MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 151 · Nr. 1

THE STRATIGRAPHY OF THE MARINE QUATERNARY DEPOSITS IN WEST GREENLAND

BY

DAN LAURSEN

WITH 29 FIGURES IN THE TEXT AND 3 PLATES

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI
1950

CONTENTS

ABSTRACT

The present report deals with the Quaternary marine deposits in West Greenland. The area in question extends from Kugssineq, Svartenhuk peninsula, in the north to the settlement of Sukkertoppen in the south. The field investigations for the paper have been made partly in 1939, partly in 1946, last-mentioned year under the auspices of GRØNLANDS GEOLOGISKE UNDERSØGELSE (abb. G.G.U., i. e. Geological Survey of Greenland). All localities visited are described with added lists of the collected shells. On the basis of the investigations made it will be demonstrated that the stratigraphy of the layers at Orpigsôq drawn up by JENSEN and HARDER in 1910 (30) is applicable to all the area investigated. Furthermore a detailed examination is made of the petrographic structure, the content of shells, and the levels of the various horizons, a discussion of a few errors, and ultimately an attempt at a correlation of the Quaternary marine layers of Greenland with the corresponding postglacial layers of Iceland, Norway, and Denmark.

PREFACE

The present publication is principally based on the collections and observations made in 1946 on the expedition sent out by GRØNLANDS GEOLOGISKE UNDERSØGELSE (abb. G.G.U., i. e. Geological Survey of Greenland). The investigations were carried out on the basis of the experiences and results which the present writer obtained on the "2. DANSKE NÛGSSUAQ EKSPEDITION 1939" under the leadership of Professor ALFRED ROSENKRANTZ. A few collections date from the G.G.U. expeditions in 1947 and 1948.

I wish to express my most sincere thanks to Professor ALFRED ROSENKRANTZ, who gave me the opportunity of taking part in the expeditions in 1939 and 1946, and who all the time watched my work in the field as well as at home with a never failing interest. I thank for many instructive and inciting talks and much good advice, without which it would have been very difficult for me to carry through the present work, far away, as I ordinarily was, from collections and libraries.

To Professor ADOLF S. JENSEN, Ph. D., my old teacher of zoology, I am also very much indebted for the interest which, though busily engaged in his own work, he showed me and my investigations by giving me the opportunity of profiting largely by his vast knowledge of Arctic marine biology, acquired through nearly two generations of active research work.

I desire to thank Mr. PETER KÆSTEL, M. Sc., headmaster of Haslev Gymnasium, for granting me the leave of absence which rendered possible my stays in Greenland, and for the readiness with which he complied with my wishes concerning the arrangement of my daily working plan that enabled me to utilize my spare time as much as possible.

I also wish to thank Professor A. NOE NYGAARD, Ph. D., Director of the Mineralogical and Geological Institute of the University of Copenhagen, and Professor R. SPÄRCK, Ph. D., Director of the Zoological Museum of the University of Copenhagen, for permission to make use of the libraries and the collections of the respective museums.

A special debt of gratitude I owe to my fellow expeditionists State Geologist HELGE GRY, Ph. D., State Geologist KELD MILTHERS, Ph. D., geology students Miss EVA LA COUR, Mr. KNUD JACOBSEN, Mr. ESKE KOCH, and Mr. KNUD ELLITSGAARD RASMUSSEN, who together with Professor A. ROSENKRANTZ have assisted me with observations and collections of material at localities, which I myself could not manage on account of the short summer time in Greenland in connection with the great extent of the country. I also owe thanks to the many Greenlanders who helped me in the field at various times. Lastly, but very far from least, I wish to thank Mr. BENT SØNDERGAARD, M. Sc. who assisted me all the summer of 1946, for the interest he took in the work and the never failing zeal he displayed. He spared no pains to secure the best possible results.

Mr. ROB. JØRGENSEN, M. A. has undertaken the translation, and the drawings have been performed by Mr. JUUL NIELSEN, Engineer and Mr. M. E. KNOP, Draugthman. The CARLSEN-LANGE FOUNDATION has contributed to the preparation and the publication of this report, for which I thank respectfully.

Haslev, July 1949. DAN LAURSEN.

