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THE LOWER JURASSIC ROCKS
OF EAST GREENLAND

PART II

THE MESOZOIC SEDIMENTS OF THE KAP HOPE AREA
SOUTHERN LIVERPOOL LAND

BY

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WITH 30 FIGURES IN THE TEXT AND 4 PLATES

KØBENHAVN

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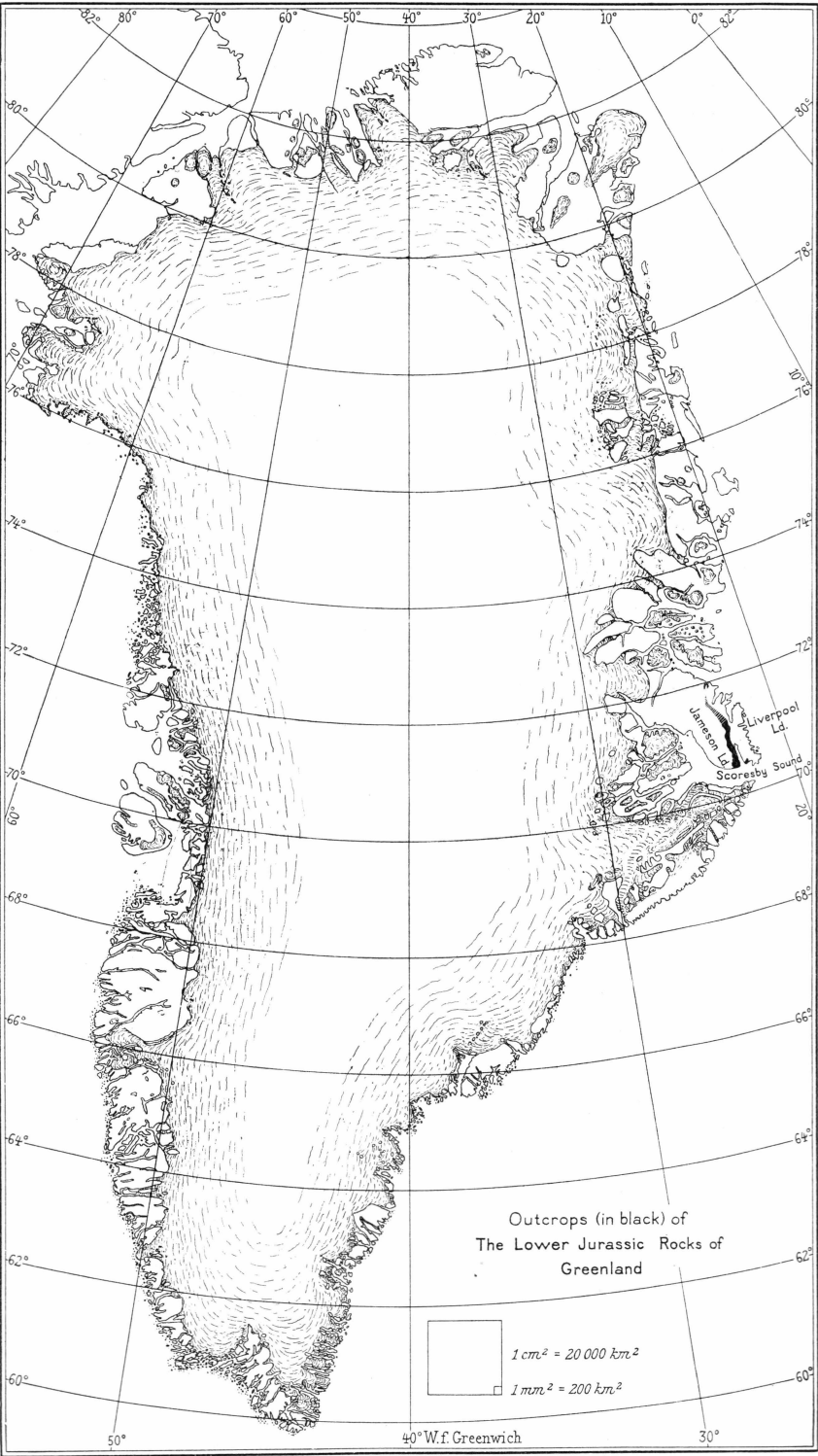
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PREFACE

Part I of this volume dealt with the strata of the Lias formation in Jameson Land and Liverpool Land, based upon investigations carried out in the years 1926—27. In the present paper a smaller section of this area, viz. the region north of Kap Hope in the southern part of Liverpool Land will be subjected to a more detailed treatment, than was possible in Part I. New investigations were carried out in the years 1934 and 1936 by the author, with the assistance of Greenlanders from the Scoresbysund settlement; besides the area treated here, parts of Jameson Land were also investigated in 1934, an account of which investigations will be rendered in Part III of this volume. The costs of these expeditions were defrayed by the Carlsberg Foundation, and I am also indebted to the Administration of Greenland for great kindness and support.

It is my pleasant duty to express my acknowledgment to these two institutions. Further, I also wish to thank my Greenland assistants, who with their usual energy and interest helped me in my task, and to whom I am indebted for many valuable finds. A special debt of gratitude I owe to Eli Lundegaard, Jens Bertelsen, Mikael Kûnak, Emil Abelsen, Jakob Simonsen, Jonas Brønlund, Stephen Høegh, Matekalât Ârqe and Evalte Simonsen.



INTRODUCTION

The sediment area at Kap Hope¹⁾ is about 34 km² in extent. Towards east it is bounded by Rosenvinge Bugt, towards west by more elevated and towards north by low-lying gneiss areas. The sediment area is morphologically divided into two parts, a northern relatively elevated part with heights of up to about 300 m, and a southern lower part which consists of a gently sloping coastal plain, the height of which hardly exceeds 40 m. The boundary between the two areas is represented by a fault, and besides, towards west and possibly also towards north, the whole of the sediment area is separated from the gneiss by faults. We are thus confronted with a down-faulted sediment area, and it is owing to this down-faulting that the sediments have been at all preserved.

The presence of this interesting area was demonstrated by BJERRING PEDERSEN in 1924 (2), and later on the same area was visited by EINAR STORGAARD in 1926, and by LAUGE KOCH, TOM HARRIS and the present author in 1926—27. An account of these previous investigations has been rendered in Part I of this work (12) p. 93, the first comprehensive statement of the geology of the area. Only few and insufficient observations were at hand, owing to the fact that the work had chiefly been carried out during the winter season, when the cover of snow was rather considerable. An attempt to carry out more exhaustive investigations was made by me in August 1927, but this work was interrupted after a few days, when I was charged with making a trip by motor boat to Gaase Fjord [ø: goose fiord] in the inner part of Scoresbysund, the object of this trip being to search for the German geologist H. K. E. KRUEGER, who was (erroneously) supposed to have crossed the inland ice, and immediately after my return from this trip the expedition left for Denmark. On August the 22nd 1934 I once more took up the abandoned task and managed to explore the southern half of the area. This

¹⁾ The geographical names used in the text are, except in quotations, in agreement with the nomenclature of the map of the Danish Geodetic Institute.

time the work was interrupted by a violent snow storm which lasted throughout the month. The work was finally completed in August 1936, including investigations of the remaining northern part of the area.

The investigations in 1927, 1934 and 1936 lasted for eighteen days in all, some with bad wether.

When in the following pages the Kap Hope area will be treated

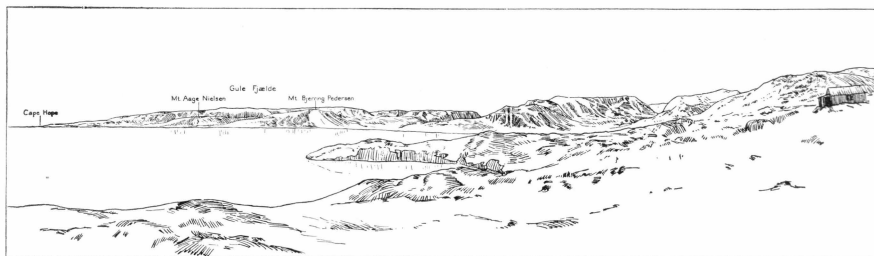


Fig. 1. The Kap Hope sediment area Gule Fjælde o: Aage Nielsen and Bjerring Pedersen Fjæld seen from Ferslews Pynt at the Scoresbysund settlement.

in a rather detailed way, more detailed than is usually the case regarding small, remote, arctic areas, the reasons are the following:

The Charmouthian part of the sediments within this area is exceptionally well developed. Moreover the sediment complex has been exposed to folding and faulting, while in Eastern Jameson Land the corresponding beds are practically undisturbed. Finally the Kap Hope area, lying close to the Scoresbysund settlement (fig. 1), is the most easily accessible part of the Jurassic districts of East Greenland, for which reason it is possible to visit here, even if the ship only stays for a few days at the settlement.

The following description may also, I hope, serve as a guide for such visitors.

THE SUBSTRATUM OF THE SEDIMENTS

In a few places along the southern part of the western boundary of the area investigated the substratum of the sediments may be observed to consist of migmatite gneisses of the same character as the gneiss west and north of the area. Rocks belonging to the crystalline complex have not been subjected to investigations by the present author, and the reader is consequently referred to the observations published on this subject by E. H. KRANCK (7) and TH. G. SAHLSTEIN (15, 16).

As to the nature of the surface of the gneiss, which is overlain by the sediments, it may be said that, to all appearance, it seems to form a rather even plane which has arisen through the agency of corosion or marine denudation.

Along the east coast of Hurry Fjord the gneiss is bounded upwards by a gently sloping plane, which rises gently from the coast line in an eastern direction (fig. 2). In the main, it undoubtedly represents part of the plane on which the mesozoic sediments were deposited.

SCORESBY already had his attention directed towards this peculiar sloping plane, and he writes about it in 1823 ((17, p. 202): "The western coast of this land, that borders Hurry-Inlet, is more regular than any thing I have seen in Greenland. From the shore, where it is low and almost even with the water's edge, it rises, with an easy slope, to the height of perhaps 1500 to 2000 feet perpendicular, and it is so uniform in its ascent and termination, that it constitutes a level ridge, regularly diminishing, to appearance, by the effect of perspective, until it sinks down to the level of the sea, in the extreme distance. This ridge, which was named Perspective Ridge, from its form and appearance, was spotted with numerous little patches of snow, but far the greater proportion of the surface of the ground was bare."

In his description of the topography of these regions I. P. KOCH observes in 1902, (5), p. 294 (translation): "This slope, which in its entirety is faintly convex, and in its southern part very nearly level, rises gradually from Hurry Inlet [Fjord] and occupies nearly two thirds

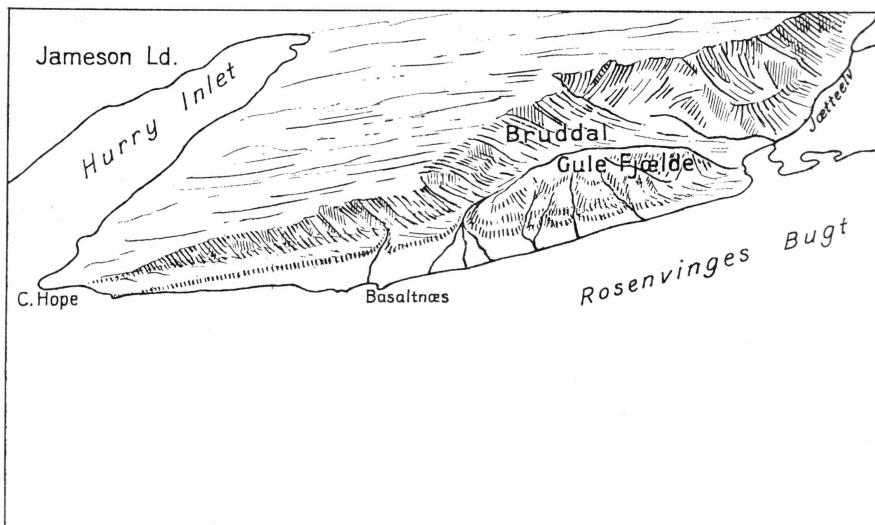


Fig. 2. The sloping gneiss surface and the sediment area at Kap Hope, July 16th. In Rosenvinges Bugt the winter ice has not yet broken up. The snow cover on the ground emphasizes the topography and also the faults bounding the wedge-shaped area south of Gule Fjælde.—Air photo from a height of 4000 m. Published by permission of the Danish Geodetic Institute.

of Liverpool Kyst [Land]. Also Klitdalen merges fairly easily into this slope, which continues in a northern direction to the level of the interior part of Carlsberg-Fjord. Seen from Nathorst-Fjæld the upper termination of the slope appears as an approximately straight line, behind and on which the highest peaks of the outer coast project."

On the same subject OTTO NORDENSKJÖLD i. a. makes the following statement in 1907 (9) p. 229: "... a long sloping foreland, beginning at a height of about 600 metres, quite devoid of all peaks and from a distance giving the impression of a plateau, while in detail the slopes appear with the rounded forms of "roches moutonnées", with typical lee-side to the W., and partly covered with débris formed by disintegration of the rock in place, partly with true, somewhat washed out moraine-débris, whose connection with the ice-masses soon to be met with in the E. is apparent. The "hillocks" themselves attain a height of 50 m or more above the level of the plateau."

In 1929 (11) and 1934 (12) I interpreted this sloping plane as the original substratum of the Mesozoic sediments and produced by marine erosion. 1929 (11) p.149 I wrote: "Like Jameson Land, the slope that forms the western limitation of Liverpool Land towards Hurry Inlet, and which has in the main the same angle of dip as the sediments on Jameson Land (about 10° towards the southwest), has in my opinion originally been covered with sediments. These have now been removed by erosion, so that the old strandflat is exposed. This conjecture is confirmed by the presence of the small down-faulted area at Cape Hope, which, to judge from the nature of the sediments, has originally formed a unit with the Jameson Land sediments." In the explanation of plate 13 (12) which represents this sloping plane as seen from the Nathorst Fjæld [ø: mountain] in Jameson Land I further wrote in 1934: "By the tilting of the Liverpool Land—Jameson Land block, presumably in the Tertiary time, the sediments in the western part of Liverpool Land have been exposed to erosion to a very large extent and have been removed from the greater part of the area. The old strandflat then became exposed and subjected to fresh erosion."

In 1933 J. P. ROTHÉ (14) writes: "Une deuxième surface d'érosion est également visible sur les pentes Ouest de la Terre de Liverpool. C'est la surface que Nordenskjöld a appelée la "zone des roches moutonnées". En réalité, cette surface, qui est particulièrement nette sur les parties gneissiques où elle est attaquée et sculptée en creux et bosses par la glaciation récente, disparaît sous les terrains secondaires de la Terre de Jameson. Cette surface présecondaire est probablement post-hercynienne, par analogie avec d'autres régions, une trace du mouvement hercynien se retrouvant peut-être dans une ligne de contact anormal que j'ai reconnue dans le Nord de l'Hurry Inlet au cours d'une exploration avec M. Backlund; cette ligne a une direction sensiblement Est-Ouest et fait chevaucher la masse gneissique du Nord sur le noyau central granitique."

