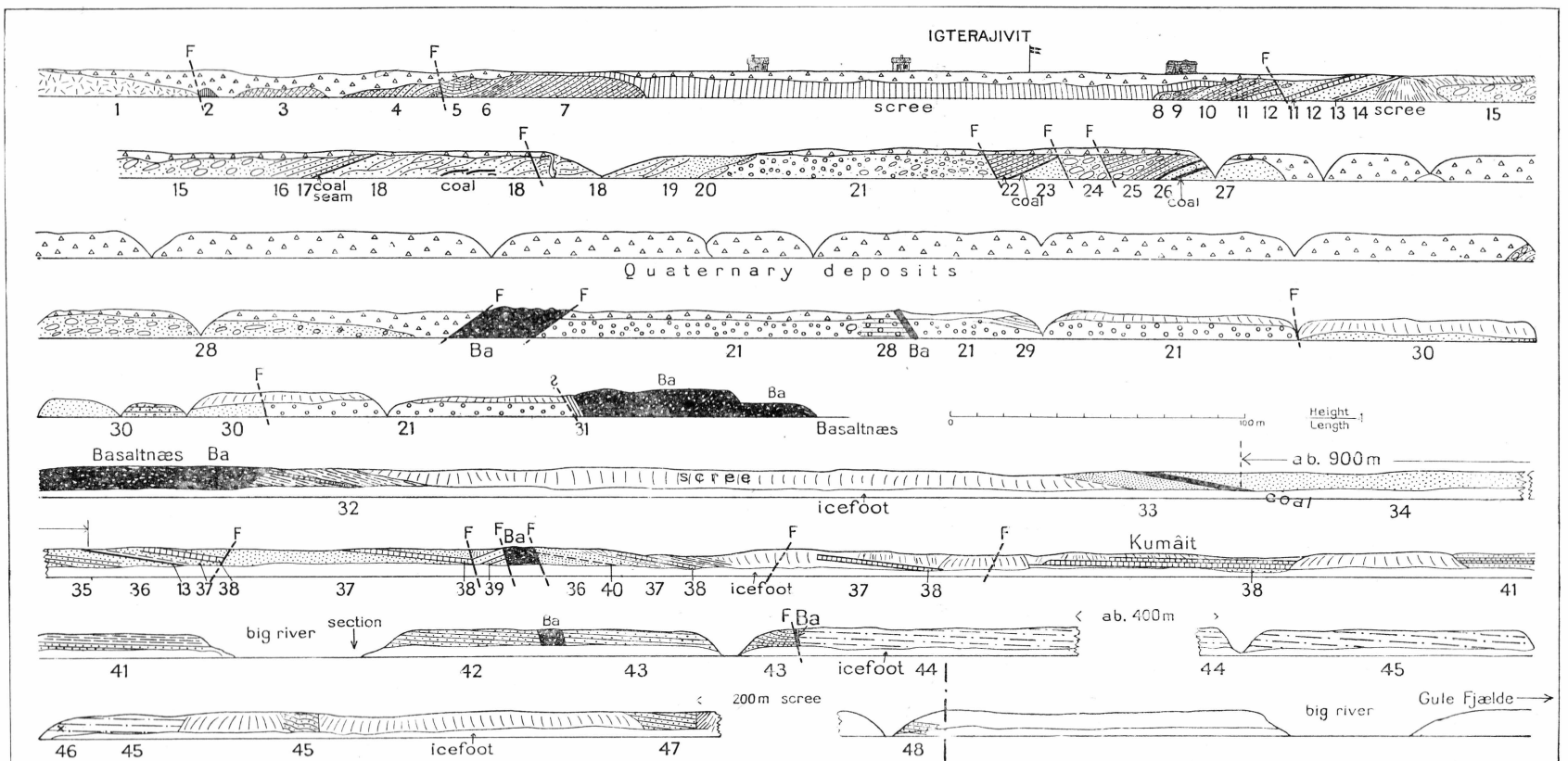
IGTERAJIVIT
F
1 2 3 4 5 6 7 scree 8 9 10 11 12 11 12 13 14 scree 15
15 16 17 coal seam 18 coal 18 18 19 20 21 22 23 24 25 26 coal 27
Quaternary deposits
28 Ba 21 28 Ba 21 29 21 30
30 30 21 31 Ba Ba Basaltnæs
Basaltnæs Ba
0 100 m Height Length
ab. 900 m
scree
32 icefoot 33 coal 34
Ba
Kumâit
35 36 13 37 38 37 38 39 36 40 37 38 icefoot 37 38 38 41
big river section Ba
ab. 400 m
41 42 43 43 icefoot 44 44 45
200 m scree
big river
Gule Fjælde
46 45 45 icefoot 47 48

Fig. 51. Diagrammatic sketch showing the coast section between Igterajivit and the Gule Fjælde (The Yellow Mountains).

I. Igterajivit — Basaltnæs.

1. Gneiss with pegmatite veins. — **2.** Purple clay. — **3.** Grey, rather fine-grained sandstone with carbonised wood, alternating with thinner layers of conglomerate, cross-bedding. — **4.** Loose, yellowish-green, mediumgrained sandstone succeeded by rather fine-grained, grey sandstone. In the eastern part big sandstone concretions and carbonised wood. — **5.** Syncline consisting of yellowish-green, fine-grained, finely laminated sandstone with mud cake conglomerate. — **6.** Alternating thin layers of shales and sandstone. — **7.** Green, medium-grained sandstone with hard layers, in the eastern part alternating with thin-bedded shales with numerous trails on the bedding planes. — **8.** Dark-green, micaceous sandstone with big unfossiliferous concretions. — **9.** Shales. — **10.** Loose, greenish sandstone with hard, concretionary layers containing a few, indeterminable fossils. — **11.** Hard Uptonia limestone with numerous fossils (fig. 55). — **12.** Loose, shaly, greyish-green sandstone. — **13.** Sharp boundary. — **14.** Hard, grey, coarse-grained sandstone with wood and two conglomeratic layers. — **15.** White, shaly sandstone with big, hard, coarse-grained, rusty concretions. — **16.** Loose, white sandstone. — **17.** Yellow sand resting on a thin coal seam. — **18.** Yellow, finely laminated, fine-grained sandstone with layers of white, coarse-grained sand, cross-bedding. In the lower part small coal seams (fig. 11). — **19.** Yellow, coarse-grained, cross-bedded sand. — **20.** Concretionary, shaly sandstone with carbonised wood. — **21.** Coarse conglomerate (fig. 10) with stones up to a hands size, predominantly quartzite, wood in the upper part. Intercalated, finely laminated, medium-grained sandstone layers. — **22.** Greyish-brown, fine-grained, shaly sandstone, with wood. — **23.** Yellow sand. — **24.** Concretionary sandstone with thin layers of shale and much wood. — **25.** Grey sandstone, fine-grained in the lower part, containing mud cake conglomerates. Subjacent brown, concretionary sandstone resting on very coarse sandstone with wood. Below follows shaly, medium-grained grey sandstone. — **26.** Concretionary sandstone succeeded by shales and resting on a thin coal seam. — **27.** Loose, white sandstone. — **28.** Green (glauconitic), argillaceous sand with calcareous nodules. The sand grows coarser towards the east. — **29.** Shaly sandstone sharply separated from the conglomerate. — **30.** Green sand and sandstone. — **31.** Shale with carbonised wood.

II. Basaltnæs — Gule Fjælde.

32. Black shales and grey sandstone with Neocalamites. — **33.** Black shales succeeded by finely laminated sandstone. — **34.** Loose, white, coarse-grained sand. — **35.** Hard, shaly sandstone with Podozamites. — **36.** Loose, white, coarse sandstone. — **37.** Shaly sandstone succeeded by loose sandstone. — **38.** Uptonia limestone. — **39.** Hard, brown sandstone. — **40.** Black shale. — **41.** Loose, shaly sandstone with harder fossiliferous beds succeeded by shales. — **42.** Cross-bedded, green sandstone with mud cake conglomerates. — **43.** Shaly sandstone with thin, hard sandstone layers. — **44.** Sandy shales. — **45.** Finely laminated sandstones and micaceous shales. — **46.** Badly preserved fossils in mud cake conglomerates. — **47.** Hard, rusty sandstone. — **48.** Yellow sandstone.

F = Faults; Ba = Basalt.

In these sections the Uptonia horizon is marked with the bed numbers 11 and 38.

Younger than this horizon are beds 3—10 and 41—48.

Older are beds 12—27, 29, 32—37.

Of unknown age are beds 28 and 30.

found, the marine horizon must occur fixed either in the lower, débris-covered, portions of the mountains or in the narrow coastal plain extending between the mountains and Rosenvinge Bay. The blocks are alike in character and content of fossils and are made up of a rather fine-grained, deep greyish-green limestone with numerous fossils and scattered quartz and felspar grains of the size of a pea. On a single bed surface a large accumulation of *Cardinia concinna* shells was found, all the shells lying with the convex side upwards (Pl. IV). The blocks have yielded the following fossils:

Nuculana zieteni BRAUNS.
Cardinia concinna (SOW.)
Cardinia hybrida (SOW.)
Cardinia aff. *attenuata* (STUTCHBURY)
Astarte bayi LUNDGR.
Astarte wandeli LUNDGR.
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Goniomya hybrida (MÜNST.)
Isognomon n. sp.
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Limea acuticosta MÜNST.
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Plicatula cf. *lævigata* (D'ORB.)?
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola sp.
Modiola scalprum SOW.
Hippopodium ponderosum SOW.

The area of the Gule Fjælde is bounded on the south by an east-west directed fault towards the sediment plain. As far as can be seen

from the coast sections, the northern part of the plain is made up of regularly bedded rocks dipping slightly towards the north, while its southern portion from some distance north of Kumâit is dissected by numerous faults, whose course could not be closely investigated on account of the thick cover of Quaternary deposits.

Fig. 51 shows a sketch of the coast northeastward from Basaltnæs, where the above-mentioned features are distinctly visible. The huge northern sediment block is built up of beds corresponding to those of the Gule Fjælde. In a single place some badly preserved fossils were found, probably of a *Trigonis*. The southern part of this stretch of coast is built up of older beds. Nearest Basaltnæs there occur shales belonging to the Rhæto-Liassic plant series. Farther north, hard beds with marine fossils belonging to the *Jamesoni* zone are encountered in the coastal cliffs. At Kumâit these hard beds repeatedly crop out in the cliff on account of the faults present there, and in the northernmost locality (fig. 50) large collections were made (both by LAUGE KOCH, on September 21st and 25th 1926, and by the present author, on August 5th, 1927) from the bed, which is here mainly made up of grey to dark grey, rather fine-grained, micaceous and ferruginous, calcareous sandstones in which are scattered numerous fossils; in some beds, however, there occurs an actual pavement with large shells of *Entolium frontale*. Certain portions of the hard bed are more shaly, with much mica on the bedding planes. *Uptonia jamesoni* was found in both rock types. As regards the over- and underlying beds, reference is made to the sketch of the section. The *Jamesoni* horizon yielded the following fossils:

Spiriferina münsteri DAV.
Tetrarhynchia? sp. A.
Rhynchonella cf. *scalpellum* QU.
Lobothyris aff. *punctata* (SOW.)
Nucula cf. *cordata* GF.
Parallelodon cf. *buckmani* (RICH.)
Parallelodon sp. A., aff. *buckmani* (RICH.)
Cardinia concinna (SOW.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma a TATE
Astarte bayi LUNDGR.
Astarte n. sp.
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia johnstrupi (LUNDGR.)
Quenstedtia? n. sp.

Mactromya lindhammeri ROLLIER
Mactromya? *groenlandica* n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Gresslya punctata (SIMPS.)
Ceratomya petricosa (SIMPS.)
Homomya sp.
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Goniomya hybrida (MÜNST.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Gervillia sp.
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys rollei (STOLICZKA)
Plicatula pectinoides LAM.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Gryphæa gigantea SOW.
Terquemia pectiniformis E. DESL. (*arietis* QU.)
Myoconcha decorata (MÜNST.)
Modiola scalprum SOW.
Hippopodium ponderosum SOW.
Dentalium parvulum (F. BUCKMAN) RICH.
Ptychomphalus consobrinus (TATE)
Ptychomphalus n. sp.
Tornatellæa sp. cf. *fontis* (DUM.)
Uptonia jamesoni (SOW.)
Uptonia aff. jamesoni (SOW.)
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)
Hastites? sp.