INTRODUCTION

When the writer of the present report in 1939 was asked by Professor A. ROSENKRANTZ to begin the investigation of the Greenlandic marine Quaternary deposits in North Greenland, there had, for more than a century, been made seperate investigations and much collecting from these layers. A historical survey of these has been published in 1944 (41). However, the observations and collections, that were made, were of a rather scattered and casual character, and until 1939 no attempt had been made to collect what was known, just as only a minor preliminary account had been published by JENSEN and HARDER (30), who after a close investigation of a small area at Disko Bugt attempted a stratigraphic division of the layers at this place. A plan was made, according to which it was decided that the work should be done through several stages, the temporary aim being the achievement of a stratigraphic division of the marine Quaternary, applying to the whole of West Greenland. When this was attained, the different horizons, if any, could be correlated with the corresponding raised terraces and deltas. The investigation was to be commenced in the northern districts and gradually be extended southward. Furthermore a great piece of work presented itself by summarizing the previous investigations and determining a good deal of unprepared shell material, which was found in the Mineralogical and Geological Museum of the University of Copenhagen. All this was to be combined with the new investigations from 1939. The years of involuntary isolation during the German occupation of our country were used inter alia in this work, and in 1944 the results were published (41).

The mentioned report deals with the conditions at Ûmánaq Fjord, partly at the southern portion of the Svartenhuk peninsula, which is moreover more fully discussed in a seperate account (69), partly on the north and west side of the Nûgssuaq peninsula and on both sides of Vaigat, the water separating Disko from the Nûgssuaq peninsula. On the south side of Nûgssuaq the investigations ceased at Qardloq. On Disko investigation was limited to the area which is found on the Geodetic Institute map 70 V. 1 Nûgssuaq.

In the report an account was also given of the level changes within the area investigated. The upper marine limit was ascertained, and it was established that this was considerably higher than supposed. A stratigraphic division was attempted, but as this only applied to a minor part of West Greenland, a generalization was out of the question.

In addition all previous collections of Quaternary shells from Nordre Strømfjord to Svartenhuk were worked up, and a summary was given of all molluscs found and their recent occurrence at Greenland and in the remainder of the North Atlantic area.

As already stated a stratigraphic division was only attempted on the basis of a separate investigation of a minor area, viz. JENSEN's and HARDER's investigation in Sydostbugten in the interior of Disko Bugt. A preliminary account was published in 1910 (30), but owing to various circumstances, among them HARDER's death, the collected material had never been published. In 1945 the present writer received an invitation from Professor AD. S. JENSEN to prepare HARDER's diaries and put them into such shape that they could be published together with AD. S. JENSEN's lists of fossils.

When at the same time the present writer, as an assistant at the Geological Survey of Greenland (G.G.U.), was asked by Professor A. ROSENKRANTZ to continue, in the summer of 1946, the investigations in Greenland commenced in 1939, and inter alia in the very area visited by JENSEN and HARDER, Professor AD. S. JENSEN's proposal was accepted with gratitude. An opportunity was hereby given to get a very detailed knowledge of a key area in the marine Quaternary geology of Greenland, besides which a verification of the preparation of HARDER's diaries and possible supplements or corrections could be made in the field. After the return from Greenland in the autumn of 1946 it was possible to work out and publish the summarizing chapters of the report (21).

In the preliminary account by JENSEN and HARDER (30) a stratigraphic sequence of the layers in the localities of Orpigsôq and Sydostbugten (op. cit., p. 405) was set up. This schema is extended in the final work (21) to include the localities of Kangersuneq and Lerbugten south of Claushavn, too, in the latter place partly on the basis of AD. S. JENSEN's lists of fossils, partly based on a personal inspection in the field in 1946.

In the present work an examination is to be made of the possibility of maintaining the stratigraphic sequence of layers in the hitherto investigated area. This extends from Kûgssuaq at Sarqaq, about 10 km. east of Qardloq in the north to the settlement of Sukkertoppen in the south, a stretch of more than 500 km. in a direct line, which, however, will be multiplied several times considering the much indented course of

the coast line. Altogether about 30 localities have been investigated, and about 150 samples have been brought home, the total weight of which amounted to about .5 ton. This considerable weight of a shell material is due to the fact that in most of the localities very big samples have been taken with the aim of getting as exact a picture of the fauna as possible. In particular it was desirable to secure as many of the small specimens as feasible. After the home-coming clay and sand have been washed from the samples and the rest sorted by hand.

It has proved necessary to make a revision of results previously obtained from the area about Ûmánaq Fjord, so that the field of investigation is extended towards the north to the Svartenhuk peninsula.

The writer has been anxious to confine himself to deal with the subject only: the stratigraphic division of the marine Quaternary, even if there is extant a great material of observations and investigations of moraines, striae, melt water formations etc., besides which additional material has been procured for examinations of the variations in the shell shapes of the different species occurring in the layers. Yet it will be natural to mention some conditions that is connected with the stratigraphic division, even if later works on these subjects have been planned.

The study of the marine Quaternary stratigraphy in the northern part of West Greenland must not be looked upon as concluded with this work, on the contrary it must be taken as a basis for continued investigations.

DESCRIPTION OF LOCALITIES

Plate 1.

Jakobshavn District.