Finally ALDINGER, who has most recently subjected this slope to more detailed examination writes in 1935 (1) p. 72: "Die mesozoische

Rumpffläche ist die Fläche auf der die mesozoischen Sedimente lagen oder noch liegen. Sie ist daher ein sehr komplexes Gebilde, sowohl was die Art der Entstehung (Denudation, Abrasion) als auch die Zeit der Bildung betrifft. Ihre ältesten Teile (Liverpoolland) sind oder waren von Trias bedeckt. Diese Trias enthält südlich von Carlsbergfjord keine marinen Fossilien mehr (NOE-NYGAARD 1934) und ist zum grössten Teil kontinentaler Entstehung, die Rumpffläche ist daher hier durch kontinentale Verwitterung und Denudation entstanden, also keine Abrasionsfläche." And on p. 74: "Über dem Meerespiegel steht die mesozoische Rumpffläche an auf Liverpoolland und Milneland. Auf Liverpoolland streicht die Fläche ungefähr NS und fällt ziemlich steil, schätzungsweise mit 3—5° nach Westen ein. Im südlichen Teil von Liverpoolland ist ein Stück der Rumpffläche an einer Verwerfung, die ungefähr von Kap Hope in W nach E oder NE bis zur Ostküste von Liverpoolland verläuft, abgesunken und in ein tieferes Niveau verlegt. In der Verwerfung, die wahrscheinlich eine ganze Zone von Störungen vorstellt, sind Reste von mesozoischen Sedimenten erhalten (Trias und Lias, ROSENKRANTZ 1929, p. 143, 149, 1934 p. 93—109), die beweisen, dass einst ganz Liverpoolland von Mesozoikum bedeckt war, was ja auch einwandfrei aus den faziellen Verhältnissen des Mesozoikums in Jamesonland hervorgeht, . . .".

To sum up it can be said, that the substratum of the sediment complex is an even plane, either a peneplain or a plain of marine denudation. On the strength of the available observations it is impossible to say whether the one or the other of these two kinds of plain is represented, and the circumstance that the basal sediment bed may be of continental origin does not solve the problem. Concerning the age of the plain it can be shown to be older than Eotrias (NOE-NYGAARD, 8), and a late Paleozoic age is probably right.

The down-faulted area at Kap Hope is, as stated by me (12) p. 94, fig. 46, larger in extent than indicated by the sediment area alone. In ALDINGER's work quoted above the down-faulted area was bounded by a fault line along the western coast of Rosenvinge Bugt across southern Liverpool Land to a point south of Lillefjord. The whole of the area southeast of this line is down-faulted in relation to the remaining part of Liverpool Land, which circumstance was already indicated by LAUGE KOCH in 1929 (6) fig. 40, p. 133. The low, flat gneiss country northeast of the Kap Hope sediments may be regarded as forming part of the original gneiss surface sloping towards south. The western boundary of the down-faulted area must then pass through Bruddal (ø: fault valley) and farther on along the western valley slope of Jættegletcher [ø: giant glacier] (fig. 2).

THE SEDIMENTS

The complex of sediments in the Kap Hope area comprises the following main rock types:

Sandstone and shale	Bathonian?
Sandstone	Toarcian
Sandstone and shale	Domerian?
Limestone, sandstone and conglomerate.....	Charmouthian
Sandstone, shale and coal	{ Lower Lias
	{ Rhætic
Limestone, sandstone and conglomerate.....	Rhætic?
Red Marl and limestone.....	Keuper?
Arkose conglomerate	Lower Trias
Gneiss	

Bathonian and Toarcian strata have not previously been identified in this area, but like the other strata they are closely connected with the complex known from Jameson Land, and thus help to emphasize the fact that the Kap Hope sediments previously made part of an unbroken cover of Mesozoic sediments overlying the crystalline complex in Jameson Land and Liverpool Land.

Triassic Sediments.

Arkose.

The oldest strata which it is possible to determine exactly as to age are the plant-bearing Rhætic strata, but underlying those there is a series of older, in part strongly deviating beds, which may be compared with the so-called Klitdal formation (11) p.140, which is known from northern Jameson Land and may be supposed to represent the older parts of the Trias formation.

Corresponding with the oldest member of the Klitdal formation, viz. the Arkose, there is a narrow area along the western boundary of

the sediment area south of Bruddal, which is situated at a somewhat higher level than the coastal plain east of it, and where it is possible, in river cuttings, to study these oldest strata and their superposition on the gneiss (fig. 3). Considering their coarseness, the exposed rocks are well stratified and consist of conglomeratic arkose with angular grains of red felspar and more rounded boulders of quartzite and other rocks up to the size of a hand. The matrix which contains kaoline is red or

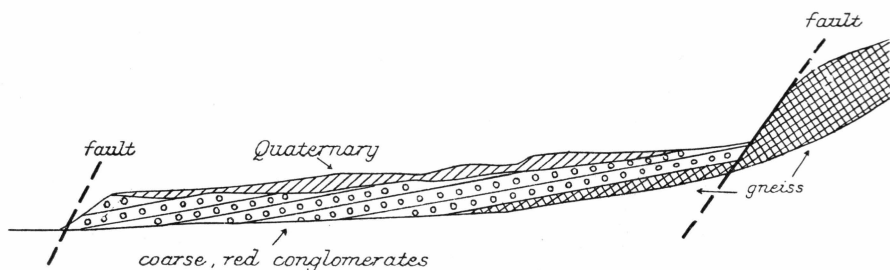


Fig. 3. Section through the red arkose and the underlying gneiss. NE of Igterajivit.

greenish with a large quantity of mica. These strata are most likely of continental origin.

In Bruddal, some distance within the place where it debouches into the coastal plain, a coarse-grained, cross-bedded, red-brown arkose conglomerate, which reminds somewhat of the strata described above, is visible in the western side. In this locality it has not proved possible to identify superposition on the gneiss, and the beds probably represent a somewhat higher level than the arkose strata farther south.

Also at the foot of Gule Fjælde [? yellow mountains], towards west as well as towards north, red sediments, greatly obscured by scree, are met with; they probably belong to the arkose strata mentioned above (plate 4).

Professor H. G. BACKLUND, who has studied sediments of this nature in Hurry Fjord and the inner ramifications of Scoresbysund, obligingly made the collection of pebbles from the Kap Hope arkose subject to an investigation, and in a letter of February 1st, 1936, he gave me the following information: "I have compared the conglomerate with all accessible sediments within the Scoresbysund area, which directly overlie the crystalline, viz. the Charcotbugt conglomerate on Milne Land (? Oxfordian according to ALDINGER), the conglomerate on western Renland, Røde Ø, the western side of Rype Fjord etc. which form a group apart; the two conglomerates on the western side of Schuckert Elven (southeast of Holger Danskes Briller), the older one being tectonically dislocated (= Upper Devonian?) the younger one lying unconformably above this and marine Permian. Both of these conglomerates

are in the same position in the interior of Hurry Fjord (Devon and Trias?).

The Kap Hope conglomerate most of all resembles the Røde Ø series; this, in its turn, resembles the Renland and Rype Fjord conglomerates, which again have some features in common with the younger conglomerate from Schuckert Elven.

The mode of weathering has more or less the same character as the latter, but this conglomerate (the Schuckert Elv conglomerate) is distinctly cross-bedded, which may also be locally observed on the western side of Rype Fjord."

On the strength of these observations Professor BACKLUND is inclined to think that the conglomerate at Kap Hope is younger than marine Carboniferous-Permian and contemporary with or somewhat older than Eotrias.

The above synchronizing of the Kap Hope arkose and the Arkose member of the Klitdal formation thus harmonizes very well with the remarks of Professor BACKLUND. According to the most recent investigations carried out by NOE-NYGAARD (8) and STAUBER (20) the arkose in the lowermost parts of the Klitdal formation is younger than marine Eotrias, and so it seems justifiable to refer the Kap Hope Arkose to Lower Trias.

In the Klitdal formation the Arkose is overlaid by the Gypsum member. Beds belonging to this member do not seem to have been developed in the Kap Hope area.

Red Marl.

The youngest beds of the Klitdal formation are comprised under the name of the Red Marl member, which consists of strata of red marl with limestone concretions and beds and upwards merges into sandy facies. This member is also represented in the Kap Hope area, but the series of beds are badly exposed, and its superposition on the Arkose has not been observed. Red marl has been identified on the south coast at Igterajivit on the boundary towards the gneiss. The occurrence is insignificant, and the beds are greatly dislocated. In the large depression extending from Basaltnæs across the coastal plain as far as the debouch of Bruddal, the soil has a characteristic reddish tinge, which is partly caused by the beds of red marl. The proof of the existence of the latter is found in the numerous concretions of red or greenish limestone which are lying among the gravel in the river beds. These concretions consist of a very pure and dense unstratified reddish or greenish limestone, and are completely identical with those from the Red Marl in Klitdal.

Rocks between Red Marl and the Rhætic.

Younger than the Red Marl are a series of unfossiliferous sediments which on the map plate 4 are included in the Rhæto-Liassic series, into which they seem to merge gradually. In Part I, 12 (fig. 51, p. 97) I have reproduced a section of the southern coast of the area between Igterajivit and Basaltnæs. Rocks belonging here are marked 21 = grey quartzite conglomerates, and 28 and 30 = green sand and sandstone with lime concretions. Samples from the green beds show that they contain glauconite and beds and concretions of grey, impure limestone with larger grains of quartz. Of special interest is the glauconite constituent, which points towards a marine origin. Unfortunately it has not been possible to find the least trace of fossils.

Similar beds: Light conglomerates of well rounded quartzite pebbles of up to 10 cm in diameter in arkose matrix, and green calcareous beds, which are devoid of stratification and must be characterized as glauconitic mudstone, have been observed in the western side of Bruddal near its debouch into the coastal plain. The series of beds are here in the direction north-south: red cross-bedded arkose conglomerate, red-brown marl (much obscured by scree) with pure limestone concretions, quartzite conglomerate, green, calcareous mudstone, quartzite conglomerate, greyish green, medium-grained sandstone with rounded quartz pebbles of the size of a nut, greyish white, medium-grained arkose sandstone with carbonized wood. The latter stratum, the youngest of the series, represents a type, which is distributed in the coal-bearing Rhæto-Liassic plant beds.

Rhæto-Liassic Beds.

Coal-bearing sediments have been observed along the southern coast between Igterajivit and Basaltnæs, on a distance immediately northeast of Basaltnæs in Rosenvinge Bugt and in the eastern side of Bruddal at its debouch into the coastal plain. Rhæto-Liassic strata, which unfortunately are very much obscured by scree, seem to form the deeper strata of Gule Fjælde. Only to the northeast of Basaltnæs determinable remains of plants have been found in the beds of a few localities (fig. 8). In my previous work I have already accounted for the succession of strata in the coast section of Igterajivit, and so I shall only add that the first mention of coal occurrences in this cliff is made by EINAR STORGAARD (21) p. 76 and (22) p. 552. As appears from the sketch of the section (12) p. 98, fig. 51, coal beds occur in several localities, and they have been worked by the Greenlanders from the time of the founding of the Scoresbysund settlement. The occurrences north of

Basaltnæs are also indicated in (12) p. 98, fig. 51. A more correct representation of the coast section from a point 280 m north of Basaltnæs and farther north has been given in plate 1.

Close to the basalt north of Basaltnæs (fig. 8, loc. 3) dark slates with thin layers of grey, fine-grained sandstone have been observed. Here I found in 1927 the first remains of plants in the Kap Hope district, and T. M. HARRIS (4) made a collection comprising the following species:

Dictyophyllum exile (BRAUNS) NATHORST

Ctenis minuta FLORIN

Pseudoctenis spectabilis HARRIS

Anomozamites minor NATHORST

Pterophyllum ptilum? HARRIS

Hartzia tenuis HARRIS

Stachyotaxus elegans NATHORST

Cycadocarpidium? sp.

Bysmatospermum macrotrachelum HARRIS

This flora which, according to HARRIS, refers the strata to the *Lepidopteris* zone (Rhætic) may be supplemented with:

Neocalamites hoerensis (SCHIMPER) HALLE

Between points 300 m and 500 m in the section (plate 1) a series of beds is observed, comprising black shales overlain by a coal lens, which can be traced in the section for a distance of about 40 m. The coal bed I discovered in 1927, and since then it has been worked for several years by the inhabitants of the Scoresbysund settlement. It attains a thickness of 53 cm and will be mentioned later on in connection with the other coal occurrences. The locality (fig. 8, loc. 5) is called Ikalissat, which is the Angmagssalik name for coal. The coal lens is overlain by rather solid beds of coarse-grained, cross-bedded sandstone with carbonized wood. Between points 400 m and 500 m in the section layers of grey, arenaceous shales are seen, being overlain by cross-bedded sandstone with thin layers of coal. An unconformity separates the basal conglomerate of the marine Charmouthian strata from the underlying coal-bearing series. According to HARRIS (4) the following plants were collected in 1927 from the grey shales (fig. 8, loc. 5):

Triletes areolatus HARRIS

Amphorispermum major HARRIS

Pterophyllum subaequale HARTZ

Sphenobaiera spectabilis (NATHORST) FLORIN

Czekanowskia hartzi HARRIS

Swedenborgia sp.

Through this flora the layers are characterized as belonging to the *Thaumatopteris* zone (Lower Lias).



25-8-1934

Fig. 4. The coastal plain at the coal mine at Ikalissat. Heaps of coals lying on the ground. The coals were mined during the summer and brought to the houses by means of sledges in the winter. In the background Rosenvinge Bugt and the gneiss mountains around the Scoresbysund settlement sloping towards the south.



25-8-1934

Fig. 5. The coal mine in the coast section at Ikalissat. The coal bed is seen in the lower part of the figure, partly hidden by small heaps of mined coal, and covered by a rather solid bed of coarse sandstone.

In 1934 I collected a small flora in the shales at point 490 m (fig. 8, loc. 5) adjoining the basal conglomerate of the Charmouthian. Professor T. M. HARRIS obligingly determined the elements of this flora which comprises:

Czekanowskia hartzi HARRIS

Podozamites sp. indet. cf. *lanceolatus* HARTZ

Swedenborgia cryptomerioides NATHORST

Also this flora belongs to the *Thaumatopteris* zone.

As appears from plate 1 there are, farther north in the coast section, a few more stretches, where sandstone and shales belonging to the plant series crop out. Here, however, no plant fossils have been collected.