The coast from Igterajivit to Basaltnæs is represented in fig. 51. Only in a single place, near the houses at Igterajivit, is the marine Charmouthian horizon exposed in the low coastal cliff. West thereof the

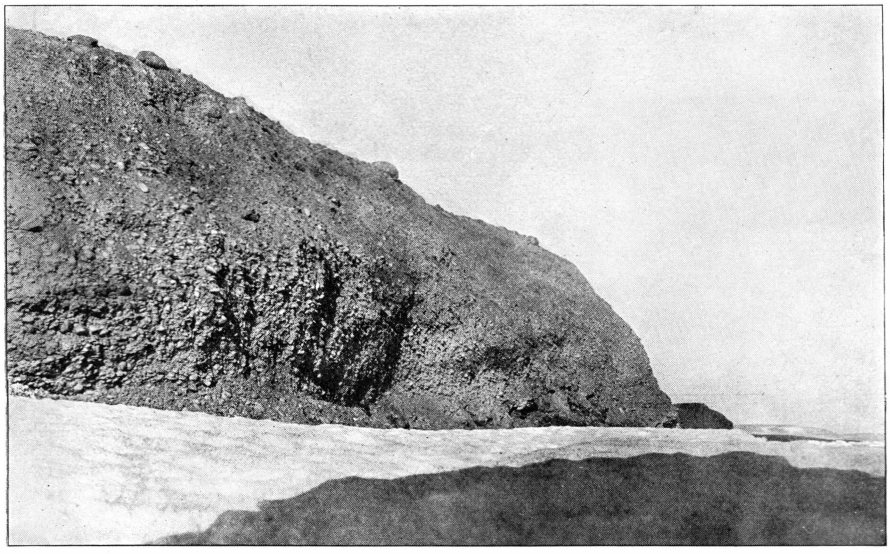

Fig. 52. Coarse conglomeratic beds belonging to the Cape Stewart Formation, east of Igterajivit. — 31.-7.-1927.

faulted and partly folded beds seem to be younger (Domerian?). Otherwise the cliff is built up of strongly faulted beds, which in one place contain small coal seams and belong to the Rhæto-Liassic series, but otherwise, as far as could be made out, are older than that horizon. From the marine beds at Igterajivit the following fauna was collected partly

Fig. 53. Shaly sandstone and small coal seams of the Cape Stewart Formation, east of Igterajivit. — 30.-7.-1927.

by LAUGE KOCH on September 21st and 25th, 1926, partly by the present author on July 30th, 1927:

"Ophiomorpha"
Serpula sp. cf. *torquata* QU.
Rimirhynchia sp. cf. *rimosa* v. BUCH.
Parallelodon cypriniformis (LUNDGR.)
Cardinia concinna (SOW.)
Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma a TATE
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Quenstedtia? n. sp.
Pseudotrapezium cucullatum MÜNST.
Mactromya? *groenlandica* n. sp.
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Goniomya hybrida (MÜNST.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Lima succincta (SCHLOTH.)
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Entolium callosum (LUNDGR.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. Qu.)
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.
Dentalium cf. *elongatum gracile* MOORE
Ptychomphalus consobrinus (TATE)
Ptychomphalus n. sp.
Lewisiella aff. *conica* (D'ORB.)
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE).

The fossiliferous bed, 1 m thick, is chiefly made up of a rather coarse, greenish calcareous arkose sandstone, which may at times be

quite conglomeratic. The remaining portions of the bed are more fine-grained and of a lighter colour, and split easily into thin flakes, the surfaces of which are covered with shells. The fauna contained in these upper strata is rather poor in species, species like *Cardinia hybrida* (fig. 55), *Aequipecten priscus*, and *Entolium callosum* being predominant. It is characteristic of the rocks that they are intersected by cracks filled with calcite. The cracks often cut across fossils, and may be up to 3 mm wide. Further, segregation of pyrite takes place. The formation of cracks has doubtless some connection with the Tertiary tectonic movements.

Fig. 54. The Jamesoni beds at Igterajivit. — 30.-7.-1927.

Within the southern portion of the sediment plain the marine horizon was found inland in two places:

1) In the river bed immediately north of Kumâit, where the section represented in figs. 56 and 57 was measured. However, no collection of fossils was made here.
2) At a point north-northwest of Igterajivit a very large, highly fossiliferous block of a hard, grey to dark-grey, rather fine-grained micaceous, ferruginous, and calcareous sandstone, penetrated by calcite-filled cracks was found. Among the fossils one notes the frequent occurrence of *Mactromya Lindhammeri*, which has been met with in no other locality in such great abundance. Otherwise the following fossils were found:

Spines of Echinoides.
Serpula limax Gf.

Fig. 55. Jamesoni limestone with *Cardinia hybrida* and calcite-filled cracks. Igterajivit.

Spiriferina münsteri DAV.
Piarorhynchia? sp.
Grandirhynchia n. sp.
Tetrarhynchia sp. A.
Squamirhynchia aff. *squamiplex* QU.
Lobothyris aff. *punctata* (SOW.)
Nuculana aff. *complanata* (GF.)
Parallelodon cf. *buckmani* (RICH.)
Parallelodon cypriniformis (LUNDGR.)
Cucullaea münsteri ZIETEN
Cardinia hybrida (SOW.)
Astarte striato-sulcata RÖM. forma a TATE
Venericardia? aff. *liasina* (MOORE)
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)
Mactromya lindhammeri ROLLIER
Mactromya? *groenlandica* n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pseudotrapezium cuculatum (MÜNST.)
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Gresslya punctata (SIMPS.)
Gresslya n. sp.
Arcomya longa (BUV.)
Arcomya? n. sp.
Goniomya hybrida (MÜNST.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.
Isognomon aff. *infraliassica* (QU.)
Gervillia lævis J. BUCKMAN
Lima succincta (SCHLOTH.)
Lima Roemeri BRAUNS
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Pseudolimea*) *boonei* COSSMAN
Entolium frontale (DUM.)
Aequipecten æquivalvis (SOW.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys cf. *textoria* (SCHLOTH.)
Camptonectes n. sp.
Plicatula pectinoides LAM.

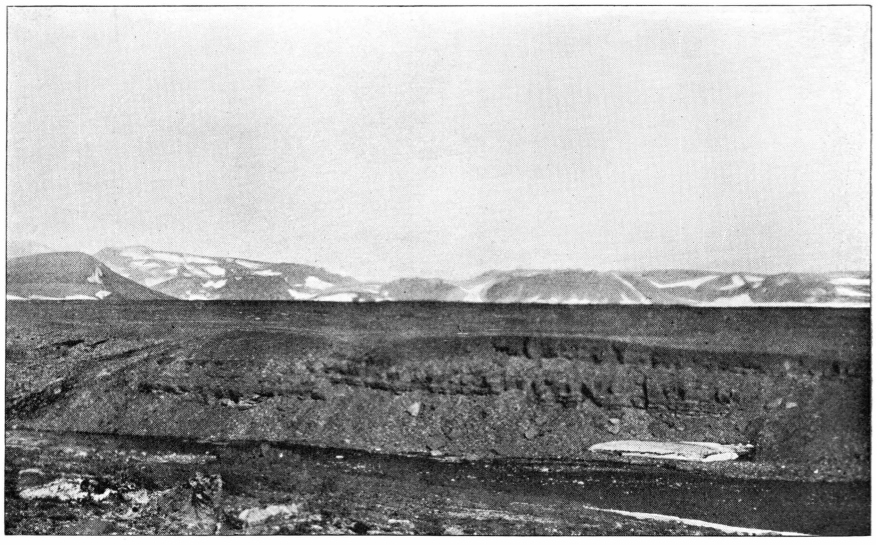

Fig. 56. Jamesoni beds in the northern bank of the large river north of Kumâit. 5.-8.-1927.

Plicatula cf. *lævigata* (D'ORB.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modicla lævis SOW.
Modiola scalprum SOW.

Section North of Kumâit.

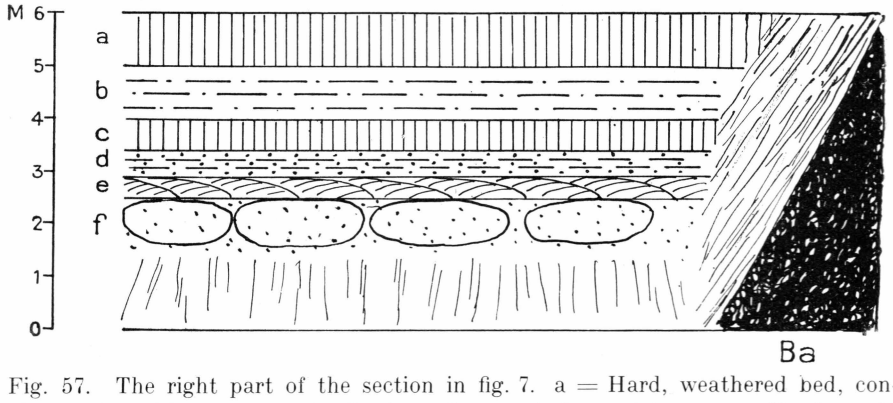

Fig. 57. The right part of the section in fig. 7. a = Hard, weathered bed, conglomeratic, with numerous fossils. b = Loose, shaly sandstone. c = Hard, sandy limestone. d = Loose, shaly sandstone, partly conglomeratic, with subordinate beds of shale. e = Arenaceous shales, cross-bedded in the lower part. f = Concretionary sandstone with thin bands of shale, conglomeratic in the upper part. Ba = Basalt.

Hippopodium ponderosum Sow.
Dentalium sp.
Pleurotomaria (*Sissenna*) *procera* d'Orb.?
Ptychomphalus consobrinus (Tate)
Ptychomphalus n. sp.
Amberleya sp.
Proconulus (*Epulotrochus*) *epulus* (d'Orb.)
cf. *Aulacotrochus nitens* Dum.
Trochopsis? sp.
Scurriopsis? *vendæensis* Cossman
Scurriopsis n. sp.
Tornatellæa sp. cf. *fontis* (Dum.)

As mentioned above, within the Cape Hope area hard beds holding a decided Charmouthian fauna were observed in several places. Only at Kumâit did ammonites occur, which show the beds to belong to the zone with *Uptonia jamesoni*. The petrographical development and the fossil contents of the beds in other localities make it reasonable to assume yhat these beds, too, belong to the said zone.

SUMMARY OF THE GREENLAND LIAS

The marine strata of the Charmouthian.

A. The *Jamesoni* horizon.

The marine transgression that initiated the deposition of the Neill's Cliff Formation, as shown in the preceding pages, gave rise to the deposition of some very coarse, often conglomeratic, arkose beds interstratified with hard bands in which lime and iron enter as components in the cement. The deposition took place in quite shallow water and under fairly quiet conditions. The composition of the conglomerates shows very clearly that the main mass of the rock, if we disregard the shells embedded in it, has originated from desintegration of eruptives, or metamorphic rocks. The exceedingly uniform development throughout the stretch from the Cape Hope area to Mt. Dusén Fjæld in connection with the coarse consistency of the beds, the lack of finer assortment, and the contents of sharp-edged grains, show that the beds investigated must have been deposited in the immediate neighbourhood of the coast of the Liassic sea. It seems natural to assume that the desintegration components of the material originate from an area situated east of the sediments, the present Liverpool Land (plate 13), which probably had a greater extension eastward over an area now covered by the sea. Here metamorphic rocks and eruptives are met with, by the desintegration of which the main mass of the Liassic sediments have originated.

The fauna embedded in the mainly coarse basal beds of the Neill's Cliff Formation (chiefly lamellibranchs) exhibits a considerable uniformity within the whole area investigated. Unfortunately the ammonites belong to the most rarely occurring fossils, so far only species of the genus *Uptonia* have been found, and almost exclusively in the southern part of the area. This shows that the beds belong to the *Jamesoni* horizon of the *Jamesoni* zone. *Uptonia Jamesoni* has been found in the upper part of the beds, while the lowermost coarse beds have yielded no deter-

minable fossils. I consider it little probable that other Charmouthian horizons should be present in the basal beds, the period during which these coarse beds were deposited having doubtless been comparatively short. From these beds the following fauna is derived:

"Ophiomorpha"
Pentacrinus sp. cf. *scalaris* GF.
Spines of *Echinoidea*
Serpula limax GF.
Serpula sp. cf. *torquata* QU.
Filograna solitaria TERQ. et PIETTE
Lingula sacculus CHAP. et DEW.
Discinisca n. sp.
Spiriferina münsteri DAV.
Spiriferina pinguis ZIETEN
Calcirhynchia? sp.
Piarorhynchia? sp.
Grandirhynchia n. sp.
Grandirhynchia elii n. sp.
Tetrarhynchia sp. A.
Tetrarhynchia sp. B.
Stolmorhynchia n. sp.
Rimirhynchia sp. cf. *rimosa* v. BUCH
Squamirhynchia aff. *squamiplex* QU.
Rhynchonella cf. *scalpellum* QU.
Lobothyris aff. *punctata* (SOW.)
Lobothyris cf. *subpunctata* (DAV.)
Ornithella cf. *sartacensis* (D'ORB.)
Ornithella sp.
Nucula cf. *cordata* GF.
Nuculana subovalis (GF.)
Nuculana aff. *complanata* (GF.)
Nuculana graphica (TATE)
Nuculana galathea (D'ORB.)
Nuculana zieteni (BRAUNS)
Parallelodon cf. *Buckmani* (RICH.)
Parallelodon sp. A. aff. *Buckmani* (RICH.)
Parallelodon sp. B.
Parallelodon sp. C.
Parallelodon cypriniformis (LUNDGR.)
Parallelodon intermedius SIMPS.
Cucullaea münsteri ZIETEN
Cardinia concinna (SOW.)

Cardinia listeri (SOW.)
Cardinia hybrida (SOW.)
Cardinia aff. *attenuata* (STUTCHBURY)
Trigonia lingonensis DUM.
Astarte striato-sulcata RÖM. forma a TATE
Astarte striato-sulcata RÖM. forma b TATE
Astarte scanensis? MBG.
Astarte obsoleta DUNKER
Astarte bayi LUNDGR.
Astarte camertonensis MOORE
Astarte wandeli LUNDGR.
Astarte n. sp.
Venericardia? aff. *liasina* (MOORE)
Tancredia cf. *elegans* MBG.
Tancredia johnstrupi (LUNDGR.)
Tancredia n. sp. A.
Tancredia n. sp. B.
Tancredia? n. sp. C.
Quenstedtia? n. sp.
Mactromya lindhammeri ROLLIER
Mactromya aspasia (D'ORB.)
Mactromya? *groenlandica* n. sp.
Cardium (*Jurassicardium*?) *phillippianum* DUNKER
Pseudotrapezium cucullatum (MÜNST.)
Tellina? n. sp.
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Gresslya punctata (SIMPS.)
Gresslya cf. *intermedia* (SIMPS.)
Gresslya n. sp.
Ceratomya petricosa (SIMPS.)
Homomya sp.
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Arcomya? n. sp.
Goniomya hybrida (MÜNST.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalve (SOW.)
Oxytoma cygnipes (Y. et B.)
Oxytoma n. sp.
Pseudomonotis cf. *papyria* (QU.)
Pinna cf. *folium* (Y. et B.)
Isognomon n. sp.

Isognomon aff. *infraliassica* (Qu.)
Gervillia lævis J. Buckman
Gervillia sp.
Cultriopsis n. sp.
Lima succincta (Schloth.)
Lima Roemeri Brauns
Lima (*Plagiostoma*) *eucharis* d'Orb.
Lima (*Plagiostoma*) *punctata* Sow.
Lima (*Pseudolimea*) *boonei* Cossman
Limea acuticosta Münst.
Limea cf. *cristata* Dum.
Velata hartzi n. sp.
Entolium frontale (Dum.)
Entolium callosum (Lundgr.)
Aequipecten æquivalvis (Sow.)
Aequipecten priscus (Schloth.)
Chlamys substriata (Röm.) var. *rinki* (Lundgr.)
Chlamys cf. *textoria* (Schloth.)
Chlamys rollei (Stoliczka)
Camptonectes n. sp.
Plicatula pectinoides Lam.
Plicatula cf. *lævigata* (d'Orb.)
Plicatula cf. *sarcinula* Münst.
Placunopsis minuta Lundgr.
Liostrea irregularis (Münst. em. Qu.)
Gryphæa arcuata Lam.
Gryphæa cymbium Lam.
Gryphæa gigantea Sow.
Terquemia pectiniformis E. Desl. (*arietis* Qu.)
Myoconcha decorata (Münst.)
Modiola lævis Sow.
Modiola scalprum Sow.
Modiola aff. *subcancellata* Buv.
Modiola cf. *hillana* Sow.
Hippopodium ponderosum Sow.
Dentalium cf. *elongatum gracile* Moore
Dentalium parvulum (J. Buckman) Rich.
Pleurotomaria aff. *singularis* Sieberer
Pleurotomaria sp.
Pleurotomaria (*Sissenna*) *procera* d'Orb.
Ptychomphalus consobrinus (Tate)
Ptychomphalus nodosus (Sieberer)
Ptychomphalus n. sp.

Amberleya cf. *polytaenia* COSSMAN
Amberleya sp.
Proconulus (*Epulotrochus*) *epulus* (D'ORB.)
cf. *Aulacotrochus nitens* DUM.
Trochopsis? sp.
Lewisiella aff. *conica* (D'ORB.)
Scurriopsis? *vendæensis* COSSMAN
Tornatellæa sp. cf. *fontis* (DUM.)
Striactæonina booni COSSMAN
Procerithium? sp.
Uptonia jamesoni (SOW.)
Uptonia aff. *jamesoni* (SOW.)
Prototeuthis cf. *pennicillata* (DUM.)
Passaloteuthis cf. *apicurvata* (DE BLAINVILLE)
Hastites? sp.

In a detailed description of the fauna to be published later there will be ample opportunity of discussing more closely the distribution of the various species within other Liassic areas, as well as other faunistic questions. It need only be pointed out here that the fauna is a pronounced Charmouthian fauna comprising a large number of species known from the *Jamesoni* beds of other countries. The fauna further includes a number of new species and several forms generally belonging to older beds, e. g. arcuate *Gryphæas*, and species that otherwise only appear in younger beds, e. g. *Entolium frontale* (Domerian). It should, however, be noted that small arcuate *Gryphæas* have been found in the *Jamesoni* beds of Scotland and Scania, and as regards the younger forms, they have all been found in beds side by side with specimens of *Uptonia Jamesoni*. Hence their vertical distribution is greater than has hitherto been known.

B. The *Centaurus* horizon.

In Dinosaurus Kløft, as stated above, an ammonite-bearing horizon with a fauna deviating on several points from that of the *Jamesoni* beds was found above the *Jamesoni* beds. Two of the ammonites found, *Beaniceras* sp. and *Lytoceras fimbriatum*, refer the bed to the *Centaurus* horizon of the *Ibex* zone. The said fauna is listed in p. 48 and includes an *Androgynoceras* sp., the determination of which, however, is not quite certain. The presence of this form formerly induced me to regard the bed as belonging to the *Capricorni* zone.

The *Tancredia* bed in Ræve Kløft (see p. 38), the bed from which BIERRING PEDERSEN collected fossils (p. 16), and the *Aequipecten bierringi* bed in Varde Kløft (p. 59) are possibly of the same age as the *Beaniceras* bed in Dinosaurus Kløft. Common to all three localities is

the above-mentioned Pectinide[1]), which is absent from the *Jamesoni* beds, but otherwise the fauna is not quite uniform within the three localities. Until ammonites have been found in the beds, we must therefore assume a possible slight difference in age between these beds. They have only been found in the southern part of Jameson Land, and not even in all localities. Thus they were apparently not developed in the large coast section at Cape Stewart.

Domerian? Strata.

It has been impossible, on the basis of the few fossils[2]) found, to ascertain with certainty the presence of beds belonging to the Domerian. However, there is hardly any doubt that the main portion of the c. 150 m thick series of strata intervening between the undoubted Charmouthian beds and the undoubted Toarcian beds belongs to this stage.

The rocks within this series of strata alternate greatly, not only within the individual sections, but also from section to section. A type section cannot, therefore, be erected. Characteristic of the whole series is the very inconsiderable content of $CaCO_3$. Limestones proper are of extremely rare occurrence, and calcareous beds on the whole play quite a subordinate role. Iron-compounds are often conspicuous as cement in most of the rocks, and on weathering lend to the rocks a rusty-brown colour.

As main types of the rocks occurring within this series the following deserve mention:

Sandstones and arenaceous shales with lenticular bedding and trails of worms and other animals on the bedding planes were observed in nearly all the sections immediately above the Charmouthian beds. Similar strata occur for instance in the Lower Rhætic of Scania, whence they have been described by HADDING (5). It must be considered doubtful whether such beds are in the true sense marine. About the deposition of the strata HADDING writes as follows: "They are deposited in a shallow, sheltered shore region. The varying nature of the material is due to varying current conditions, dependent in their turn on variations in the connection of the region with the sea and in the configuration of the bottom."

Sandstones with mud cake conglomerates occur at different levels. They have been deposited in shallow water, the mud cakes have

[1]) Left valve inflated, ornamentation very like that of *Æquipecten æquivalve*, right valve flat with very broad, flat ribs, much broader than the interspaces.

[2]) The small fauna listed on page 91, from loose blocks in the Lejr Elv Canyon, is not known from beds *in situ*. At present it is difficult to determine its age. The occurrence of *Homæorhynchia* indicates Upper Lias, while other species, as for instance *Lobothyris* aff. *punctata* and *Ornithella* cf. *sarthacensis*, would seem to point to a somewhat older age.

probably originated by the waves washing across dry, cracked clay beds (in dried up lagoons along the coast) and carrying pieces of the clay out to sea and depositing them there together with the sand.

Conglomeratic beds, in which the pebbles are made up of clay ironstone and originating from the disintegration of older Rhætic or Liassic beds. In one single case (p. 46) marine shells have been found in these beds.

Sandstone beds alternating with thin beds of clay ironstone or clay ironstone nodules. In a single case a marine fossil has been found in these beds, which occur at various levels, most frequently, however, within the lower part of the series.

Black shales are only of subordinate importance, and often contain plant remains. The same is the case with beds of argillaceous sandstone, which have been found in several places in the middle part of the series.

Coarse, cross-bedded sandstones are of common occurrence within the upper part of the series, and in the northern part of the area, northward from Nathorst Mountain, they play a large role in the middle part of the series too. Oblique beds often alternate with intercalated horizontal ones. These beds must be considered to be delta beds. The diagonal strata almost without exception dip towards the west, which shows that the transport of material has taken place from the east.

On the whole the Domerian? strata have been deposited in shallow water. Even if marine fossils are rare, most of the beds must be assumed to have been deposited in the sea. Other beds have been deposited in lagoons with calm water, and others again are to be regarded as delta deposits.

Toarcian strata.

Above the coarse, cross-bedded, unfossiliferous sandstones there follows a series of generally fairly loose, often cross-bedded, more or less calcareous, fossiliferous sandstones, in which are embedded concretions with marine Upper Liassic fossils. These beds are rather coarse, often conglomeratic, and have been deposited in shallow water. The oldest fossiliferous horizon is presumably the *Gervillia* horizon, which has only been ascertained with certainty south of Dinosaurus Kløft. It is characterised by being made up of big limy concretions teeming with fossils. The fauna is very poor in species, and is possibly derived from brackish water. Only one single species is known from other countries, namely *Pseudomonotis substriata*. The Greenland specimens agree very well with the forms from the Whitbian in Yorkshire, but the vertical distribution of this species is very wide. Within the younger horizons the following species have been found:

Pentacrinus (*Isocrinus*?) sp.
Serpula limax GF.
Lingula beani PHILL.