In the eastern side of Bruddal, near its debouch into the coastal plain, a section through the upper part of the plant series is seen; it is reproduced in fig. 6, but is unfortunately rather obscured by scree. The strata are terminated upwards by the Charmouthian basal conglomerate. In the series farthest to the north there is a coal bed, which has been utilized by the Greenlanders. No determinable remains of plants have been found in this locality.

The Coal Beds of the Plant Series.

As will appear from what has been said above, coal beds are found in several localities in the plant series, and east of Igterajivit and at Ikalissat these beds may attain a thickness of more than half a meter. The coals in these two localities are deep black in colour and have a fairly bright lustre; they do not rub off and seem to show a rather uniform composition throughout the whole bed. The coals consist of durite with numerous veins of vitrite. A detailed account of the petrography of the coals will, however, not be given here, as a monograph on all the coal occurrences in Greenland has been planned elsewhere. By means of the usual tests, viz. streak and various simple chemical reactions, it is possible to establish that the coals from the two said localities belong to the type of bituminous coal, which has also been confirmed by analyses, the results of which are given in the table below. The analyses have been worked out by the Danish State Testing Laboratory on the initiative of the Administration of Greenland.

The coals from Bruddal are, as it will appear, essentially of a poorer quality than the coals from Igterajivit and Ikalissat. These differences in quality may possibly be explained by the fact that the coal beds from Igterajivit and Ikalissat belong to a series of beds, which is folded (see p. 50), while the beds in Bruddal are unfolded.

The coals resemble the somewhat younger Jurassic coals from Hochstetter Foreland, which were mentioned by FREBOLD (3). As far as may

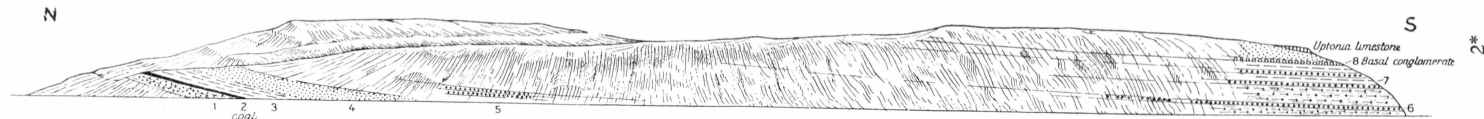


Fig. 6. The eastern side of Bruddal at its debouch into the coastal plain. Panoramic view. **1.** Yellowish green, micaceous, rather fine-grained, shaly sandstone. **2.** Coal bed. **3.** Black, arenaceous shales and dark, shaly sandstone. **4.** White, coarse-grained, cross-bedded arkosic sandstone. **5.** Greenish, medium-grained, micaceous sandstone. **6.** Green, partly conglomeratic, micaceous sandstone, glauconitic. **7.** Greenish-grey, partly conglomeratic, arkosic sandstone, interbedded with grey, shaly sandstone and thin layers of shale with plants. **8.** The basal conglomerate of the Charmouthian.

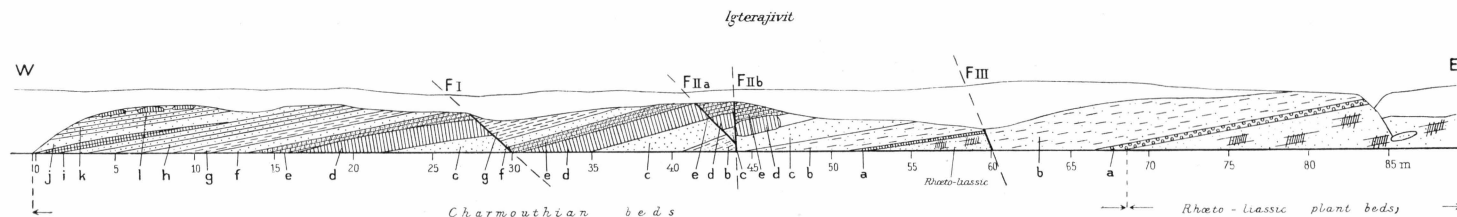


Fig. 7. Part of the coast section at Igterajivit. The substratum of the Charmouthian series consists of light-grey, conglomeratic, cross-bedded sandstone with carbonized wood. **a.** Basal conglomerate with blunt-edged quartzite pebbles of the size of a nut, in a coarse-grained matrix, 10—30 cm thick. **b.** Light-grey, medium-grained arkose sandstone with thin coats of clay. Upwards the bed becomes more coarse-grained with scattered pebbles of the size of a nut. 280 cm. **c.** Yellowish green, micaceous, shaly arkose sandstone, with scattered pebbles of the size of a pea. 165 cm. About 1 m above the base concretionary formations, 40 cm thick. **d.** Hard, impure limestone bed with cracks filled with calcite. Fossils at 4 levels. 132 cm. See plate 2 and 3. **e.** Light grey, medium- to fine-grained, loose, micaceous, shaly sandstone. Splits up into thin flakes. 54 cm. **f.** Yellowish green, coarse, loose sandstone with scattered pebbles of the size of a nut. 23 cm. **g.** Dark-green, fine-medium-grained, ferruginous sandstone. 52 cm. **h.** Greyish green, rather fine-grained, ferruginous, micaceous, shaly sandstone, with dark coats of clay. 235 cm. **i.** Greyish green, hard, fine-grained, micaceous sandstone with dark coats of clay. Penetrated by cracks filled with calcite. 35 cm. **j.** Greyish green, loose, coarse sandstone with a 7 cm thick hard micaceous bed. 66 cm. **k.** Greyish green, medium-grained, shaly sandstone, very ferruginous. In the upper part the bed passes into laminated, arenaceous shales. 152 cm. **l.** Greyish green, fine-grained, hard sandstone with bore-holes, filled with a black, clayey substance. 27 cm. — F = fault.

Analyses of Coals from Liverpool Land.

Constituents	Ikalissat	Igterajivit	Bruddal	Ikalissat	Igterajivit	Bruddal
Volatile matter	38,5	39,7	24,4	..	..	..
Fixed carbon	48,5	42,4	42,7	..	..	..
Moisture	2,4	2,0	3,6	..	..	..
Ash	10,6	15,9	29,3	..	..	..
Moisture	2,4	2,0	3,6	..	..	..
Ash	10,6	15,9	29,3	..	..	..
Sulphur	1,03	1,72	0,76	..	..	..
Hydrogen	5,5	5,0	3,3	6,39	6,23	4,98
Carbon (total)	71,2	66,5	53,0	82,79	82,73	79,89
Nitrogen	1,00	0,87	0,64	1,16	1,08	0,96
Oxygen	8,3	8,0	9,4	9,66	9,96	14,17
Coke	59,1	58,3	72,0	..	..	..
Upper calorific power	7117	6857	5061	..	..	..
Lower calorific power, effective ...	6810	6583	4866	..	..	..
Specific gravity	1,45	1,53	1,72	..	..	..

be judged from analyses quoted by FREBOLD p. 59, the coals from Igterajivit and Ikalissat are not inferior in quality to the Hochstetter coals, and they are said to be better than the West Greenland coals.

The coals from the Kap Hope area have, for a number of years, been very largely used by the population at Scoresbysund, and this also applies to contemporary coal occurrences in Jameson Land. The discontinuance during later years of the working of the coal beds at Kap Hope is not due to the fact that the occurrences of coal have been exhausted, but to the difficulties which the very primitive working method gradually encountered in the covering layer of sandstone.

Jurassic Sediments.**Charmouthian Beds.**

The Charmouthian (= Carixian) beds have supplied all the fossils which have hitherto been mentioned in the literature from the Kap Hope area, with the exception of those of plants. By far the greater number of the fossils mentioned in part I (12) as originating from these beds were collected in 1926, upon the initiative of LAUGE KOCH, by Greenlanders from Igterajivit. The fossils from different horizons were mixed up by the collectors, and one of my tasks in 1934 and 1936 was

consequently to try to account for the occurrence of the fossils in the marine Charmouthian series, which in the Kap Hope area attains a thickness of more than 20 m, this thickness being unsurpassed at any other locality in East Greenland. A similar thickness may be observed at Kap Stewart in the eastern part of Jameson Land; but from here this series decreases in thickness towards the north and finally wedges out entirely in Klitdal. This condition which I was already able to

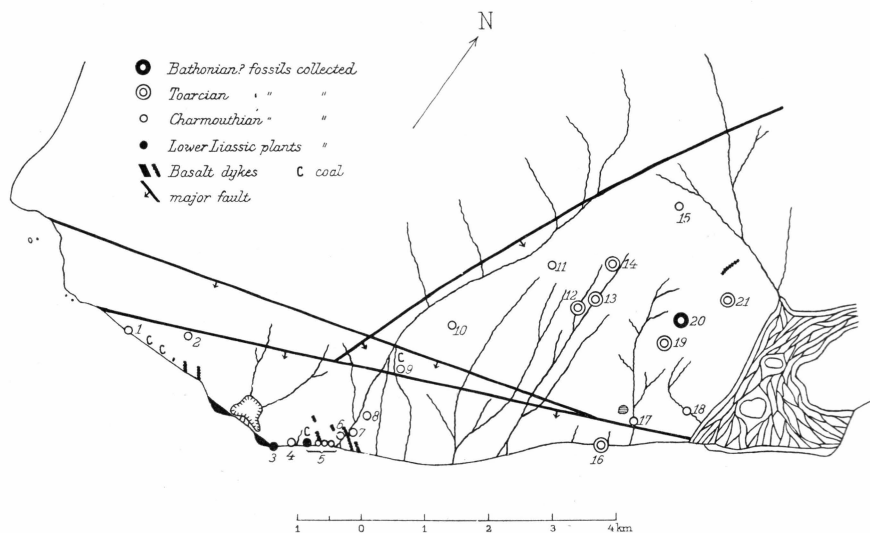


Fig. 8. Map showing the position of the localities, where fossils have been collected. In loc. 3 Rhætic (not Lower Liassic) plants were found. Basalt dykes, faults and coal occurrences have been drawn in.

establish in 1926—27, was in 1934 subjected to a particularly thorough examination in Neill's Klipper [ø: cliff], further details of which examination will be given in Part III.

In the Kap Hope area there seems to be a slight unconformity between the Rhæto-Liassic plant beds and the marine Charmouthian. This unconformity is especially obvious between points 480 m and 500 m in the coast section at Kumâit (plate 1).

In the following an account will be rendered of the fossiliferous localities within this series of beds in the Kap Hope area. The position of the localities appears from the map (fig. 8).

Locality 1. Igterajivit.

In the coast section between Kap Hope and Basaltnæs the Charmouthian series crops out in a single locality at the dwelling place of Igterajivit. The complete coast section is reproduced in Part I (12) fig. 51, p. 98). In 1934 the Charmouthian part of the section, which was

then more clearly defined than in 1927, was again measured. The result is given in fig. 7 and plate 2, where also an account has been rendered of the nature of the different beds, several of which proved to be fossiliferous, viz.:

Bed a. The basal conglomerate which, however, has yielded no determinable fossils.

Bed d, hard, arenaceous limestone, with fossils at four levels, see plate 3 and figg. 9 and 10.

Fossil beds 68—77 cm. The fossils which lie pell mell comprise:

Cardinia concinna (Sow.)
Cardinia hybrida (Sow.) common
Trigonia lingonensis DUM.
Venericardia? *aff. liasinum* (MOORE) common
Tancredia n. sp. A.
Mactromya? *groenlandica* RKZ.
Pleuromya costata (Y. et B.)
Gresslya lunulata TATE
Arcomya longa (BUV.)
Arcomya aff. pelea (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalvis (SOW.)
Pinna cf. folium (Y. et B.)
Lima (*Plagiostoma*) *eucharis* D'ORB.
Lima (*Pseudolimea*) *boonei* COSSMAN
Pseudentolium frontale (DUM.)
Æquipecten æquivalvis (SOW.)
Æquipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR)
Plicatula pectinoides LAM.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.
Ptychomphalus consobrinus (TATE)
Ptychomphalus n. sp.

Fossil bed, 88—92 cm. *Cardinia* pavement containing:

Cardinia hybrida (Sow.) common
Pseudentolium frontale (DUM.) fragments and juv.
Æquipecten priscus (SCHLOTH.)

Fossil bed, 105—107 cm. *Cardinia* pavement containing:

Cardinia hybrida (Sow.)
Astarte sp.
Æquipecten priscus (SCHLOTH.)

Fossil bed, 129—132 cm. *Cardinia* pavement containing:

Cardinia hybrida (SOW.) common
Oxytoma inæquivalvis (SOW.)
Pseudentolium frontale (DUM.) juv. common
Æquipecten priscus (SCHLOTH.) common
Plicatula pectinoides LAM.

The following collection of fossils was made in bed d to the east of the fault F I (fig. 7):

Cardinia hybrida (SOW.) very common
Venericardia? *aff. liasina* (MOORE)
Tancredia sp.
Arcomya aff. pelea (D'ORB.)
Pseudentolium frontale (DUM.)
Æquipecten priscus (SCHLOTH.)
Camptonectes n. sp.

Bed e, grey, medium-grained, finely laminated sandstone. In the lower part of this bed the following fossils have been collected:

Limea acuticosta MÜNST.
Pseudentolium frontale (DUM.)
Æquipecten priscus (SCHLOTH.)
Modiola lævis SOW.

Bed f, yellowish green, loose sandstone with small pebbles. Only indeterminate remains of fossils were found in this bed.

Bed g, greenish, arenaceous shale. In this bed were found:

Ditrupa sp.
Nuculana graphica (TATE)
Cardinia hybrida (SOW.)? common
Macromya lindhammeri ROLLIER very common
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya costata (Y. & B.)
Limea acuticosta MÜNST.
Æquipecten priscus (SCHLOTH.)
Plicatula pectinoides LAM.
Gryphæa cymbium LAM.
Lewisiella aff. conica (D'ORB.)

The rock is very ferruginous and the fossils rusty brown.