Discinisca n. sp.
cf. *Rhynchonella lineata* Y. et B.
Rhynchonella sp. indet.
Loboidothyris n. sp.
Nuculana ovum (D'ORB.)
Parallelodon sp.
cf. *Arca elegans* RÖM.
Cucullaea? sp.
Trigonia literata Y. et B.
Trigonia sp. (*Glabrae*)
Astarte madseni n. sp.
Tancredia aff. *donaciformis* LYC.
Tancredia cf. *dionvillensis* TERQ.
Tancredia n. sp.
Sphæriola? cf. *onesimi* (DUM.)
Protocardium substriatulum (D'ORB.)
Quenstedtia? sp.
Pleuromya cf. *unioides* (RÖM.)
Pleuromya aff. *elongata* (MÜNST.)
Gresslya donaciformis (PHILL.)
Gresslya abducta (PHILL.)
Gresslya rotundata (PHILL.)
Gresslya aff. *intermedia* (SIMPS.)
Arcomya aff. *longa* BUV.
Arcomya n. sp.
Pholadomya aff. *fidicula* SOW.
Oxytoma inæquivalve (SOW.) var.
Oxytoma cf. *cygnipes* Y. et B.
Pseudomonotis substriata (MÜNST.)
Pseudomonotis n. sp.
Pinna cf. *opalina* QU.
Isognomon cf. *isognomoides* (STAHL.)
Gervillia cf. *acuta* SOW.
Gervillia n. sp.
Inoceramus cf. *substriatus* (MÜNST.)
Inoceramus aff. *polyplocus* RÖM.
Lima (*Plagiostoma*) cf. *tcarcensis* DESL.
Lima (*Plagiostoma*) n. sp.
Lima (*Pseudolimea*) cf. *boonei* COSSMAN
Entolium demissum (PHILL.)
Variamussium n. sp.
Camptonectes aff. *sublævigatus* (ERNST)
Placunopsis aff. *gingensis* QU.

Placunopsis n. sp.
Liostrea cf. *erina* (D'ORB.)
Modiola cf. *cuneata* SOW.
Modiola n. sp.
Amberleya cf. *capitanea* (MÜNST.)
Trochus aff. *torulosus* QU.
Patella sp.
Catacoeloceras n. sp.
Dactylioceras groenlandicum n. sp.
Dactylioceras sp.
Pseudolioceras beyrichi (SCHLOENB.)
Pseudolioceras compactile (SIMPS.)
Pseudolioceras dumortieri (BUCKMAN)
Pseudolioceras lythense (Y. et B.)
Pseudolioceras württembergeri (DENCKM.)
Pseudolioceras n. sp.
Pseudolioceras spp.
cf. *Passaloteuthis subaduncata* (VOLTZ)
Megateuthis rhenana (OPPEL)
Megateuthis aff. *conoidea* (OPPEL)
Megateuthis cf. *quenstedti* (OPPEL)
Megateuthis spp.
big phragmocones.

On a comparison with the European division of the Upper Lias the following horizons seem to be represented in East Greenland:

Aalenian? *Aalensis* zone, or uppermost Yeovillian.

Beds yielding *Pseudolioceras beyrichi*. Nathorst Mountain 550 m. From this horizon a *Pseudolioceras lythense*, collected by Greenlanders, is also recorded, probably, however, it has been collected from deeper-lying beds.

Yeovillian. ab. *striatulum* zone.

Beds with *Pseudolioceras compactile*. Trigonia Elv.

Whitbian. *Bifrons* zone.

a. Beds with *Pseudolioceras lythense*. Nathorst Mt. Loc. 3?
b. Beds with *Pentacrinus* sp. Varde Kløft. Harris Mt. Nathorst Mt. Loc. 3.
c. Beds with *Pseudolioceras dumortieri*. Nathorst Mt. Loc. 1. At 525 m.
d. Beds with *Dactylioceras groenlandicum* and div. sp., *Catacoeloceras* sp. Harris Mt. Nathorst Mt. Loc. 1, at 520 m. Loc. 2, at 494 and 498 m. Umimmak Mt. Hjørnefjæld.

Comparison between the Greenland Lias and some other areas.

According to the above the Lias in East Greenland is composed of the following series of strata:

Upper Bathonian gap	
Aalenian? Yeovillian Whitbian	shallow-water calcareous sandstones with several fossil horizons
Domerian	partly marine and partly estuarine sandstones, conglomerates and shales
Charmouthian jamesoni—centaurus	Coarse arkose limestones and conglomerates with marine faunas
Lower Charmouthian Sinemurian Upper Hettangian	no deposits
Lower Hettangian subplanorbis—planorbis	estuarine plant beds
Rhætic	estuarine plant beds
Keuper?	red marl

This sequence shows great similarity to the deposits in Southern Scandinavia. In Scania and Bornholm, as in East Greenland, an immense Rhæto-Liassic estuarine series of strata is developed, in which, however, subordinate beds with marine fossils are in some localities included[1]). This series is overlain, as in Greenland, by marine Charmouthian beds. Compared with the English standard section (SPATH 1923 (24)) the following horizons are represented:

Oppel	Great Britain Dorset	Scotland Pabay. Inn. Hebr.	East Greenland Scoresbysound	Scania	Bornholm
ibex zone	*centaurus*	÷	+	÷	+
	actæon	÷	÷	÷	÷
	maugenesti	+	÷	÷	+
jamesoni zone	*masseanus*	+	÷	÷	÷
	pettos	÷	÷	÷	+
	jamesoni	+	+	+	+
	obsoleta	+	÷	÷	+
	brevispina	+	÷	÷	
	polymorphus	+	÷	÷	+
	peregrinus	÷	÷	÷	÷
	taylori	+	÷	÷	+

The Bornholmian zones are based upon the late Dr. MALLING's large collections.

[1]) In the Rhætic beds in Lejr Elv HARRIS found a dorsal spine of a *Hybodus*, the only marine fossil that has hitherto been found in these beds.

The Greenland series also exhibits some similarity to the sequence at Dunrobbin in East Scotland. Here, however, the estuarine series is overlain by marine strata, probably belonging to the Sinemurian.

The Upper Liassic beds in East Greenland, as regards their fossil contents, have many points of resemblance to the beds in Yorkshire and Scotland. Points of similarity to the Upper Liassic fauna of Spitsbergen are also present. The fauna described by FREBOLD (4) is derived from phosphoritic concretions very reminiscent of the concretions from loc. 3, at 550 m, Nathorst Mountain. They occur in the basal conglomerate of the Jurassic formation, which in places is overlain by strata of Callovian age. The age of the conglomeratic bed is regarded by FREBOLD as Upper Liassic, and the fauna found in the phosphorite concretions as belonging to one and the same horizon, which is intermediate in age between the zone with *Haugia illustris* and the zone with *Grammoceras striatulum*. A great number of the ammonites found indicate that age, but in addition there occur specimens of *Dactylioceras* and *Coeloceras*. In view of the fact that in southern France, e. g. at Aveyron, these genera, or at any rate *Coeloceras*, may be found as far upwards as in the *variabilis* and *striatulum* zones, FREBOLD is of opinion that the presence of these forms cannot be taken as evidence of the presence of older zones. However, FREBOLD has advanced no decisive proof of an Upper Liassic age of the conglomeratic bed, and according to the nature of the deposit it may equally well belong to the Callovian, and if so, the concretions are derived from destroyed Liassic beds and may represent several horizons. This view is further favoured by the sequence of the East Greenland Lias, where *Dactylioceras* and *Coeloceras*, as in Northwestern Europe, only occur in beds which must belong to the *bifrons* zone.

In plates 4—8 a number of the stratigraphically important forms of the East Greenland Lias are figured. They will be described in a paper to be published later together with the remaining part of the fauna. In another paper various other questions, i. a. concerning the stratigraphy of the strata and their importance for the palæogeography, will be subjected to a closer discussion.

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PLATES

Plate 1.

Map of Jameson Land and Liverpol Land, based on J. P. Koch's map of 1902 (Medd. om Grønl. Bd. XXVII) and the map of East Greenland published in 1932 by the Geodetic Institute, Copenhagen.

1. R. Storgaard Elv and Ræve Kløft.
2. Tancredia Kløft.
3. R. Trigonia Elv.
4. R. Modiola Elv.
5. Goniomya Kløft.
6. R. Astarte Elv and Astarte Kløft.
7. R. Moskusokse Elv and Moskusokse Kløft.
8. Mt. Harris Fjæld.
9. R. Zamites Elv.
10. Mt. Eli Fjæld.
11. Mt. Mikael Fjæld and, in a southeastern continuation of this, Mt. Umimmak Fjæld.
12. Mt. Hjørnefjæld.
13. R. Lepidopteris Elv.
14. R. Ostrea Elv.

R = river. Mt. = Mount. Kløft = ravine.

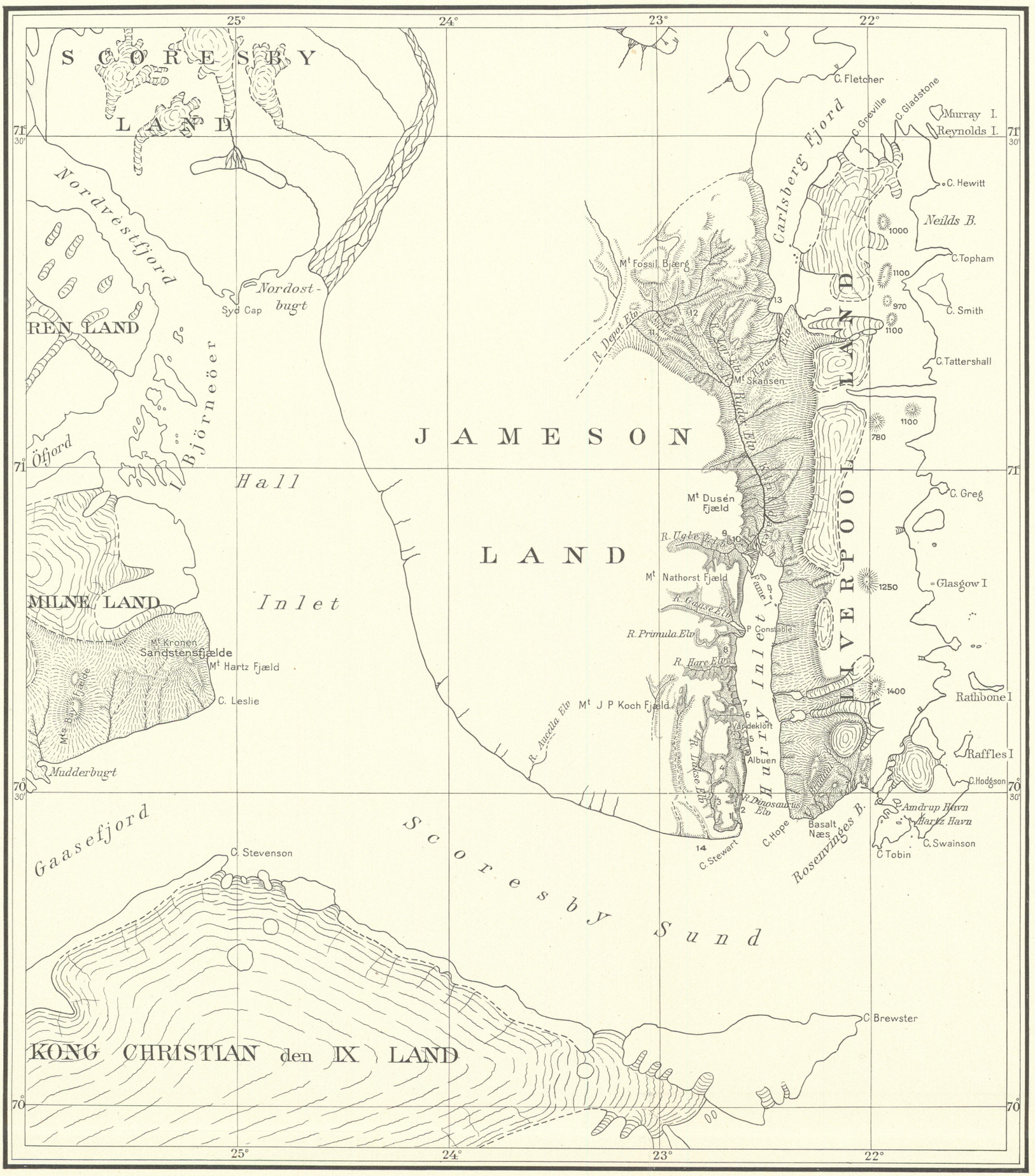
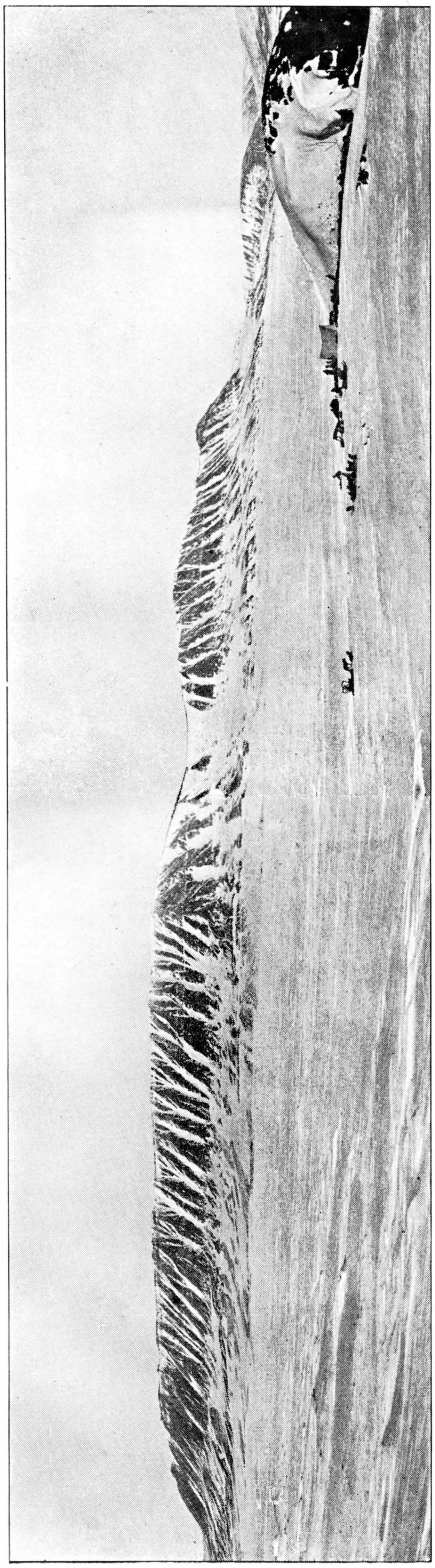