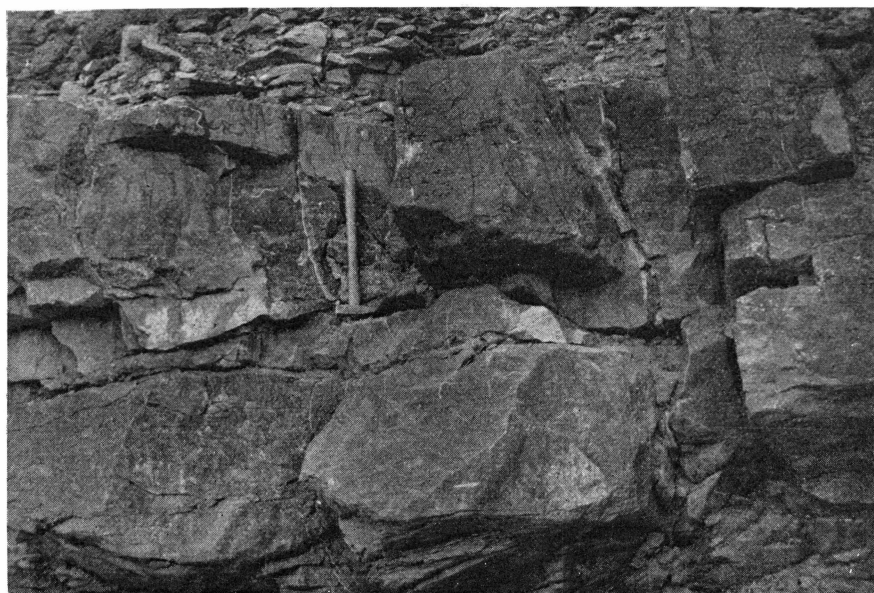
Bed h, greenish grey, fine-grained, shaly sandstone. From the lower part the following fossils were collected:

Ditrupa capitata (PHILLIPS)
Cardinia hybrida (SOW.) very common
Venericardia? *aff. liasina* (MOORE)
Protocardia cf. oxynoti QUENST.
Pleuromya costata (Y. & B.)?
Æquipecten priscus (SCHLOTH.)



23-8-1934

Fig. 9. The coast cliff at Igterajivit. Charmouthian beds. The two outcrops of bed d marked by the projecting parts of the coast cliff.



27-8-1934

Fig. 10. Hard limestone (bed d) with fractures produced by folding and filled with calcite. See also part I (12) p.106, fig. 55. Length of the hammer 35 cm.

Æquipecten bjerringi n. sp.

Prototeuthis sp.

Passaloteuthis cf. *apicurvata* DE BLAINVILLE

From the upper bed the following species possibly originate, having been collected in 1926:

Cardinia hybrida (Sow.)

Æquipecten bjerringi n. sp.

Bed i, hard arenaceous sandstone containing:

Cardinia hybrida (Sow.)? very common

Pseudotrapezium cucullatum (MÜNST.)

Dentalium cf. *elongatum gracile* MOORE

Lewisiella aff. *conica* (D'ORB.)

Ooliticia sp.

Bed l, greenish, fine-grained, hard sandstone, containing a number of specimens of

Oxytoma inæquivalvis (Sow.)

Locality 2. 1 km to the northeast of Igterajivit.

As mentioned in Part I (12) p.105 there was here in 1927 a large block of a grey, hard calcareous sandstone, containing a fauna very rich in species (pp.105, 107 and 108), the distinguishing feature of which is that it comprises a very large number of specimens of *Mactromya lindhammeri*. This species is not known to occur in any noteworthy quantity in the hard beds with *Uptonia Jamesoni*, but characterizes certain loose sandstone beds at Igterajivit and Kumâit, situated at a higher level than the *Uptonia* bed.

Locality 4. Coast section between Basaltnæs and Ikalissat.

Between points 310 m and 370 m (plate 1) a number of loose-lying blocks of a hard, calcareous sandstone are to be seen; they contain the following fauna:

Grandirhynchia sp.

Tetrarhynchia sp.

Parallelodon buckmani (RICH.)

Cardinia concinna (Sow.)

Cardinia hybrida (Sow.) common

Pleuromya costata (Y. & B.)

Arcomya longa (BUV.)

Gryphæa cymbium LAM.

This fauna resembles the fauna of bed 9 in the Kumâit section, see below.



27-8-1936

Fig. 11. The coast cliff from Ikalissat to Kumâit II. The distant mountains consist of gneiss; to the right part of Gule Fjælde is to be seen.



27-8-1936

Fig. 12. The coast cliff at Kumâit II and III. In the background gneiss, to the right Bruddal (the fault valley).

Locality 5. Kumâit.

Between points 480 m and 1150 m in the coast section northeast of Basaltnæs, the marine Charmouthian series is seen in a well exposed section through the low coast cliff. The series of beds is penetrated by basalt dykes and numerous faults. As appears from plate 1, the highly fossiliferous "Pecten limestone" (bed 11), owing to the tectonic disturbances, repeatedly crops out in the coast section. This easily accessible locality has been the best place for finding Charmouthian fossils in the whole of the Kap Hope area.

A survey of the fossils contained in the various beds of this locality will be given in the following, reference being made to plates 1 and 2.

Kumâit I.

On the stretch between points 610 m and 720 m the fossils mentioned below have been collected (the numbers of the beds refer to plate 2).

Bed 1. The amount of fossils found in the basal conglomerates is as a rule very scanty. In this locality the supply of fossils is, however, greater than normal and comprises the following species:

Parallelodon cf. buckmani (RICH.)
Cardinia listeri (SOW.)
Pleuromya costata (Y. & B.)
Lima succincta (SCHLOTH.)
Æquipecten priscus (SCHLOTH.)
Plicatula cf. lævigata (D'ORB.)
Modiola aff. subcancellata BUV.

Bed 5, hard, arenaceous limestone. The lowermost 40 cm of this hard bed contain:

Parallelodon cf. buckmani (RICH.)
Cardinia hybrida (SOW.)
Arcomya longa (BUV.)
Oxytoma inæquivalvis (SOW.)
Plicatula pectinoides LAM.
Gryphæa cymbium LAM.

Bed 7, calcareous concretions with

Liostrea irregularis (MÜNST. em. QU.)

Bed 9, calcareous concretions containing a particularly well preserved fauna consisting of:

Spiriferina münsteri DAV.
Tetrahynchia sp.
Lobothyris sp.
Parallelodon cf. buckmani (RICH.) very common
Parallelodon cypriniformis (LUNDGR.)
Cardinia concinna (SOW.) common

Cardinia listeri (Sow.) common
Trigonia lingonensis DUM.
Venericardia? *aff. liasina* (MOORE)
Tancredia n. sp. A.
Mactromya? *groenlandica* RKZ.
Cardium (*Jurassicardium?*) *phillipianum* DUNKER
Arcomya aff. pelea (D'ORB.)
Pholadomya ambigua (Sow.)
Oxytoma inæquivalvis (Sow.)
Lima succincta (SCHLOTH.)
Aequipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) *var. rinki* (LUNDGR.)
Plicatula pectinoides LAM.
Gryphæa cymbium LAM.
Modiola lævis Sow.
Hippopodium ponderosum Sow.
Striactæonina booni COSSMAN

Bed 11, hard, arenaceous limestone with *Pseudentolium* pavements (fig. 15). From this hard bench the following fossils have been collected:

Discinisca n. sp.
Tetrarhynchia sp.
Parallelodon cf. buckmani (RICH.)
Parallelodon sp.
Cardinia hybrida (Sow.)
Cardinia concinna (Sow.)
Trigonia lingonensis (DUM.)
Venericardia? *aff. liasina* (MOORE)
Tancredia n. sp. A.
Tancredia johnstrupi (LUNDGR.)
Tancredia n. sp. C.
Quenstedtia? *n. sp.*
Cardium (*Jurassicardium?*) *phillipianum* DUNKER
Pleuromya costata (Y. & B.)
Gresslya lunulata TATE
Arcomya longa (BUV.)
Arcomya aff. pelea (D'ORB.)
Pholadomya ambigua (Sow.)
Oxytoma inæquivalvis (Sow.)
Oxytoma n. sp.
Inoceramus? *sp.*
Pseudentolium frontale (DUM.)
Æruipecten æquivalvis (Sow.)
Chlamys substriata (RÖM.) *var. rinki* (LUNDGR.)
Liostræa irregularis (MÜNST. em. QU.)
Gryphæa cymbium LAM.
Modiola lævis Sow.
Hippopodium ponderosum Sow.
Ptychomphalus consobrinus (TATE)
Uptonia jamesoni (Sow.)

Kumâit II.

Between points 750 m and 810 m bed 11 is again to be seen in the coast section; in this bed a number of fossils have been collected:

Grandirhynchia n. sp.
Grandirhynchia Elii RKZ.
Tetrarhynchia sp.
Parallelodon cf. *buckmani* (RICH.)
Cardinia hybrida (SOW.)
Trigonia lingonense DUM.
Tancredia n. sp. A.
Quenstedtia? n. sp.
Mactromya? *groenlandica* RKZ.
Cardium (*Jurassicardium*?) *phillipianum* DUNKER
Pleuromya costata (Y. & B.)
Gresslya lunulata TATE
Ceratomya sp.
Arcomya longa (BUV.)
Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inaequivalvis (SOW.)
Oxytoma n. sp.
Pseudolimea boonei COSSMAN
Pseudentolium frontale (DUM.)
Æquipecten priscus (SCHLOTH.)
Chlamys substriatus (RÖM.) var. *rinki* (LUNDGR.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphaea cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola scalprum SOW.
Hippopodium ponderosum SOW.
Pleurotomaria cf. *anglica* SOW.
Ptychomphalus consobrinus (TATE)
Ptychomphalus n. sp.
Uptonia jamesoni (SOW.)

Kumâit III.

Between points 815 m and 905 m bed 11 is for the last time seen in the coast section. On this stretch the bed contains several well defined fossil horizons, which are represented in plate 3.

Fossil bed 40—45 cm. The characteristic feature of this bed is that it contains a large number of Rhynchonellids. The collections made here comprise the following specimens:

Grandirhynchia sp.
Tetrarhynchia sp.
Lobothyris aff. *punctata* (SOW.)
Æquipecten priscus (SCHLOTH.)
Hippopodium ponderosum SOW.



Fig. 13. Part of the coast section NE of Basaltnæs, between points 540 and 560 m. The Charmouthian basal conglomerate (bed 1) is seen as a protruding bed in the middle of the section to the left above cross-bedded sandstone of the Rhæto-Liassic plant-series; in the background bed 5 at the top of the cliff.



Fig. 14. The surface of bed 5 at Kumâit I dipping towards northeast. In the background the Greenlanders at work in bed 11. The large erratic block on the beach lies at point 700 m.

Fossil bed 60—73 cm. The fossils in this horizon lie pell mell. In the lowermost part of the bed there is a great accumulation of shells of *Modiola scalprum*. This horizon has supplied the following fossils:

Parallelodon cf. buckmani (RICH.)
Cardinia concinna (SOW.)
Cardinia hybrida (SOW.)
Trigonia lingonensis DUM.
Tancredia sp.
Pleuromya costata (Y. & B.)
Gresslya lunulata TATE
Pholadomya ambigua (SOW.)
Oxytoma inæquivalvis (SOW.)
Pseudolimea boonei COSSMAN
Pseudentolium frontale (DUM.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)
Chlamys textoria (SCHLOTH.)
Æquipecten priscus (SCHLOTH.)
Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Hippopodium ponderosum SOW.
Uptonia jamesoni (SOW.)

Modiola bed.

Pseudentolium frontale (DUM.)
Modiola scalprum SOW.

At 75 cm *Pseudentolium* pavement.

At 85 cm *Pseudentolium* pavement.

Fossil bed 88—125 cm. Shaly limestone with fossils lying pell mell. Between 115 and 125 cm the bed is developed as a breccia of shells with many worn fragments, but also a few extremely well preserved specimens. In this horizon the following fossils were collected:

Parallelodon cf. buckmani (RICH.)
Parallelodon cypriniformis (LUNDGR.)
Cardinia hybrida (SOW.)
Trigonia lingonense DUM.
Tancredia johnstrupi (LUNDGR.)
Tancredia n. sp. A.
Quenstedtia? n. sp.
Mactromya aspasia (D'ORB.)
Pseudotrapezium cucullatum (MÜNST.)
Arcomya longa BUV.
Arcomya aff. pelea (D'ORB.)
Oxytoma inæquivalvis (SOW.)
Pholadomya ambigua (SOW.)
Pseudolimea boonei COSSMAN
Pseudentolium frontale (DUM.)
Æquipecten priscus (SCHLOTH.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.)

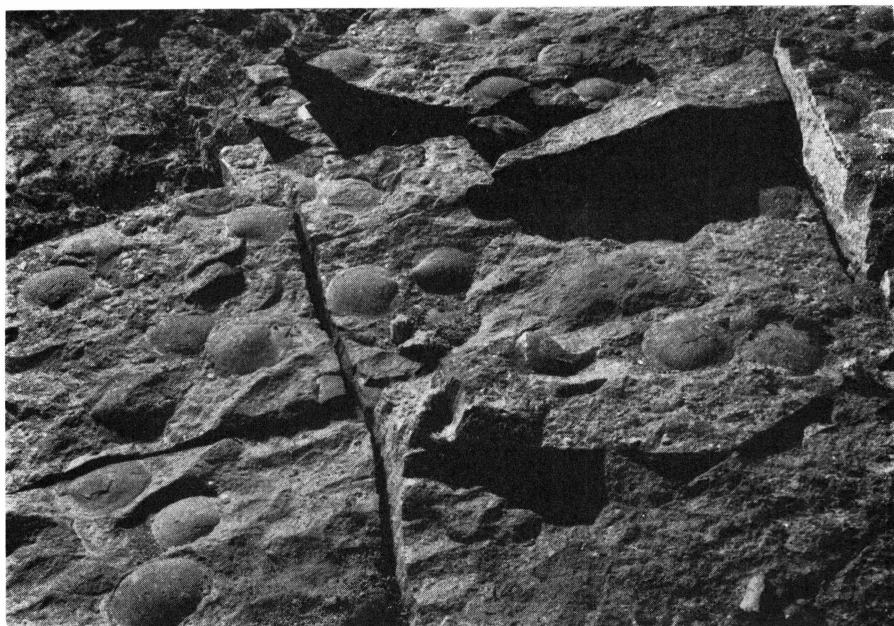


Fig. 15. *Pseudentolium* pavement at Kumâit I, point 690 m, plate 1. 25-8-1934

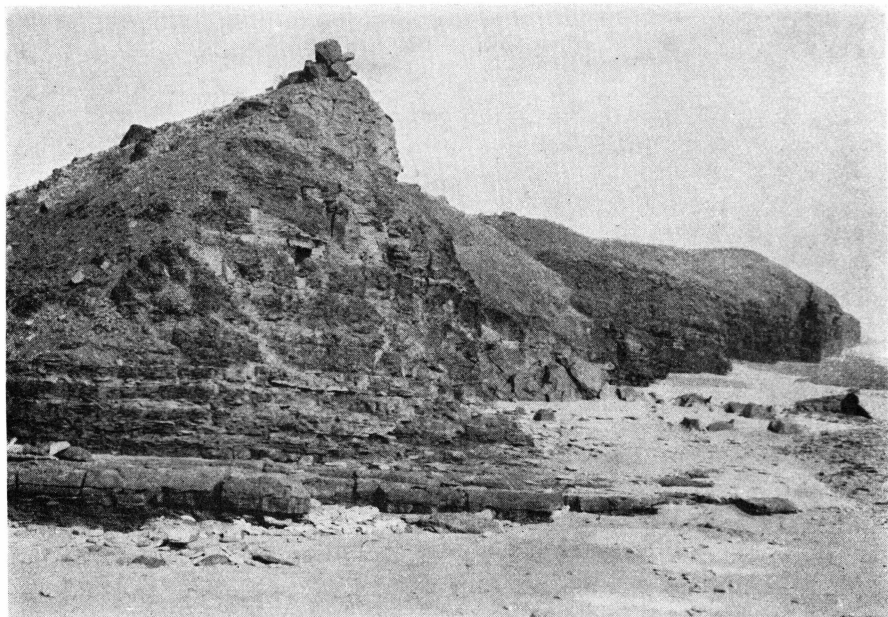


Fig. 16. Coast section NE of Kumâit. Point 1140 m. In the foreground on the beach the conglomerate bed 22 overlain by Domerian? strata. The outcrop farthest out on the beach belongs to the basalt dyke at point 1154 m, plate 1. 29-8-1936

Chlamys cf. textoria (SCHLOTH.)
Plicatula pectinoides LAM.
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Gryphæa arcuata LAM.
Gryphæa cymbium LAM.
Terquemia pectiniformis DESL.
Myoconcha decorata (MÜNST.)
Hippopodium ponderosum SOW.
Ptychomphalus consobrinus (TATE)
Uptonia jamesoni (SOW.)

Bed 15, greenish, shaly sandstone. In the uppermost part of this bed the following, greatly deformed fossils have been collected:

Lobothyris sp.
Cardinia hybrida (SOW.)
Mactromya lindhammeri ROLLIER
Mactromya aspasia? (D'ORB.)
Cardium (*Jurassicardium?*) *phillipianum* DUNKER
Pseudotrapezium cucullatum (MÜNST.)
Pleuromya sp.
Arcomya aff. pelea? (D'ORB.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalvis (SOW.)
Limea acuticosta MÜNST.
Æquipecten bjerringi RKZ.
Æquipecten priscus (SCHLOTH.)
Gryphæa cymbium LAM.
Ptychomphalus sp.

Bed 16, greenish, finely laminated sandstone with rusty brown concretions and fossils in the lowermost part. The characteristic feature of the bed is that it contains a large quantity of shells of *Mactromya lindhammeri*. It is presumably this and the underlying, adjoining horizon, which locally, where large quantities of shells have accumulated, may form a massive limestone bench with an abundant fauna, such as the block from loc. 2. In bed 16 the following greatly deformed fossils have been collected:

Mactromya lindhammeri ROLLIER
Pseudotrapezium cucullatum (MÜNST.)
Pholadomya ambigua (SOW.)
Ostrea sp.

As appears from plate 1, bed 16 is again to be seen in the coast cliff northeast of Vestre Brudelv, and when following the coast in a northeastern direction it is seen to be overlain by a series of greenish sandstone beds with subordinate shales. At point 1140 m in the section the series is terminated by a conglomerate of clay ironstone nodules (bed 22, fig. 16).

Beds 17—22 (incl.) have not yielded any fossils in this locality, but the glauconite constituent shows the very close connection between these and the fossiliferous marine beds. In beds corresponding with the conglomerate bed 22 marine fossils i. e. *Plicatula lævigata* and *Æquipecten bjerringi*, have been collected in Rævekløft (ø: fox ravine) at Kap Stewart in Jameson Land.

Bed 22 is in the coast section overlain by lenticular bedded sandstone and shales which are provisionally classed among the Domerian, even though the hitherto found, very scanty fossils do not justify an exact determination as to age.

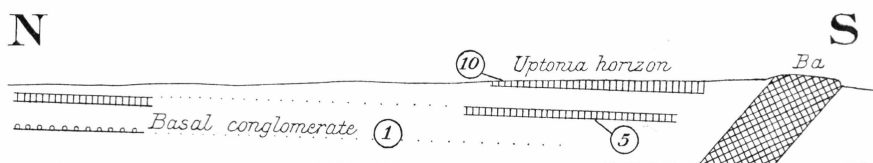


Fig. 17. Section on the northern side of Vestre Brudelv, near the mouth.

Ba = basalt dyke. The *Uptonia* horizon is bed 11, not bed 10.

Locality 6. Vestre Brudelv.

At the debouch of Vestre Brudelv, close south of a basalt dyke crossing the river bed, an outcrop of hard limestone is visible in the southern bank; here the following specimens have been collected:

Cardinia hybrida (Sow.)
Pholadomya ambigua (Sow.)
Pinna cf. folium (Y. & B.)
Modiola scalprum Sow.
Uptonia jamesoni (Sow.)

Locality 7. Vestre Brudelv.

This locality which is situated to the north of the above-mentioned basalt dyke, but in the northern bank of the river bed, has been mentioned in Part I (12) pp. 105 and 108, figs. 56 and 57, and a new sketch of the section is shown in fig. 17. No collections were made at this locality in 1927. In 1934 and 1936 a quantity of fossils were collected in the following beds, the numbers of which correspond with the Kumâit section.

Bed 1, the basal conglomerate *Plicatula lævigata* (D'ORB.).

Bed 11, upper part. Here the following fossils have been collected:

Tetrarhynchia sp. A.
Parallelodon buckmani (RICH.)
Cardinia concinna (Sow.)
Cardinia hybrida (Sow.)

Cardium (Jurassicardium?) phillipianum DUNKER
Ceratomya petricosa (SIMPS.)
Gresslya lunulata TATE
Arcomya aff. pelea (D'ORB.)
Pholadomya ambigua (SOW.)
Limea acuticosta MÜNST.
Æquipecten priscus (SCHLOTH.)
Gryphaea cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola lævis SOW.
Modiola cf. hillana SOW.
Uptonia jamesoni (SOW.)
Passaloteuthis sp.

Locality 8. Brudelv.

1 km from the mouth of Brudelv two hard limestone beds of the Charmouthian series are seen to crop out close to the east of the river. In this locality the beds are very much weathered, and no collections have been made. The most westerly of the benches contains no fossils, whereas shells of *Cardinia concinna* were seen in the eastern bench. The locality is situated 28 m above sea level.

Locality 9. Bruddal's debouch into the coastal plain.

In this locality the Charmouthian beds (fig. 18) are seen overlying the plant series represented in fig. 6. The basal conglomerate, in which only remains of shells of *Æquipecten* have been found, is succeeded by a greyish green, loose sandstone. 50 m above sea level the latter is overlain by "Uptonia limestone", the lower hard bench known from the Kumâit section thus being absent in this locality.

The fossiliferous hard limestone bench contains fossils at several levels (plate 3).

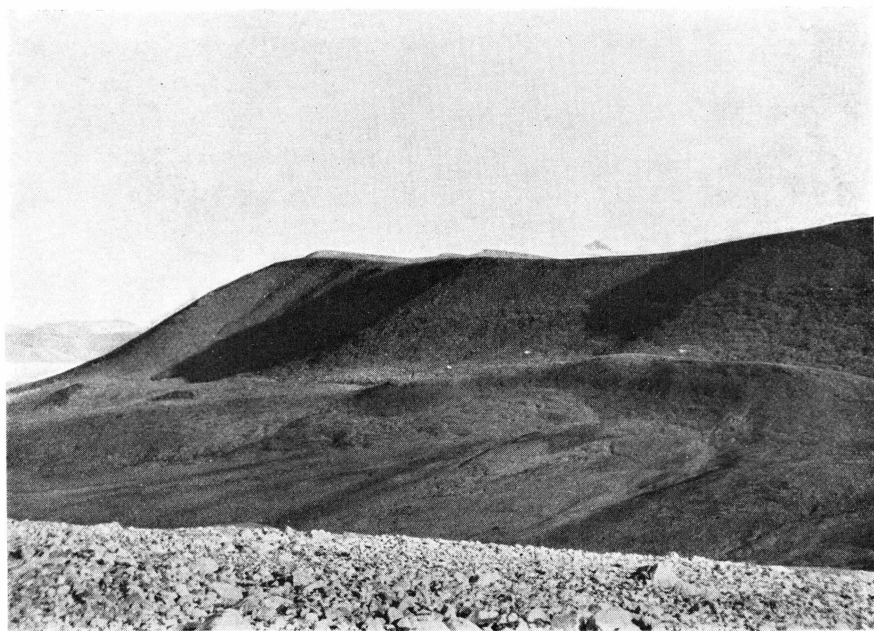
Fossil bed 12—17 cm containing:

Tancredia n. sp.
Pseudotrapezium cucullatum (MÜNST.)
Goniomya hybrida (MÜNST.)
Pholadomya ambigua (SOW.)
Oxytoma inæquivalvis (SOW.)
Pinna cf. folium (Y. & B.)
Cultriopsis n. sp.
Pseudentolium frontale (DUM.)
Æquipecten priscus (SCHLOTH.)
Placunopsis minuta LUNDGR.
Liostrea irregularis (MÜNST. em. QU.)
Ptychomphalus consobrinus (TATE)
Uptonia sp.



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Fig. 18. Section through Charmouthian beds at the debouch of Bruddal into the coastal plain. The *Uptonia* bed marked by large blocks in the scree.



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Fig. 19. North side of Bjerring Pedersen Fjæld. The hard, fossiliferous, Charmouthian bench stands out clearly in the middle part of the mountain.

At 25 cm *Pseudentolium* pavement.

At 40 cm *Pseudentolium* pavement.

Fossil bed 47—49 cm is remarkable as containing a great quantity of Rhynchonellids and also the following fossils:

Tetrarhynchia sp.
Parallelodon buckmani (RICH.)
Cardinia listeri (Sow.)
Venericardia? aff. *liasina* (MOORE)
Cardium (*Jurassicardium?*) *phillipianum* DUNKER
Modiola lævis Sow.
Hippopodium ponderosum Sow.

Locality 10. Bruddal.

In the eastern side of Bruddal, about 1 km north of locality 9, a hard bench with Charmouthian fossils crops out in the cliff at a height of 105 m above sea level. In this place a number of fossils were collected in 1927 (12) p. 97, and by means of the new collections made in 1936 this list may be supplemented with the following two species:

Goniomya hybrida (MÜNST.)
Chlamys substriata (RÖM.) var. *rinki* (LUNDGR.).

Locality 11. Bruddal.

About 2 km farther north in the eastern side of Bruddal, 120 m above sea level, the same hard bench with *Pseudentolium frontale* is to be seen. No collections of fossils have been made in this place.

Locality 15. Northern side of Bjerring Pedersen Fjæld.

In further continuation of the localities 10 and 11 the hard bench with *Pseudentolium frontale* is visible along the northern side of this mountain (fig. 19). The other beds in the Charmouthian series are covered by scree. Fossils were collected at an altitude of 165 m above sea level and comprise the following species:

Cardinia concinna (Sow.)
Cardinia listeri (Sow.)
Tancredia johnstrupi (LUNDGR.)
Mactromya? *groenlandica* RKZ.
Cardium (*Jurassicardium?*) *phillipianum* DUNKER
Gresslya lunulata TATE
Pholadomya ambigua (Sow.)
Oxytoma inæquivalvis (Sow.)
Pinna cf. *folium* (Y. & B.)
Pseudentolium frontale (DUM.)
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)

Locality 17. Blok Elv.

This occurrence was mentioned in Part I (12) p. 97 and plate 4. No further collections have been made in this locality. Like bed 9 in the Kumâit section the fauna is dominated by big shells of *Cardinia concinna* but here forming a pavement.

Locality 18. Small river to the northeast of Blok Elv.

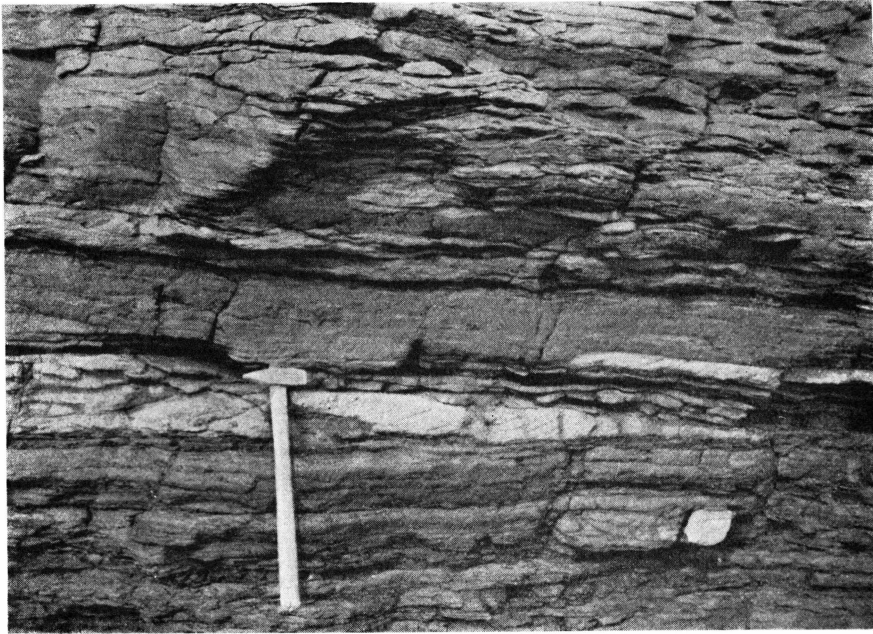
In a small river bed, barely 1 km to the northeast of Blok Elv, are seen blocks of hard limestone which must undoubtedly be fixed in the neighbourhood. Here the following fauna was collected:

Tetrarhynchia sp.
Cardinia listeri (Sow.)
Mactromya? *groenlandica* Rkz.
Mactromya lindhammeri ROLLIER
Arcomya aff. *pelea* (D'ORB.)
Pholadomya ambigua (Sow.)
Oxytoma inæquivalvis (Sow.)
Pseudentolium frontale (DUM.)
Equipecten priscus (SCHLOTH.)
Plicatula pectinoides LAM.
Gryphæa cymbium LAM.
Myoconcha decorata (MÜNST.)
Modiola scalprum Sow.