25°
24°
23°
22°
71° 30'
71°
70° 30'
70°
SCORESBY LAND
Nordvestfjord
Nordost-bugt
Syd Cap
REN LAND
Björneöer
Öfjord
Hall
Inlet
MILNE LAND
Mt Kronen
Sandstensfjælde
Mt Hartz Fjæld
C. Leslie
Mts Dayes Fjælde
Mudderbugt
Gaasefjord
C. Stevenson
JAMESON LAND
Mt Fossil Bjærg
R. Depot Elv
R. Pass Elv
Mt Skansen
Mt Dusén Fjæld
R. Ugle Elv
Mt Nathorst Fjæld
R. Gaase Elv
R. Primula Elv
R. Hare Elv
R. Anccila Elv
Mt J P Koch Fjæld
Landeklint
Albuen
Carlsberg Fjord
Hurry Inlet
LIVERPOOL LAND
C. Fletcher
C. Greville
C. Gladstone
Murray I.
Reynolds I.
C. Hewitt
Neilds B.
1000
C. Topham
1100
970
C. Smith
1100
C. Tattershall
780
1100
C. Greg
Glasgow I
1250
1400
Rathbone I
Raffles I
C. Hodgson
Amdrup Havn
Hartz Havn
C. Swainson
C. Tobin
Rosenvinges B.
Basalt Næs
C. Hope
C. Stewart
C. Brewster
Scoresby Sund
KONG CHRISTIAN den IX LAND

Plate 2.

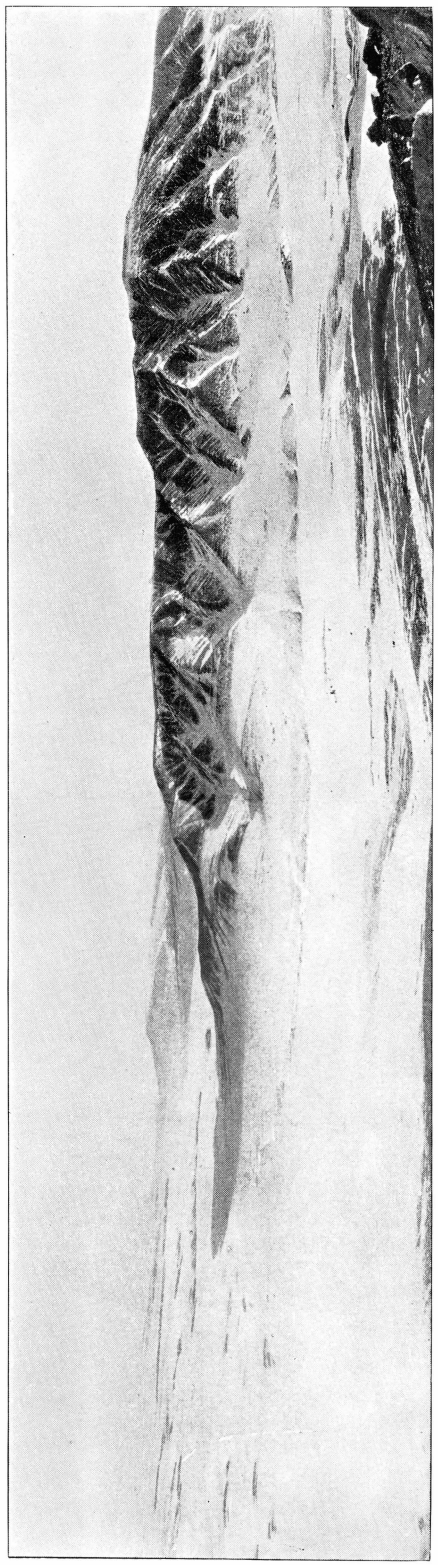
Fig. 1. Mt. Nathorst Fjæld seen from the northernmost of the Fame Islands. To the right basalt dome.

Fig. 2. The mountain Skansen and the river Lejr Elv. To the left the big valley Klitdalen separating Liverpool Land and Jameson Land and in the background Mt. Dusén Fjæld. Mt. Skansen is mainly built up of Rhæto-Liassic sediments. The top beds belong to the Vardekløft Formation.



23.-5.-1927.

Fig. 1.



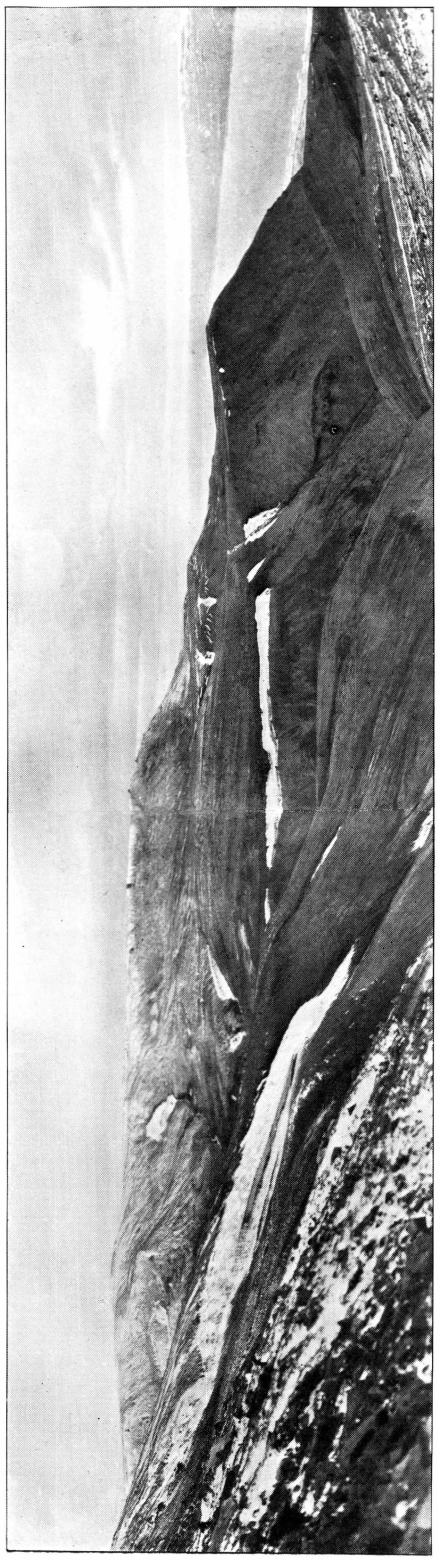
28.-5.-1927.

Fig. 2.

Plate 3.

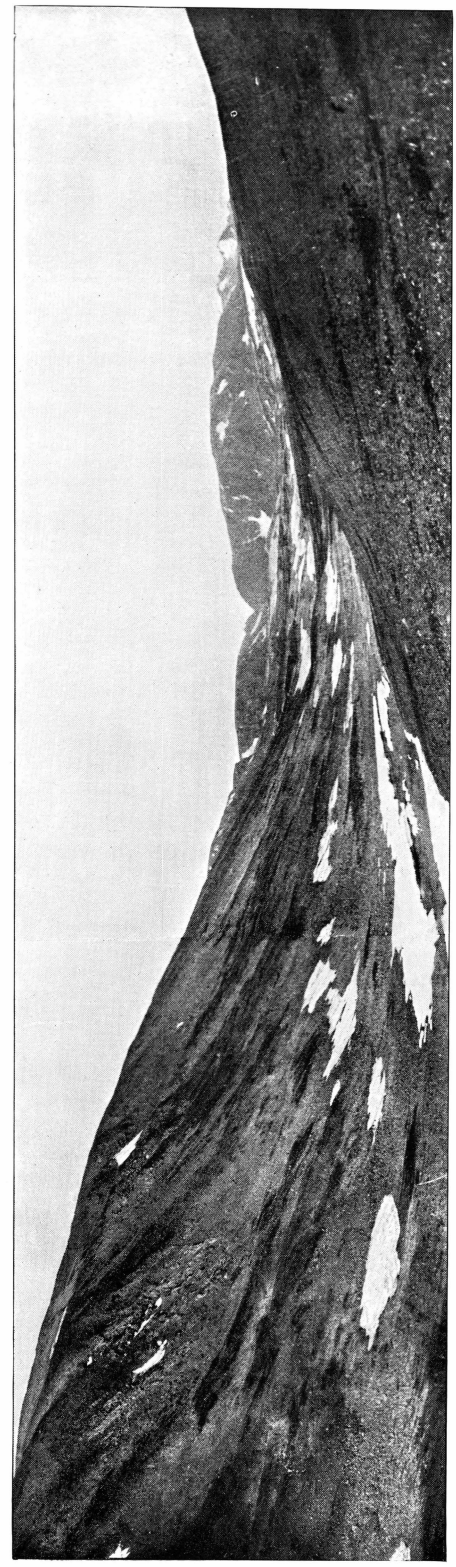
Fig. 1. Mouth of Astarte Kløft, Jameson Land. The low-lying plateau is built up of beds belonging to the Neill's Cliff Formation. The snow-covered beds to the left and in the background belong to the Vardekløft Formation. In the background to the right, Hurry Inlet and Liverpool Land.

Fig. 2. Bruddalen (The fault valley), Liverpool Land. In the background and to the left, gneiss. In the foreground to the right, Mesozoic sediments.



29.-8.-1926.

Fig. 1.