The succession of strata in the Charmouthian of the Kap Hope complex is rather varying from one place to another. Wherever it is possible to study the superposition on the Rhæto-Liassic plant series, the Charmouthian begins with a transgression conglomerate, 10—30 cm thick and consisting of quartzite pebbles of the size of a pea. The succeeding beds vary greatly, as appears at a glance on plate 2, where the two most important localities, Igterajivit and Kumâit, are placed side by side for comparison. The lower part of this series of beds comprises coarse, greenish or grey, arkosic sandstone, in the lower part often conglomeratic. The material of these coarse beds is very badly assorted, large angular grains of felspar being visible here and there. An exception is the bed of fine-grained sandstone and shales in the coarse basal series at Kumâit (point 500 m). As a characteristic feature of these coarse sediments, which may attain a thickness of more than 9 m (Kumâit), there are everywhere hard benches cemented with lime carbonate. In three localities (5, 7 and 8) two such thick, hard benches are to be found, being separated by looser beds of sandstone. The upper bench is remarkable in that it contains one or more *Pseudentolium* pavements. At Igterajivit there is only one thick bench, the fossil contents of which are

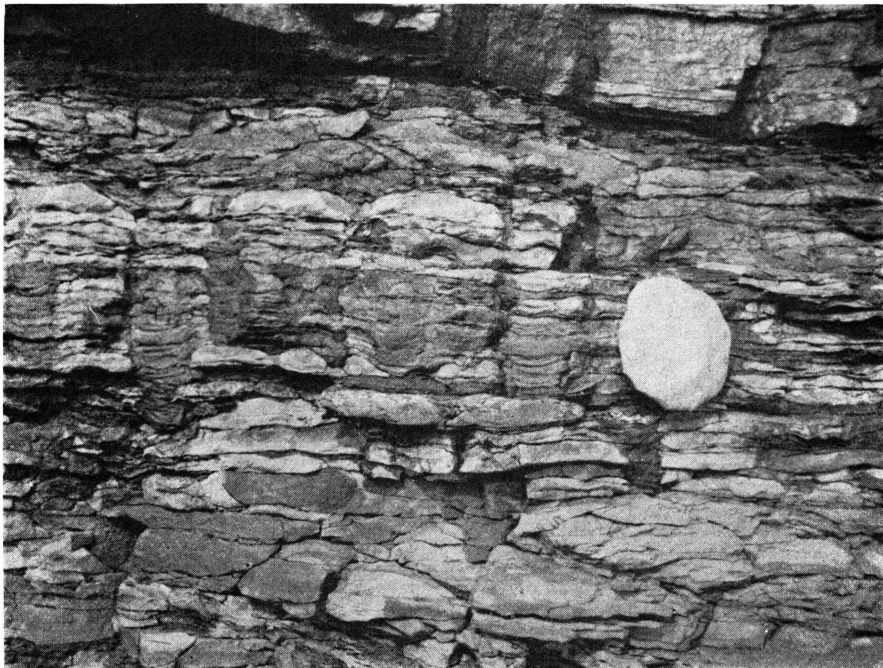
distinguished from the pavement bed just mentioned by the absence of large shells of *Pseudentolium* and *Uptonia*. As appears from plate 2, this bench is found at a somewhat lower level than the pavement bed at Kumâit and corresponds more nearly with beds 7 and 9 in this locality. In Blok Elv there is a hard bench, the pavement of which consists of shells of *Cardinia concinna* (see Part I (12) plate 4).

The upper, less fossiliferous part of the Charmouthian series consists of better assorted sediments, for the greater part fine-grained sandstone and in some localities shales. In this upper series, which may attain a thickness of more than 12 m (Kumâit) there are at Igterajivit two thin, hard sandstone benches. The green colour, which characterizes so many of the beds, is owing to the glauconite constituent. A conglomerate bed known from Kumâit, 25 cm thick with nodules of clay ironstone, terminates the Charmouthian series upwards, and it thus reflects a transgression followed by a continuous subsidence of the area and, in conclusion, an upheaval by which the area is raised up into the coast region. All the beds of the series bear evidence of having been deposited in rather shallow water. The pavements in the lower part of the series must have arisen on a beach, where the waves have turned the convex sides of the *Pectinid* or *Cardinia* shells upwards. Further contributions to the understanding of the mode of deposition have been made by ALDINGER (1), based upon observations in Jameson Land. On page 15 he mentions the hard pavement beds as a marine basal bench against the Rhæto-Liassic plant beds. As appears from what has been said above, this, however, does not apply to the Kap Hope area, where the basal conglomerate proper is situated 5—7 m below the base of the pavement bed. As shown by my investigations in 1934, the same conditions prevail in southern Jameson Land, but the distance between the two beds is generally shorter. ALDINGER's subsequent reflections on the manner in which the bed has been deposited, are based upon the following conception of the composition of the bed (1) p. 16: "Die Fossilien sind in der Bank nach einer gewissen Regel verteilt. Die Fossil-lagen beginnen im Liegenden mit einem Pflaster grosser Pecten oder Perna (*Entolium frontale* und *Isognomon* n. sp. nach ROSENKRANTZ). Die Schalen liegen gewölbt oben, dicht an dicht, und überdecken sich gewöhnlich mit den Rändern etwas (vgl. Fig. 2 und ROSENKRANTZ 1934 Fig. 2). Auf dieses Pectenpflaster folgen zunächst dicht gepackte grosse Muschelschalen, die nach oben an Grösse abnehmen und schliesslich in grobes bis feines Schill und Sand übergehen. Mit scharfer Grenze folgt auf die feinen hangenden Lagen wieder ein Muschelpflaster und darauf wieder Schill in abnehmender Korngrösse. Die Mächtigkeit einer Einheit, d. h. der Abstand der Pflaster von einander, beträgt ein bis mehrere Dezimeter und sie sind in drei und vierfacher Wiederholung zu beobachten."



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Fig. 20. Domerian? strata with lenticular bedding. Coast section NE of Kumâit.
Length of the hammer 35 cm.



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Fig. 21. Domerian? strata with *Monocraterion*-like structures. Coast section NE
of Kumâit at point 500 m (fig. 22). Width of the cap 22 cm.

This rhythmic arrangement of the sediment, which is represented schematically in ALDINGER's fig. 2 cannot be said to be particularly striking in the pavement beds from the Kap Hope area (see plate 3) and is also only exceptionally present in the corresponding beds in Jameson Land. The interpretation given by ALDINGER (p.16) therefore rests on a rather slender foundation.

As regards the zonal division of the Charmouthian beds, which is based upon the fossils collected, the following may be said:

The find of *Uptonia jamesoni* in the pavement beds in a number of localities shows that the *jamesoni* zone is represented. The absence of further finds of ammonites makes it difficult to decide, whether other Charmouthian zones are represented. However, the species *Æquipecten bjerringi* Rkz. which occurs in the upper beds at Igterajivit and Kumâit, make it probable that also the *ibex* zone is present. This species has never been identified in beds with *Uptonia jamesoni*, but it is to be found in the *centaurus* horizon of the *ibex* zone at Dinosaurus Elv in Jameson Land. In the *bjerringi* beds at Igterajivit and Kumâit also *Mactromya lindhammeri* occurs in rather great quantities, while it is extremely rare in the *Uptonia* bed. Thus the *Mactromya* block from locality 2 possibly belongs to the *bjerringi* zone.

In the Kap Hope area we may thus consider the *jamesoni* zone to be finally ascertained, whereas the upper beds possibly belong to the *ibex* zone. All the fossils originating from the series of beds dealt with in this place refer the beds to the Charmouthian (Carixian).

Domerian? Beds.

The Charmouthian is succeeded by a series of beds more than 100 m thick, which are classed with the Domerian, and this in spite of the fact that none of the fossils, which are of stratigraphical importance, have been brought to light here. This series of beds is situated between Charmouthian (= Carixian) and Toarcian beds. It is seen to crop out in certain localities within the Kap Hope area, but it has not been possible to determine its thickness with the necessary degree of exactitude. It has been developed in a similar manner as the corresponding beds in Jameson Land (12) p.115, beginning with sandstones and arenaceous shales with lenticular bedding (fig. 20) and trails of worms and other animals on the bedding planes. Higher up in the series the beds of sandstone become more predominant, and at certain levels they contain *Monocraterion*-like structures (fig. 21); also mudcake conglomerates are included in the series and beds of clay ironstone. In a higher level fine-grained, micaceous sandstone and grey, arenaceous shales occur with mica-covered trails and plant fossils (indeterminable).

These layers crop out within three areas, viz.:

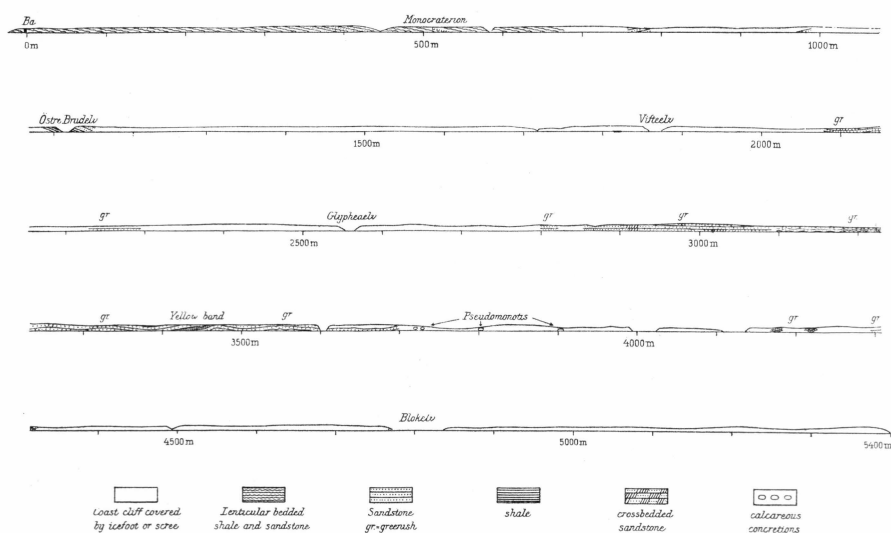


Fig. 22. The coast section Vestre Brudelv—Blokely. Basalt dyke at point 0 m is identical with the basalt dyke at point 1154 m on plate 1.



Fig. 23. Domerian? strata with cross-bedded sandstone. The minor sandstone strata dip towards SW. Coast section NE of Kumâit.

1. West of Igterajivit.

The series of beds in this locality has been dealt with in Part I (12) p. 98.

2. Section of the coast NE of Basaltnæs.

The series of beds is here represented in fig. 22 and is seen between points 0 m and 2000 m. The pictures of figs. 20, 21 and 23 give an idea of the appearance of the beds.

3. Gule Fjælde.

As appears from plate 4, the Domerian? beds play a considerable part in the composition of these mountains. However, no good sections have been measured through the beds within this area, but they make themselves known in the scree through fragments of sandstone and shale, with trails on the bedding planes and lenticular bedding.

The Domerian? beds have been deposited in shallow water; most of them must be assumed to be of marine origin, even if marine fossils have not been met with in the Kap Hope area. Some few marine fossils have been found in Jameson Land.

Toarcian Beds.

Beds belonging to the Upper Lias were discovered in 1934 in Bjer-ring Pedersen Fjæld, and their great distribution within the area was proved by investigations in 1936. The beds of this series chiefly consist of greyish green, fine- to medium-grained sandstone with dark mud planes. The strata which are frequently cross-bedded, are calcareous and contain concretions formed round marine shells. From Jameson Land several fossiliferous horizons are known (12) p. 116, and a few of these are to be found in the Kap Hope area. The beds have been observed in the following localities:

1. Coast section NE of Basaltnæs. Locality 16.

Between points 2000 m and 4300 m (fig. 22) a series of minute-folded or horizontal beds are visible; between points 3700 m and 3900 m these beds contain fossiliferous concretions consisting of dark-grey, fine-grained, micaceous and calcareous sandstone. Here the following species were collected:

Lingula beani PHILL.

Tancredia sp.

Pseudomonotis substriata (MÜNST.)

These concretions correspond entirely with the concretions from the so-called *Gervillia* horizon, south of Dinosaurus Elv in Jameson Land (12) p. 46. Similar large concretions were observed in 1936 in the top-most most northerly part of Gule Fjælde at a height of 244 m. In this locality, which is situated midway between locality 14 and 15, no fossils were collected.

2. Gule Fjælde.

The map on plate 4 shows the wide distribution of the Toarcian beds in this mountain area. Fossils have been collected in the following localities (fig. 8):

Locality 12, Glyphea Elv, west of Aage Nielsen Fjæld.

In this locality at a height of about 100 m above sea level were collected:

Trigonia literata Y. & B.
Pholadomya aff. *fidicula* Sow.
Liostrea cf. *erina* (D'ORB.)

Locality 13, Glyphea Elv.

300 m north of locality 12 were collected:

Gresslya sp.
Glyphea rosenkrantzi V. STRAEL.

Locality 14, Glyphea Elv.

600 m north of loc. 13, at a height of 170 m above sea level, a number of fossiliferous concretions were found, in which the following species were collected:

Isocrinus sp.
Inoceramus cf. *substriatus* (MÜNST.)
Pseudolioceras dumortieri (BUCKMAN)
Glyphea sp.

The material of fossils within the concretions collected is distributed in the following manner:

1	concretion with wood	
1	—	Inoceramus & Pseudolioceras
7	—	Glyphea
10	—	Pseudolioceras
6	—	Large phragmocones of belemnites
2	—	Crinoid stems.

Locality 19, Bjerring Pedersen Fjæld.

The first finds of Toarcian fossils were made in this locality. In 1934 and 1936 the following fauna was collected at a height of 75 m to 85 m:

Lingula beani PHILL.
Trigonia literata Y. & B.
Sphæriola sp.
Astarte madseni RKZ.
Gresslya abducta (PHILL.)
Arcomya cf. longa BUV.
Pholadomya aff. fidicula SOW.
Oxytoma inæquivalvis (SOW.) var.
Plagiotoma cf. toarcensis DESL.
Lima sp.
Variamussium n. sp.
Amberleya sp.
Glyphea rosenkrantzi v. STRAEL.

Locality 21, Bjerring Pedersen Fjæld.

The presence of Upper Liassic fossils in the northeastern corner of this mountain was proved by the finding of *Gresslya abducta* (PHILL.) at a height of 180 m. The slope is here very much covered with scree.

The Upper Liassic fossils collected are all known from Jameson Land, Part I (12) p.116. Only in locality 14 fossils have been found, which are of a zonal importance, viz. *Pseudolioceras dumortieri* (BUCKMAN). This ammonite refers the beds in locality 14 to a comparatively low level in the *bifrons* zone of the Whitbian.

The other fossils from localities 12, 13, 19 and 21 yield no exact information regarding the one or more zones represented there. However, they all occur in the Whitbian beds from Jameson Land.

The marine Upper Liassic series is composed of relatively coarse, badly assorted sediments with cross-bedding. It is thus a question of deposits originating from shallow waters.

Bathonian? Beds.

In the uppermost parts of Bjerring Pedersen Fjæld and Aage Nielsen Fjæld (Gule Fjælde) there are remains of a series of beds, which are younger than Toarcian (fig. 26). When following the ridge at locality 19, sandstone of the Upper Liassic type is visible up to a height of 160 m and succeeded by dark-grey, arenaceous and micaceous shales with concretions, in which fossils are of extremely rare occurrence. At



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Fig. 24. The coastal plain with Bjerring Pedersen Fjæld in the background. Locality 19 is situated on both sides of the small ravine in the lowermost part of the mountain. In the distance gneiss mountains with the glacier Jættegletscher.



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Fig. 25. The coastal plain with Aage Nielsen Fjæld in the background.

210 m these beds are overlain by greenish grey, fine-grained, micaceous sandstone, and from 235 m to 295 m the uppermost part of the mountain is composed of rusty brown sandstone; the grains of these increase

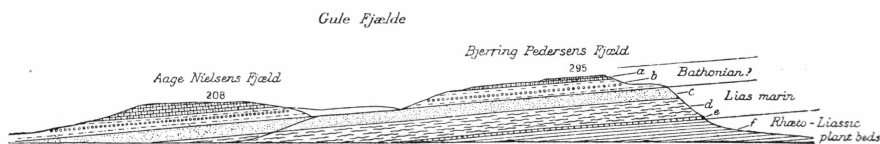


Fig. 26. Schematic section through Gule Fjælde, seen from the east. Bathonian?: a = top sandstone, b = concretions with very few fossils. Lias: c = Toarcian sandstone, d = Domerian? strata, e = Charmouthian strata.

in size upwards, so that the top bed consists of a rather coarse-grained sandstone with well rounded grains of quartz, ball-shaped sandstone concretions being visible at certain levels (fig. 27). The same series of beds is found in Aage Nielsen Fjæld, though the top sandstone is here preserved in a somewhat greater thickness (fig. 26).

The fossiliferous concretions, which have been collected in locality 20 (fig. 8), Bjerring Pedersen Fjæld, consist of a dark-brown, oolitic, impure limestone with some few grains of glauconite. In these concretions a few, not very well preserved fossils were collected in 1934, but since



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Fig. 27. The top of Bjerring Pedersen Fjæld. Bathonian? sandstone. In the background gneiss mountains and Jættegletscher, drained by the river Jætteelv.

then I have not succeeded in finding fossils within this horizon. The material collected comprises:

Nuculana aequilatera (DUNKER & KOCH)

Tancredia? sp.

Pseudomonotis aff. doneziana (BORISSJAK)

Oxytoma cf. intermedia EMM.

This small fauna refers the beds to the Middle Jurassic, and I have, though with some doubt, referred them to the Bathonian. From the Bathonian beds in Jameson Land SPATH (19) records *Pseudomonotis aff. doneziana*. *Nuculana aequilatera* is known from Dogger ε in Germany.

The uppermost beds of sandstone in Aage Nielsen Fjæld show pronounced examples of deflation (s. l.), see Part I (12) p. 96 fig. 48¹).

¹) As to wind action in Arctic regions see: CURT TEICHERT: Die Bedeutung des Windes in arktischen Gegenden. »Natur und Volk« 65, p. 619—628, Frankfurt a. M.

TECTONIC CONDITIONS

Plate 4.

From a tectonical point of view the Kap Hope area may be divided into two principal parts:

1. Gule Fjælde.

This area is composed of one large block which is overtilted in a southern direction. The northeastern boundary of the sediment area is perhaps represented by a fault, but the possibility also exists that the gneiss to the northeast of Skelev continues unbroken under the sediment block. Fragments of red Arkose are found scattered on the gneiss in this area, and so there is a possibility of finding a few fixed remains of sediments on top of the gneiss. Towards the west Gule Fjælde are bounded by the large fault traversing Bruddal. The southern boundary of the area is marked by a fault, which continues as far as Kap Hope. South of the latter there is a wedge-shaped area bounded by faults. The eastern half, from Bruddal to Rosenvinge Bugt, represents a comparatively slight down-faulting of the beds in Gule Fjælde, whereas the western part, west of the Bruddal fault, comprises gneiss, locally covered by red Arkose and consequently occupying a considerably more elevated position than the Gule Fjælde block.

2. The coastal plain: Igterajivit-Basaltnæs-Blokely.

If a line is drawn from the head of the small bay west of Basaltnæs towards north, the formations within the coastal plain are lying symmetrically arranged round the line with the red marl in the middle (see plate 4). In the coast section Basaltnæs-Igterajivit the sediments have a western dip; on the distance Basaltnæs-Vifteelv [ø: fan river] they slope towards the east. Thus the beds in the coastal plain form an anticline, the axis of which is the line mentioned above. Minute foldings of the beds are observed at Igterajivit (12) p. 98 and along the distance Vifteelv-Blokely (fig. 22). After or in conjunction with the folding this series of beds has been traversed by faults, as appears from fig. 7 and plate 1. In order to illustrate the character of these faults, a

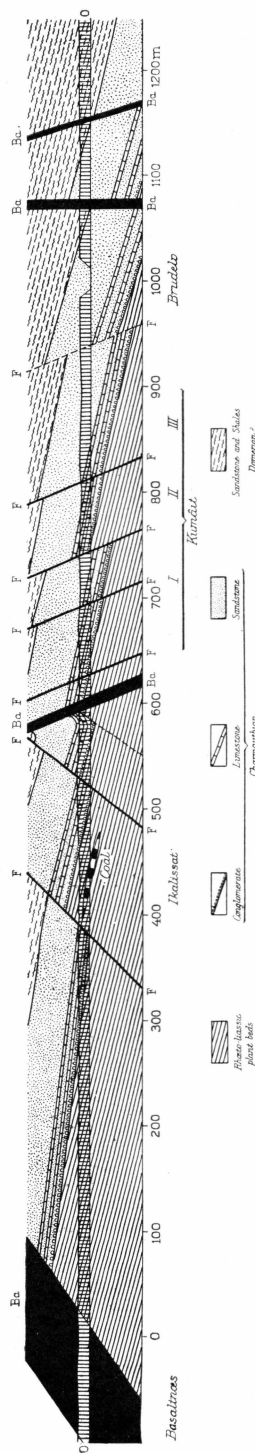


Fig. 28. Schematic diagram illustrating the tectonic conditions in the coast cliff between Basaltnæs and Vestre Brudelv. The coast cliff is marked by vertical hatching. 0 — 0 = sea level. Ba = basalt dyke. F = fault.

schematic representation of the conditions along the distance Basaltnæs-Vestre Brudelv has been given in fig. 28.

As to the age of these tectonic events, by which the whole area has become down-faulted, divided into blocks and in part folded, it may be said with certainty that they are younger than the Bathonian. There is reason to suppose that these events synchronize with the over-tilting of Liverpool Land—Jameson Land, which is illustrated by the sloping plane in western Liverpool Land and the dip of the beds in eastern Jameson Land. It is not improbable that this tilting may be connected with the basalt eruptions, which produced the basalt sheets, several kilometres thick, south of Scoresbysund. It may be said with certainty that the volcanic activity had begun before the deposition of the Kap Dalton sediments from the east coast south of Scoresbysund, and according to the opinion of some authors had continued after the deposition of these beds. RAVN (10) referred the Kap Dalton beds to the Lower Eocene (London clay), but as emphasized by SORGENFREI (18) p. 85 they are possibly much younger (Middle Oligocene to Lower Miocene).

Based upon new investigations and RAVN's determination of the age of the Kap Dalton beds L. R. WAGER (23) p. 13 says: "The preservation of the Kap Dalton sediments is considered to be due to down-faulting which has protected them from complete removal by erosion. It is believed that the sediments once overlay all the basalts now found in the district, and that the basalts are therefore earlier in age than the sediments. The unweathered state of the basalt immediately below the sediments suggests that there was no

great interval of time between the extrusion of the basalt and the deposition of the sediment. Thus the highest basalts of the Kap Dalton area are, with a high degree of probability, Lower Eocene in age".

The uppermost sediment layer met with at Kap Dalton, which BØGGILD¹⁾ determined as "a rather highly metamorphosed volcanic tuff" is considered by WAGER to be "a sediment of unusual appearance", but not metamorphosed. In favour of WAGER's interpretation is the fact that the sediments are not penetrated by basalt dykes and are not metamorphosed, as is the case within the true intra-basaltic sediments known from the region south of Scoresbysund (NORDENSKIÖLD (9), p. 191).

In West Greenland I have been able to prove (13) that the formation of the basalt sheets only began after the deposition of a marine series of beds, which belongs to the Lower Eocene. These Eocene beds are dislocated, and it can be proved that a very comprehensive levelling of the relief produced by the dislocation took place, before the basalt formation was formed. Thus in West Greenland the age of the basalt formation is in all probability confined to the Oligocene or younger divisions of the Tertiary.

Precursors of this volcanic activity on a grand scale have been identified in Danian and Paleocene, marine beds in West Greenland (13), through the existence of tuff layers being possibly contemporaneous with some of the plateau basalts in East Greenland which are older than the Kap Dalton sediments.

The table below comprehends all available material concerning the age of the basalt formation in Greenland.

	West Greenland		East Greenland	Iceland Denmark
Miocene and younger	Plateau basalt Basalt breccia		Plateau basalt. Not exist- ing according to WAGER	Plateau basalt inclosing marine, Pliocene beds (Iceland)
Oligocene			K. Dalton beds according to SORGENFREI	
Eocene	strong faulting followed by levelling		(Plateau basalt)	
Lower	Marine beds	Tuff layers	K. Dalton beds according to RAVN	Marine tuff layers in Denmark
Paleocene			Plateau basalt	
Danian				
Senonian			Marine beds	

¹⁾ see J. P. J. RAVN: New Investigations of the Tertiary at Cape Dalton, East Greenland. — Medd. om Grønland. Vol. 105, Nr. 1, p. 7.



Fig. 29. Air photo of the southern part of Liverpool Land, taken at a height of 4000 m. Behind Liverpool Land Hurry Fjord, the southernmost part of Jameson Land, Scoresbysund and the coast of Kong Christian d. IX's Land (Plateau basalt) and Milne Land are to be seen. In Liverpool Land the picture shows the coastal plain, the wedge shaped area and part of the Gule Fjælde block and moreover the even dip of the gneiss surface towards Hurry Fjord. In the gneiss surface three crevasses are seen, passing right through it. Hot springs are found at the points of intersection between these lines and the faults.—Published by permission of the Danish Geodetic Institute.

BASALT DYKES AND HOT SPRINGS

In several localities the sediments are penetrated by basalt dykes which may attain a thickness of up to 16 m. The dyke forming Basaltnæs is possibly even thicker, but it has not been possible to establish its southern boundary. The most important dykes are indicated in fig. 8. The conditions in the coast cliff NE of Basaltnæs (fig. 28) seems to indicate that the faults here are caused by the penetration of the basalt magma, following crevasses in the folded sediment complex which are possibly not much older than the magmatic penetration. Basalt sills, which play such a great part in southern Jameson Land, have not been observed within this area.

To BJERRING PEDERSEN (2) we owe the discovery of a number of hot springs in this area¹⁾, and he further demonstrated the connection between those and the faults which constitute the western boundary of the area. The springs keep a temperature of at most 2° C during the coldest season, the time of the year which is most favourable for proving the existence of such springs, as the water in summer has a temperature not much higher than the winter temperature. In the summers of 1934 and 1936 it was not possible to identify new hot springs, but it seems that such are to be found in the river valley at the fossil localities 12—14.

A few of the previously known hot springs on the fault line along the gneiss are situated in localities, where the fault line is crossed by conspicuous crevasses in the gneiss (plate 4 and fig. 29). These crevasses can be traced from the fault to the coast of Hurry Fjord, the northernmost being traversed by Grøfteelv [ø: trench river].

¹⁾ A short mention of these springs has been made by ALWIN PEDERSEN: De varme Kilder ved Scoresbysund. Meddelelser om Grønland. Vol. 68, 4. 1926.

QUATERNARY GEOLOGY

Bruddal (Part I (12), plate 3, fig. 2) is a pronounced glacier valley, but only contains scanty quantities of morainic material, and this applies to the whole of the area. The large coastal plain has presumably been formed by marine erosion in Quaternary time, though deposits with Quaternary marine shells have not been found. Within the gneiss area north of Kap Hope other more elevated terraces of a possible marine origin seem to have developed (fig. 29). Also the wedge-shaped area south of Gule Fjælde possibly represents an elevated, marine terrace.

On the coastal plain to the west of Basaltnæs well marked examples of stone nets can be observed. Detailed investigations of the Quaternary formation have not been carried out.

LITERATURE

1. ALDINGER, HERMANN. Geologische Beobachtungen im oberen Jura des Scoresbysundes (Ostgrönland). — Medd. om Grönland. Vol. 99, Nr. 1. 1935.
2. BJERRING PEDERSEN, TH. Efterladte Noter om geologiske Undersøgelser i Scoresbysund 1924—25. — Medd. fra Dansk geol. Forening. Bd. 7, Hefte 4. København 1929.
3. FIEBIGER, HANS. Geologie der Jurakohlen des nördlichen Ostgrönland. — Medd. om Grönland. Vol. 84, Nr. 5. 1932.
4. HARRIS, T. M. The fossil Flora of Scoresby Sound East Greenland. Part 5. Stratigraphic Relations of the Plant Beds. — Medd. om Grönland. Vol. 112, Nr. 2. 1937.
5. KOCH, J. P. Bemærkninger vedrørende de paa Skibsekspeditionen til Grönlands Østkyst 1900 opmaalte Kyststrækninger. — Medd. om Grönland. Vol. XXVII. p. 275. 1902.
6. KOCH, LAUGE. The Geology of East Greenland. — Medd. om Grönland. Vol. LXXIII, 2. 1929.
7. KRANCK, E. H. On the Crystalline Complex of Liverpool Land. — Medd. om Grönland. Vol. 95, Nr. 7. 1935.
8. NOE-NYGAARD, ARNE. Stratigraphical Outlines of the Area round Fleming Inlet (East Greenland). — Medd. om Grönland. Vol. 103, Nr. 1. 1934.
9. NORDENSKIÖLD, OTTO. On the Geology and Physical Geography of East Greenland. — Medd. om Grönland. Vol. XXVIII. 1907.
10. RAVN, J. P. J. The Tertiary Fauna at Kap Dalton in East Greenland. — Medd. om Grönland. Vol. XXIX, p. 93. 1903.
11. ROSENKRANTZ, A. Preliminary Account of the Geology of the Scoresby Sound District. — Medd. om Grönland. Vol. LXXIII, 2, p. 135. 1929.
12. — The Lower Jurassic Rocks of East Greenland. Part I. — Medd. om Grönland. Vol. 110, Nr. 1. 1934.
13. — in "Den danske Nügssuaq Ekspedition 1939. Foreløbig Oversigt over de geologiske Resultater". — Medd. fra Dansk Geologisk Forening. Vol. 9, Hft. 5, p. 653—663. København 1940.
14. ROTHÉ, J. P. Géologie. — Observation morphologiques au Scoresby-Sund. — Comptes rendus des séances de l'Académie des Sciences. Vol. 197, p. 1443. Paris 1933.
15. SAHLSTEIN, TH. G. Zur Regelung der Gesteine im Kristallin von Liverpool-Land in Ostgrönland. — Medd. om Grönland. Vol. 95, Nr. 6. 1935.
16. — Petrographie der Eklogiteinschlüsse in den Gneisen in Ost-Grönland nebst

- Anhang: Granulitartiger Gneiss nordöstlich von Kap Hope. — Medd. om Grønland. Vol. 95, Nr. 5. 1935.
17. SCORESBY, WILLIAM (junior). Journal of a Voyage to the Northern Whale Fishery. Edinburgh 1823.
 18. SORGENFREI, TH. Marint Nedre-Miocæn i Klintinghoved paa Als. — Danmarks Geologiske Undersøgelse. II. Række. Nr. 65. København 1940.
 19. SPATH, L. F. The Invertebrate Faunas of the Bathonian-Callovian Deposits of Jameson Land (East Greenland). — Medd. om Grønland. Vol. 87, Nr. 7. 1932.
 20. STAUBER, HANS. Stratigraphisch-geologische Untersuchungen in der ostgrönländischen Senkungszone des nördlichen Jamesonlandes. — Medd. om Grønland. Vol. 114, Nr. 7. 1940.
 21. STORGAARD, EINAR. Under Dannebrog og Trikoloren paa Grønlands Østkyst. København 1926.
 22. — The Physiography of East Greenland. — Greenland. Vol. I, p. 519. Copenhagen 1928.
 23. WAGER, L. R. Geological Investigations in East Greenland. Part II: Geology of Kap Dalton. — Medd. om Grønland. Vol. 105. Nr. 3. 1935.
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PLATES

Plate 1.