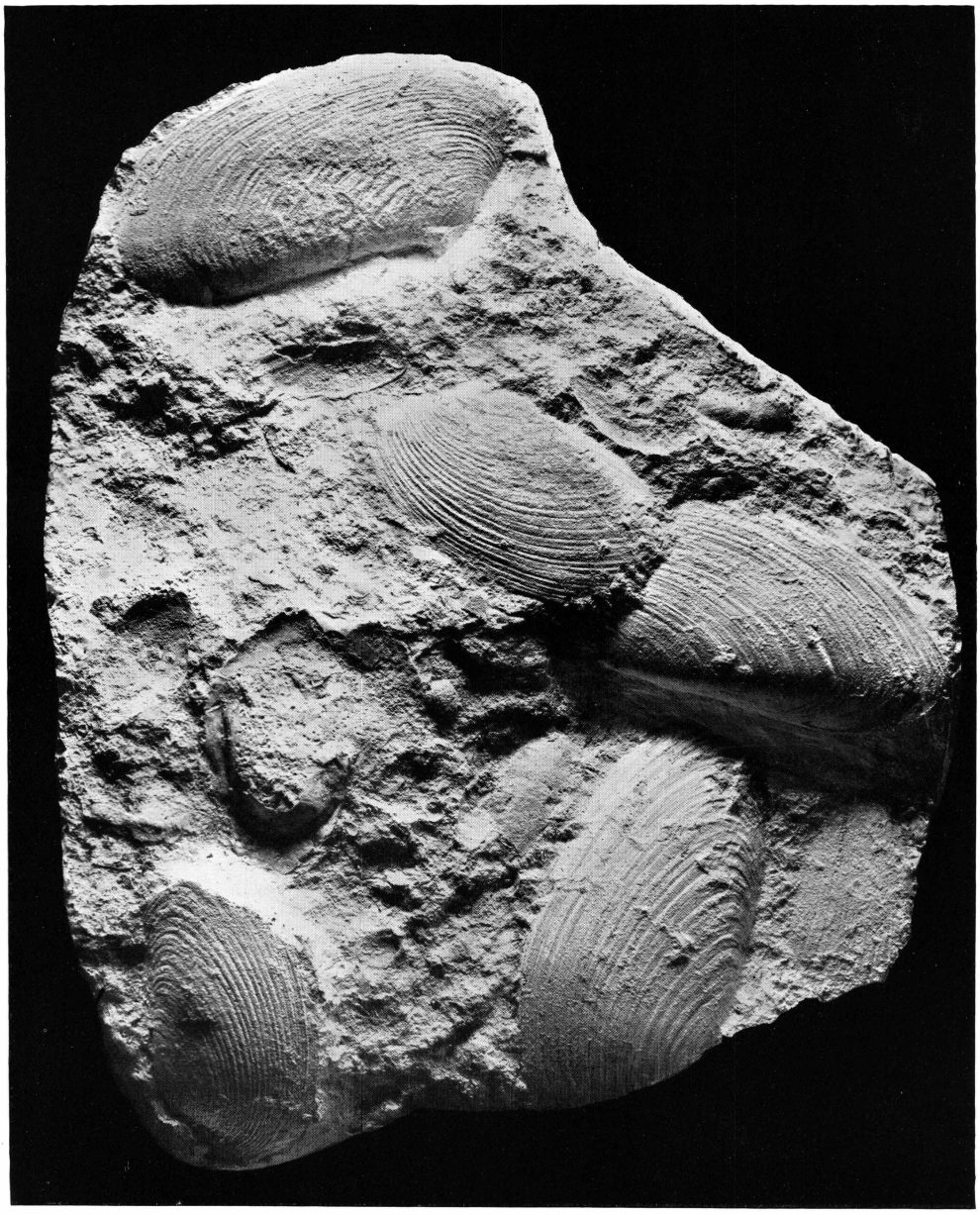


6.-8.-1926.

Fig. 2.

Plate 4.

Pavement with *Cardinia concinna* (Sow.), Blok Elv. $^1/_2$, p. 97.



Chr. Halkier phot.

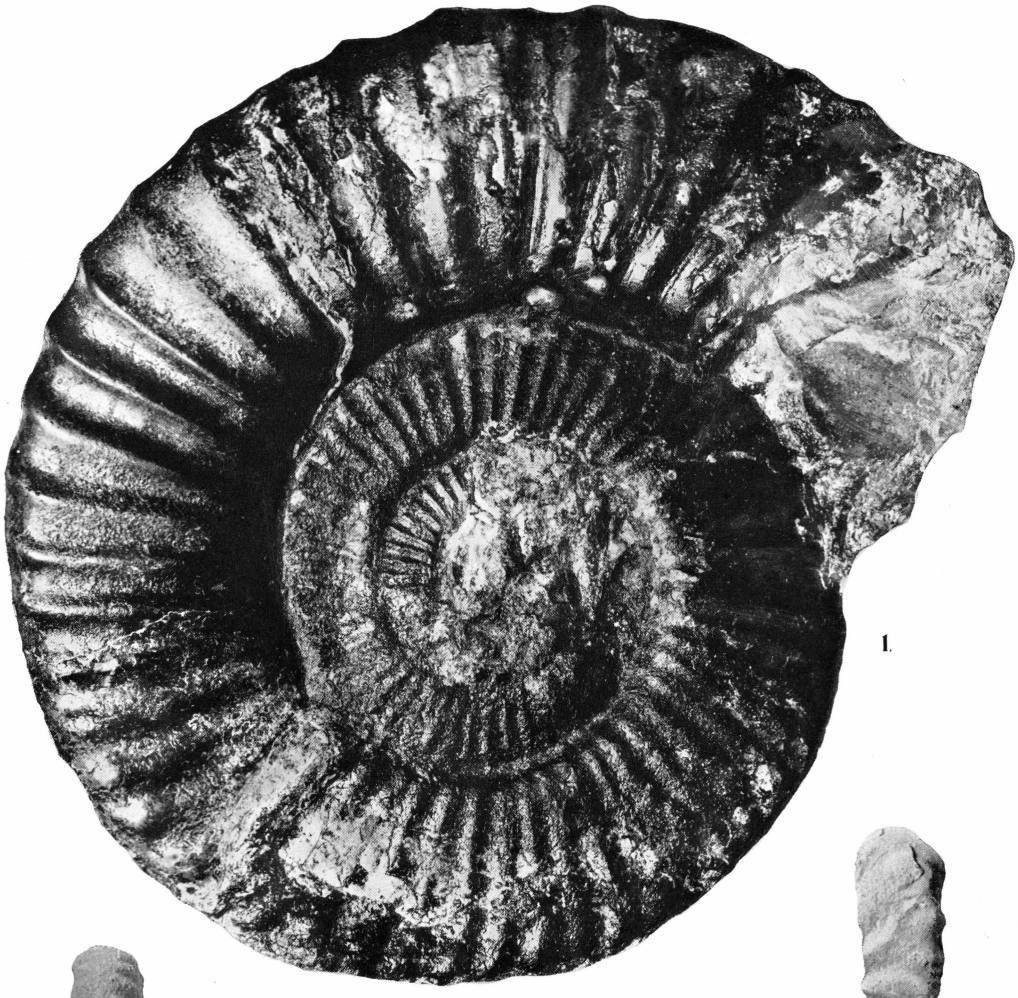
Plate 5.

Fig. 1. *Uptonia jamesoni* (Sow.), Tancredia Kløft. $^{1}/_{1}$, p. 44.

Fig. 2. *Androgynoceras?* sp. *Beaniceras* horizon. Dinosaurus Kløft. $^{3}/_{2}$, p. 47.

Fig. 3. *Beaniceras* sp. Dinosaurus Kløft. $^{3}/_{2}$.

Figs. 4 and 5. *Dactylioceras groenlandicum* n. sp. aff. *semicellatum* (SIMPS.). Ryder Elv. 355 m. $^{3}/_{2}$, p. 88.

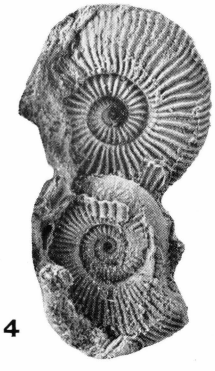


1

2b

2a

3b



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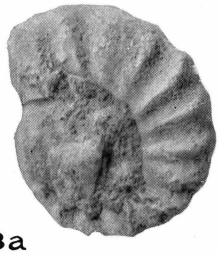


3a

5

Chr. Halkier phot.

Plate 6.

Fig. 1. *Pseudolioceras lythense* (Y. & B.). Nathorst Mountain. Loc. 3? $^3/_2$, p. 84.

Fig. 2. *Pseudolioceras dumortieri* (Buckman). Nathorst Mountain. Loc. 1. 525 m. $^3/_2$, p. 80.

Fig. 3. *Pseudolioceras* n. sp. Ryder Elv. 360 m. $^3/_2$, p. 88.

Plate 6.

1

2

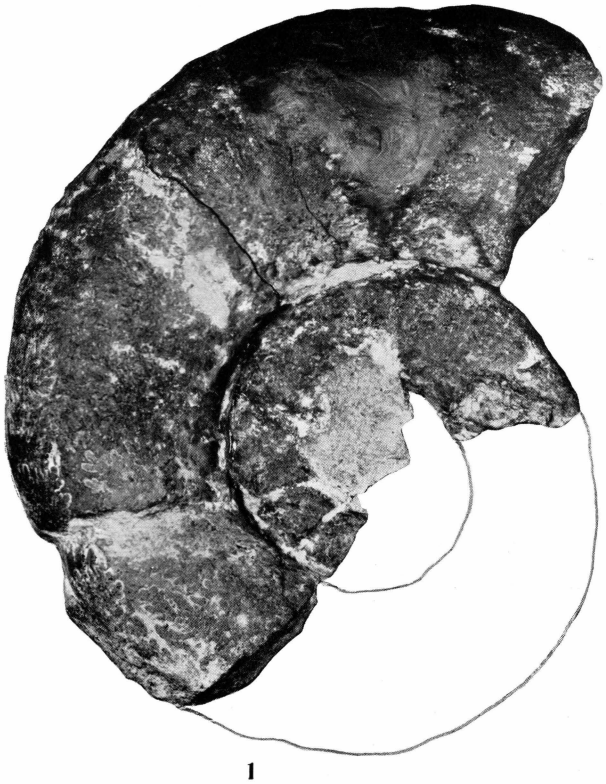
3

Chr. Halkier phot.

Plate 7.

Figs. 1 and 2. *Lytoceras fimbriatum* (Sow.). $^1/_1$. *Beaniceras* horizon. Dinosaurus Kløft, p. 47.

Fig. 3. *Pseudolioceras compactile* (Simps.). $^1/_1$. Trigonia Elv, p. 51.



1

2

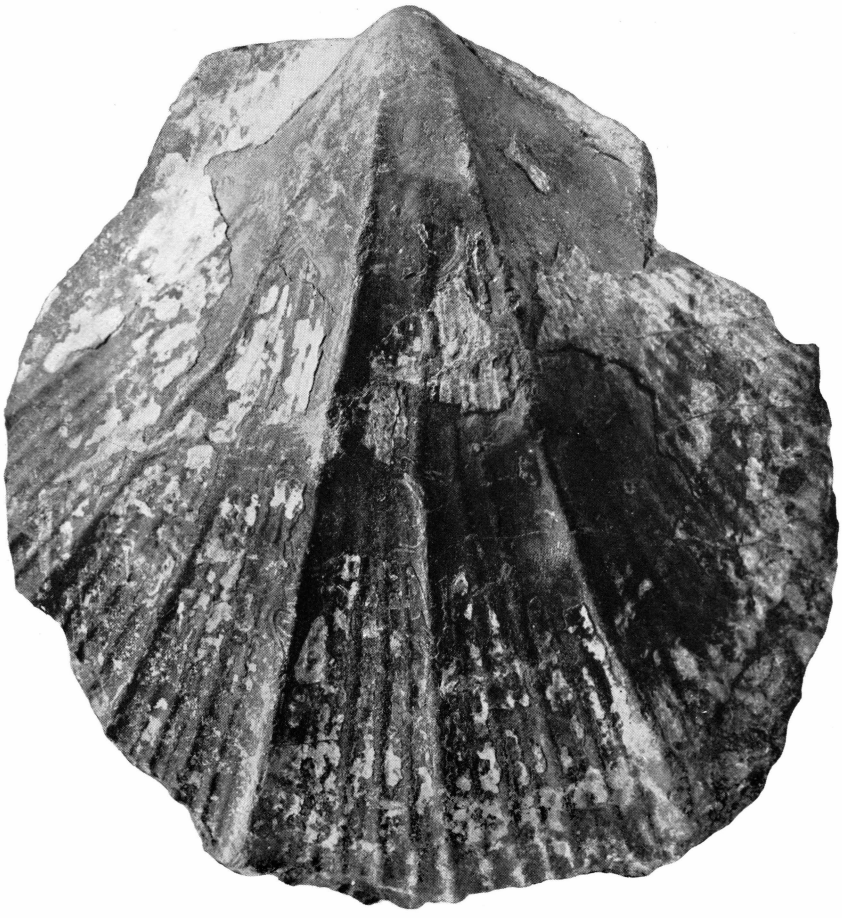
Chr. Halkier phot.