Coast section NE of Basaltnæs.

The numbers below the section indicate in m the distance from Basaltnæs.

1. The basal conglomerate consisting of angular quartz pebbles of the size of a nut in coarse, ferruginous matrix. 10—30 cm. **2.** (Point 500 m) Grey, conglomeratic sandstone with mud cakes and cross-bedding. **3.** (Point 500 m) Grey, micaceous, shaly sandstone and shales. **4.** (Point 500 m) Greenish, coarse, shaly sandstone. —In other parts of the section farther northeast the series between **1** and **5** is developed in a deviating manner, both as regards the nature of the beds and their thickness. At point 550 m a hard lense-shaped bench is inserted in the middle of the series; at point 630 the whole of the series consists of shaly sandstone. **5.** Hard, arenaceous limestone. In the upper part (20 cm) and in the lowermost fossiliferous part (40 cm) conglomeratic. **6.** Greenish, shaly sandstone with mud cakes. **7.** Calcareous concretions of the same rock type as **6**. **8.** = **6**. **9.** Calcareous concretions consisting of greyish green, very fine-grained, micaceous limestone. Filled with shells which lie pell mell. **10.** Grey, fine-grained, micaceous, shaly sandstone. **11.** Hard, arenaceous limestone with *Pseudentolium* pavements and conglomeratic layers. In the uppermost part shell breccia. For further details see plate 3. **12.** Greenish, coarse, shaly sandstone with mud cakes and concretions. **13.** Brown, conglomeratic sandstone with argillaceous, ferruginous matrix. **14.** Black shale, in the lowest part with concretions. **15.** Green, rather fine-grained, micaceous, ferruginous, shaly sandstone. **16.** Greenish, fine-grained, laminated, micaceous sandstone with rusty brown concretions, coats of clay and mud cakes. **17.** Dark-green, fine-grained, micaceous sandstone with layers of black sandstone and shales. **18.** Greenish, coarse, laminated sandstone. **19.** Greenish, medium-grained sandstone, with scattered quartz pebbles and black mud cakes. **20.** Dark-grey, micaceous shales. **21.** Green, coarse sand with layers of mud cakes and arenaceous shales. **22.** Conglomerate with clay ironstone nodules of the size of a walnut. Bed **22** is succeeded by lenticular bedded sandstone and shales with trails on the bedding planes belonging to the Domerian?

F = fault. — Ba = basalt dyke. Distances in m.

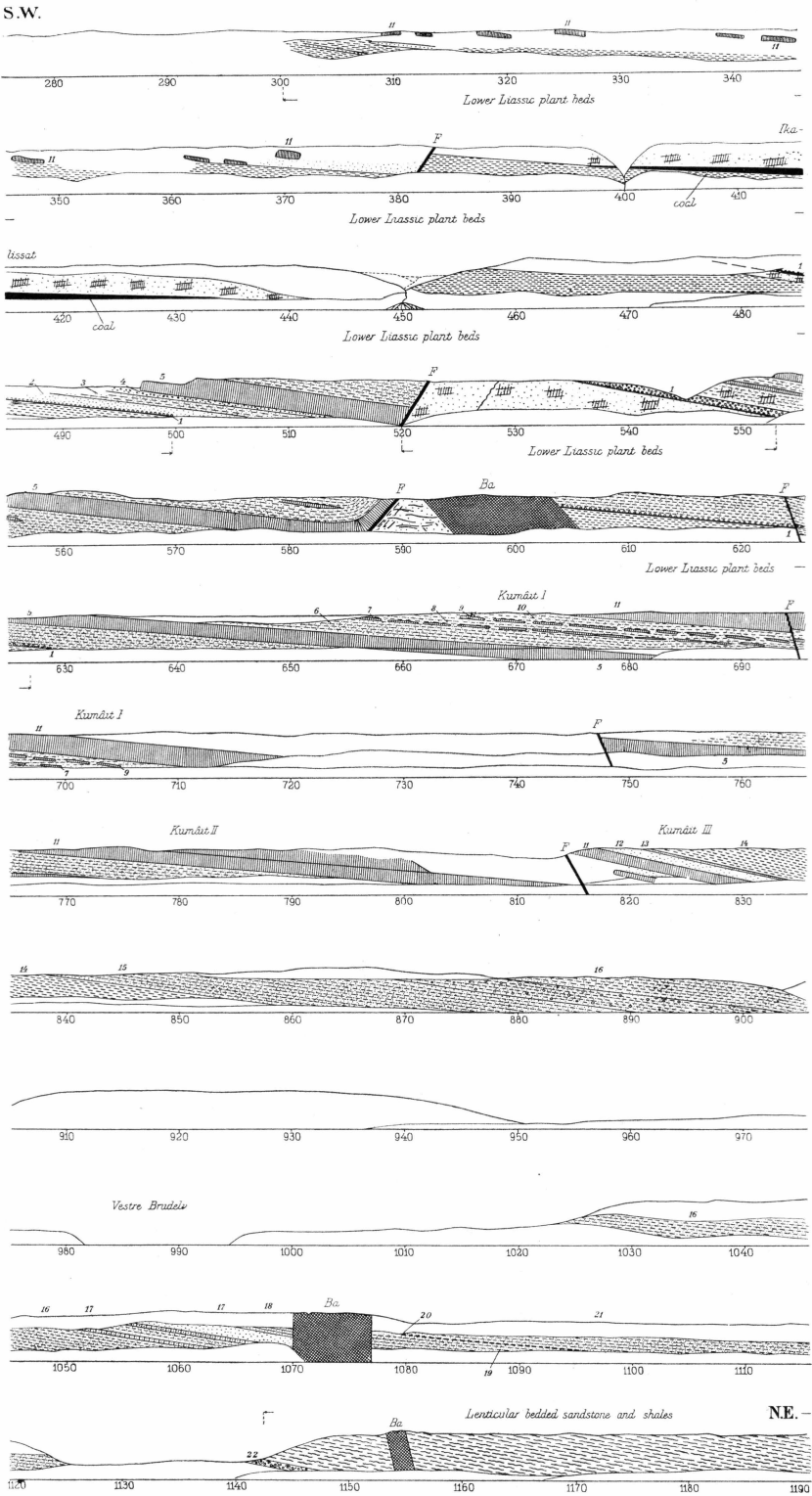
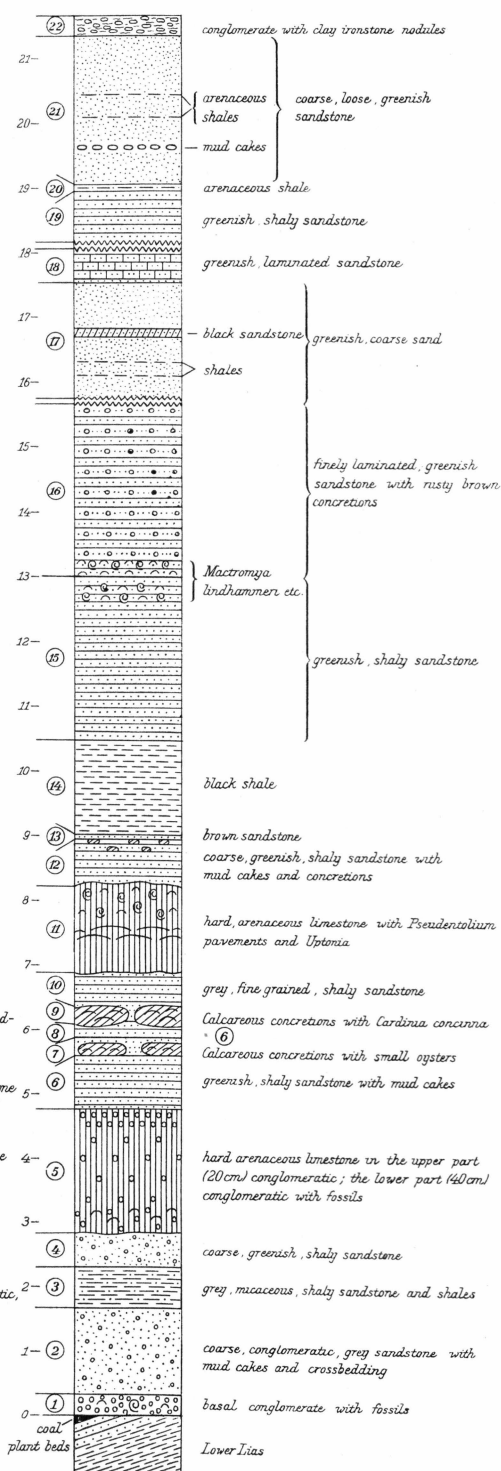


Plate 2.

Sections through the Charmouthian beds from Igterajivit and Kumâit for comparison. Scale in m.

Kumâit



Iqterajivit

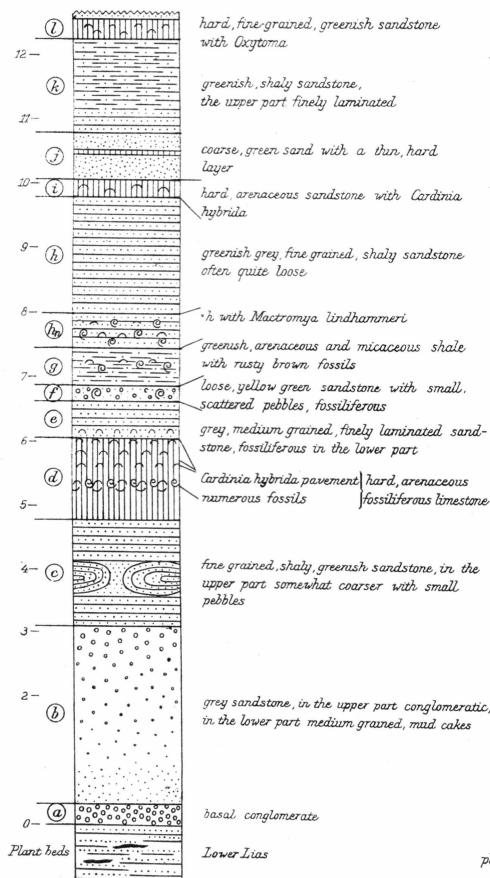
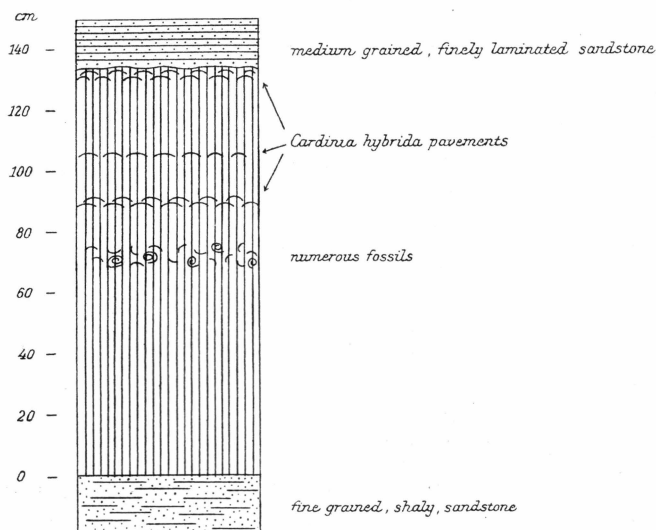
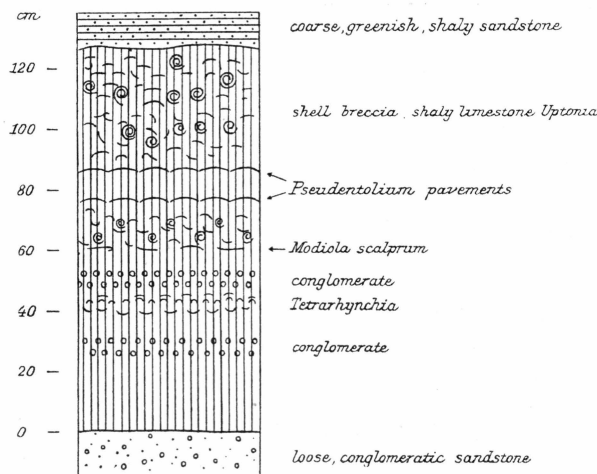


Plate 3.

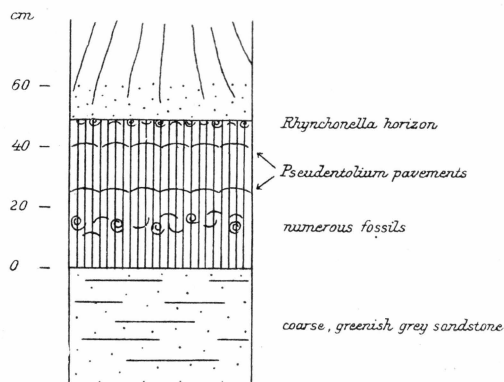
Diagrams of hard, fossiliferous benches from Igterajivit (bed d), Kumâit (bed 11) and Bruddal at its debouch into the coastal plain, showing the levels of fossil accumulations, fossil pavements and conglomeratic, unfossiliferous horizons.



Igterajivit



Kumâit



Bruddal

Plate 4.

Geologic map of the sediment area at Kap Hope, Southern Liverpool Land, compiled by Alfred Rosenkrantz 1926, 1927, 1934 and 1936, and based upon the map published by the Danish Geodetic Institute. Altitudes in m.

Corrigenda: The dip of the strata in the coast cliff east of Igterajivit is not, as shown on the plate, to the west, but more to the north-west.