3

Plate 8.

Fig. 1. *Velata hartzi* n. sp. $^1/_1$. Ræve Kløft, p. 38.

Figs. 2 and 3. *Pseudolioceras beyrichi* (SCHLOENB.). $^3/_2$. Nathorst Mountain. 550 m. Loc. 3, p. 84.



1

2

Chr. Halkier phot. 3

Plate 9.

The following sections are shown:
Cape Stewart. Coast section. For Explanation see p. 29.
Ræve Kløft, p. 38.
Tancredia Kløft, p. 44.

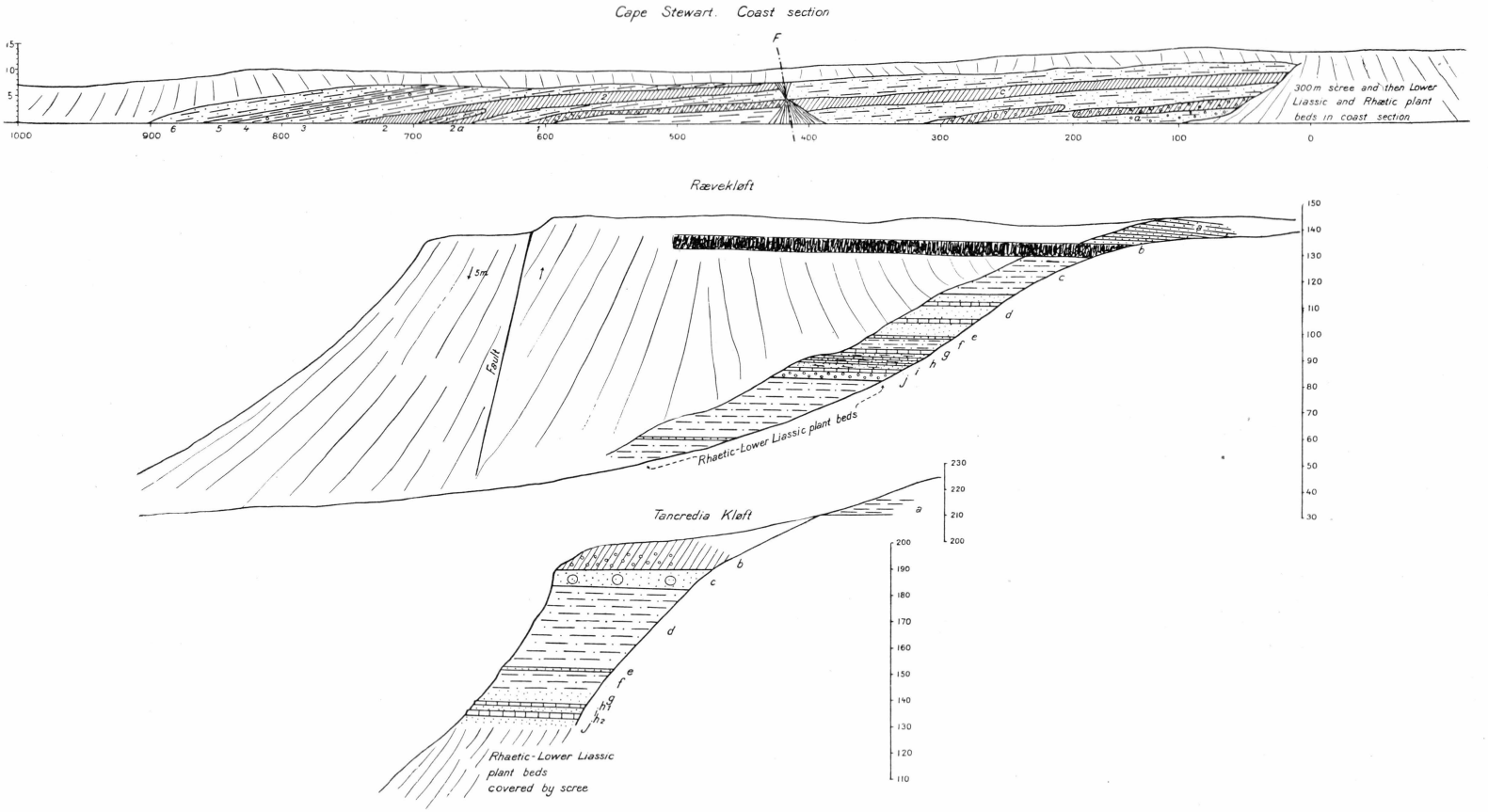

Cape Stewart. Coast section
F
300 m scree and then Lower Liassic and Rhætic plant beds in coast section
1000
900
800
700
600
500
400
300
200
100
0
Rævekløft
Fault
Rhaetic-Lower Liassic plant beds
Tancredia Kløft
Rhaetic-Lower Liassic plant beds covered by scree

Plate 10.

The following sections are shown:
Second ravine south of Dinosaurus Kløft. For explanation see p. 46.
South side of Dinosaurus Kløft, p. 47.
Ravine in Neill's Cliff at Albuen, p. 53.

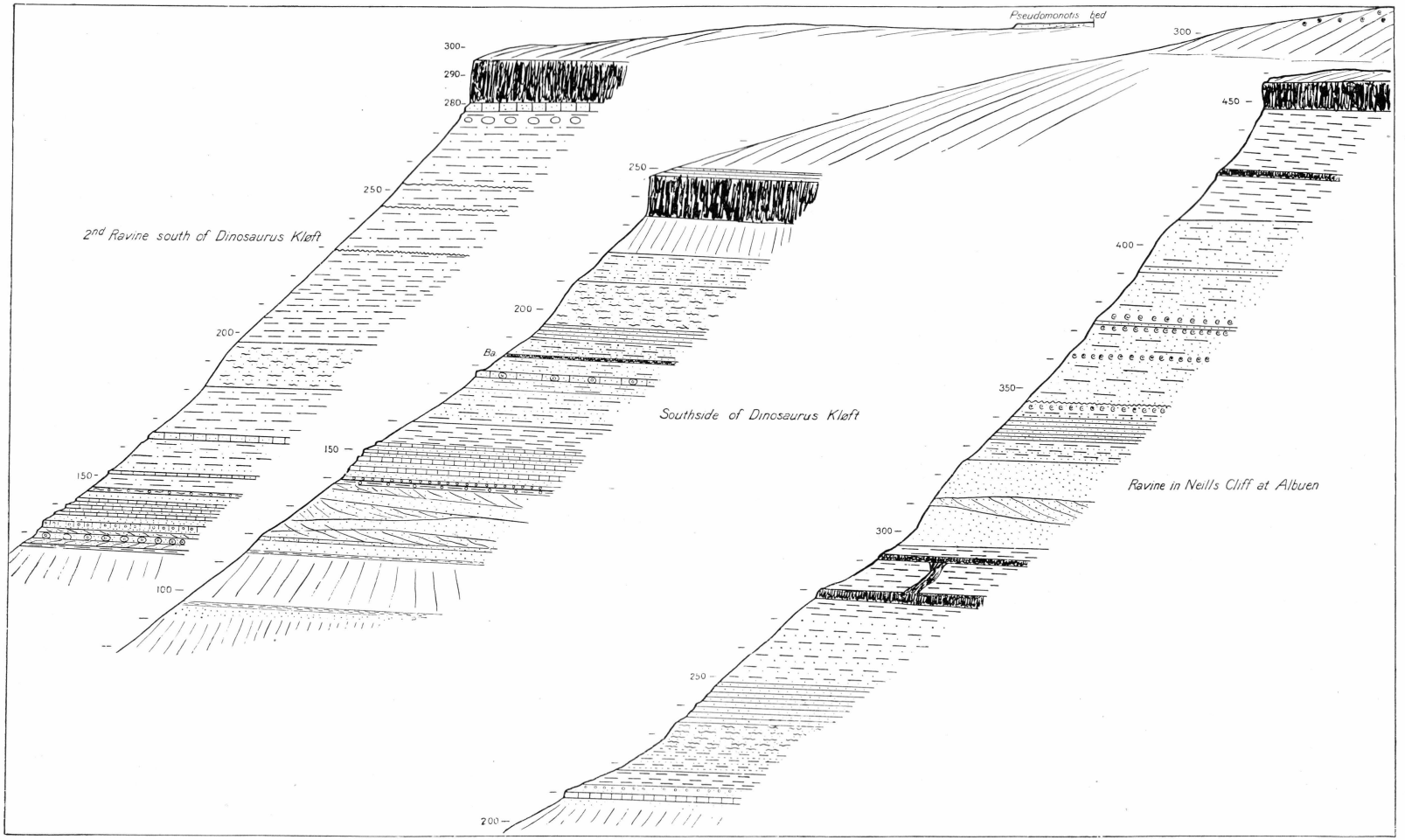

Pseudomonotis fed
300
290
280
250
200
150
100
2nd Ravine south of Dinosaurus Kløft
Ba
Southside of Dinosaurus Kløft
300
450
400
350
300
250
200
Ravine in Neill's Cliff at Albuen

Plate 11.

The Varde Kløft section. For explanation see p. 58.

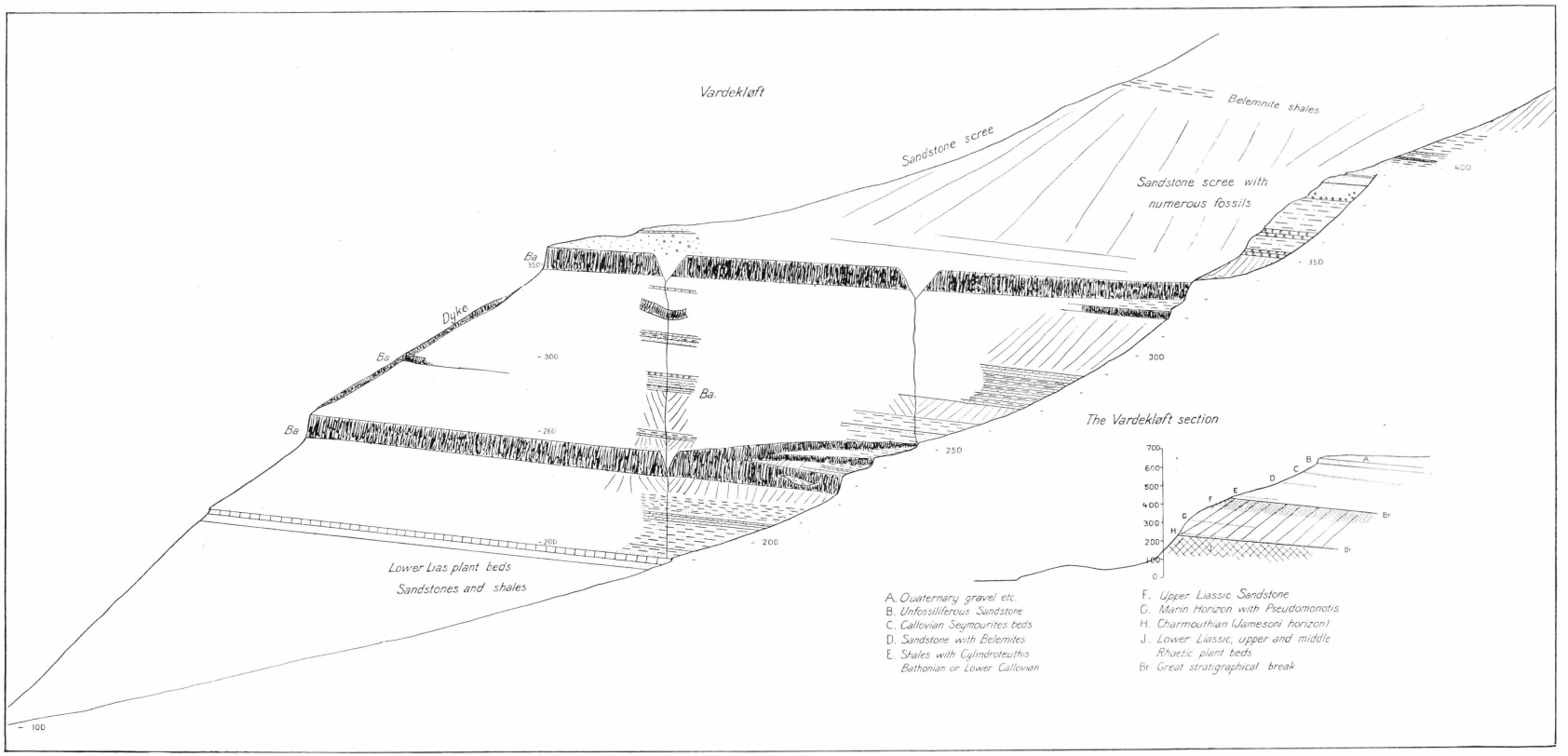

Vardekløft
Belemnite shales
Sandstone scree
Sandstone scree with numerous fossils
Dyke
Ba
Ba.
- 100
- 200
- 250
- 260
- 300
- 350
- 400
Lower Lias plant beds
Sandstones and shales
The Vardekløft section
A. Quaternary gravel etc.
B. Unfossiliferous Sandstone
C. Callovian Seymourites beds
D. Sandstone with Belemnites
E. Shales with Cylindroteuthis Bathonian or Lower Callovian
F. Upper Liassic Sandstone
G. Marin Horizon with Pseudomonotis
H. Charmouthian (Jamesoni horizon)
J. Lower Liassic, upper and middle Rhaetic plant beds
Br Great stratigraphical break

Plate 12.

The following sections are shown:
Mouth of Astarte Kløft. For explanation see p. 64.
Mt. Harris Fjæld, p. 76.
Mt. Nathorst Fjæld, loc. 2, p. 82, and loc. 3, p. 84.
Mt. Eli Fjæld, p. 85.
Mt. Dusén Fjæld, p. 88.
Coll Mountain, p. 85.

Further, a sketch of Mt. Nathorst Fjæld seen from the northermost of the Fame Islands, showing the situation of the following localities: 1, p. 80, 2 (section), p. 82 and 3, p. 84.

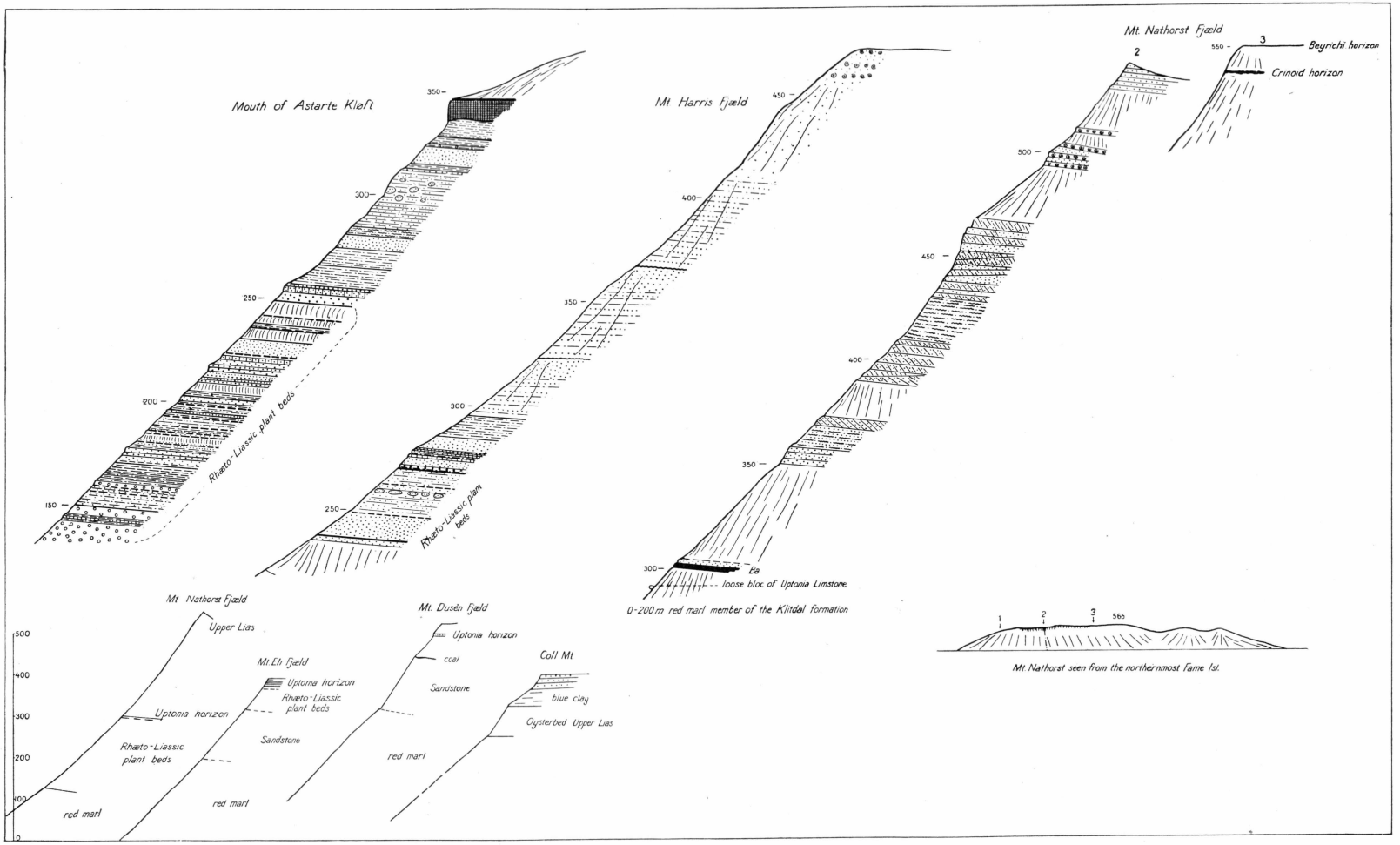

Mouth of Astarte Kleft
350
300
250
200
150
Rhæto-Liassic plant beds
Mt Harris Fjæld
450
400
350
300
250
Rhæto-Liassic plant beds
Mt. Nathorst Fjæld
2
3
550
500
450
400
350
300
Beynichi horizon
Crinoid horizon
Ba
loose bloc of Uptonia Limstone
0-200 m red marl member of the Klitdal formation
Mt Nathorst Fjæld
500
400
300
200
100
0
Upper Lias
Mt Eli Fjæld
Uptonia horizon
Rhæto-Liassic plant beds
Sandstone
red marl
Mt. Dusén Fjæld
Uptonia horizon
coal
Sandstone
red marl
Coll Mt
blue clay
Oysterbed Upper Lias
1
2
3
565
Mt. Nathorst seen from the northernmost Fame Isl.

Plate 13.

Fig. 1. Liverpool Land seen from Mt. Nathorst Fjæld at an altitude of 490 m. The rather gentle slope that forms the western part of Liverpool Land has in the main the same angle of dip as the sediments in Jameson Land, and I think it quite possible that this slope is an old strandflat originally covered by sediments of the same kind as in Jameson Land. The small down-faulted sediment area at Cape Hope, judging from the nature of the sediments there, has originally formed a unit with the sediments in Jameson Land. By the tilting of the Liverpool Land—Jameson Land block, presumably in Tertiary time, the sediments in the western part of Liverpool Land have been exposed to erosion to a very great extent and have been removed from the greater part of the area. The old strandflat then became exposed and subjected to fresh erosion.

Fig. 2. Neill's Cliff seen from the shore of Liverpool Land west of the southernmost twin glacier.

Fig. 3. The Cape Hope sediment area with surrounding Gneiss mountains seen from Ferslew's Pynt at the Colony of Scoresby Sound.

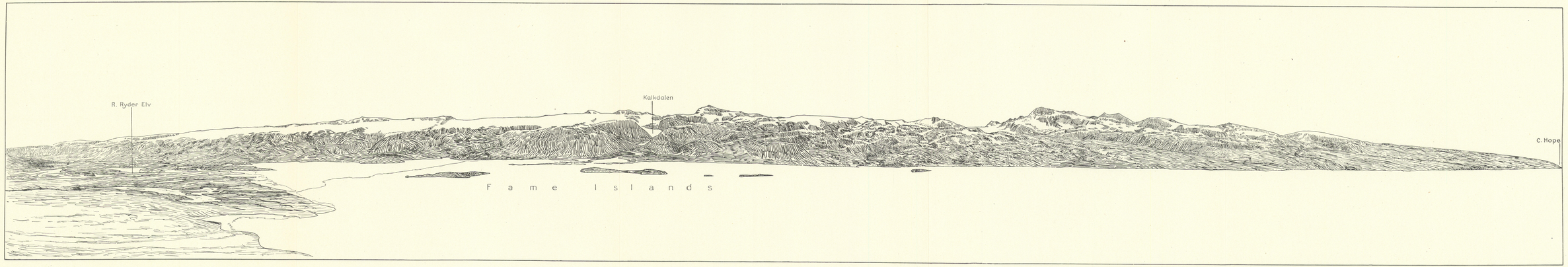


Fig. 1.

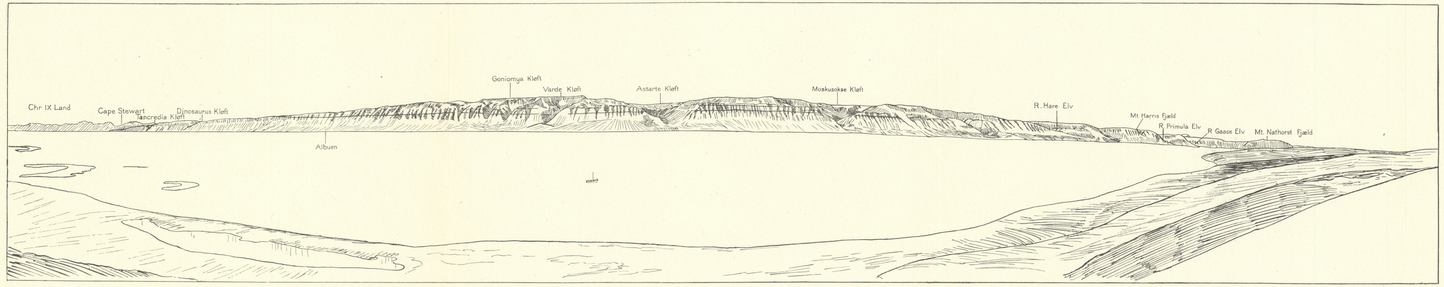


Fig. 2.

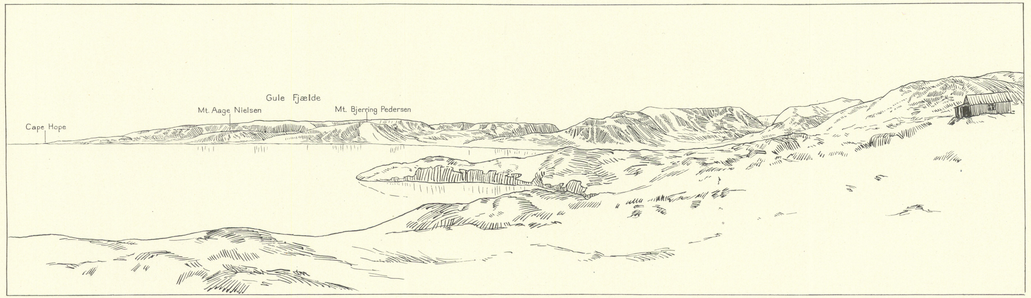


Fig. 3.