Kûgssuaq at Sarqaq. The investigations have been made by Professor A. ROSENKRANTZ and Mr. ESKE KOCH and Mr. KNUD JACOBSEN, geology students. In the valley, leading to the interior of Nûgssuaq there was about 3.5 km. from the outlet of the river a mud volcano, on the sides of which at about 20 m. above sea level there was found a great number of shells in the clay pressed up there. These shells were identified as belonging to the following species:

Cardium ciliatum FABR. 8 shells and some fragments.
Serripes groenlandicum (CHEMN.) 2 shells and some fragments.
Macoma calcaria (CHEMN.) 1 specimen, about 100 shells and many fragments.
Mya truncata (L.) 13 shells and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 2 shells.
Buccinum tenue GRAY. Fragments of 7 specimens.

On the inner side of the top of the big cone which crowns the big mud volcano at the west side of the river, Mr. KNUD JACOBSEN found:

Macoma calcaria (CHEMN.) 2 big fragments.

Igdluluarssuk, 3 km. west of Sarqaq. Here was a terrace with frontal edge at 5 m. above sea level and inner edge at 12 m. above sea level. The terrace consists partly of fine sand and partly of stony sand. Investigation and surveys of this locality and the following ones up to and including Kangârssuk, north of Rodebay, have been made by State Geologist H. GRY, Ph. D.

Ikorfat. At the outpost were three terraces:

Outer edge 7 m. above sea level. Inner edge 8 m. above sea level.
Very distinct.
— — 12 m. — - — — — 15 m. — - —
Only poorly developed.
— — 17 m. — - — — — 21 m. — - —
Pronounced.

All three terraces consist of sand and gravel with many stones, but with no shells.

Oqaitsoq island, on the south-west side, about 1.5 km. south-east of Niaqornaq. Here were two terraces:

Outer edge 4 m. above sea level.	Inner edge 6 m. above sea level. Well developed, beach gravel.
— — 7 m. — - —	— — 8.5 m. — - — Well developed.

The structure could be seen in the scarp of the terrace. Clay was found lowest down, somewhat stony, superposed by sandy clay, over it sand, and uppermost gravel.

In the clay the following shells were found:

Pecten islandicus MÜLL. 4 fragments.
Mytilus edulis L. 2 small fragments.
Serripes groenlandicum (CHEMN.) 1 fragment.
Macoma calcaria (CHEMN.) Some large fragments, one of which drilled by *Natica*.
Mya truncata (L.) Some fragments.
Lepeta coeca (MÜLL.) 1 specimen.
Balanus balanus DA COSTA. 3 shells.

The clay has been deposited under Arctic climatic conditions like the present conditions at the west coast of Greenland.

Oqaitsoq river. In the river bank the following section was measured.

0.00— 1.75 m. stony beach.
1.75— 2.50 m. recent beach ridge.
2.50— 5.00 m. steep slope in lowest terrace. The material consisted exclusively of beach boulders 5—20 cm. in diameter.
5.00— 8.50 m. 1st terrace.
8.50—11.00 m. gentle slope.
11.00—25.00 m. steep slope.
25.00—28.50 m. 2nd terrace.
28.50—36.00 m. slope.
36.00—51.00 m. very big terrace.

Arnâ. At the river of the same name west of the Nordvesthalvøen of Arveprinsens Ejland a terrace was found at 6 m. above sea level.

Langebugt. At the head of the bay there was also a terrace at 3 m. above sea level.

Ritenbenk. At the outpost two terraces were found:

Outer edge 11 m. above sea level. Inner edge 12 m. above sea level.
Fine gravel.
— — 20 m. — - — — — 27 m. — - —

The uppermost terrace consists in the lowest portion of small beach pebbles, which inland increase in size up to 30 cm. in diameter. A concentration of closely packed boulders, obviously the old beach ridge, was found at 27 m. above sea level. On the terrace flat at about 24—25 m. altitude is the cemetery. PJETURSSON reports this altitude to be 42.5 m. (64, p. 317), but this figure must be erroneous, as Dr. GRY's figure is based on two sets of measurements.

Kangeq south of Ritenbenk. Here were two terraces cut by a river.

Outer edge 22 m. above sea level. Inner edge 27 m. above sea level.
— — 28 m. — - — — — 35 m. — - —

The low terrace is composed at the foot of sandy clay with stones, at the top is a concentration of closely packed boulders. In the clay the following shells were found:

Pecten islandicus MÜLL. 2 small fragments.
Modiolaria sp. 1 small fragment.
Macoma calcaria (CHEMN.) 3 shells and some fragments.
Saxicava arctica (L.) 12 shells, some rather large and thick, a couple of them "pinched", furthermore a number of fragments.
Mya truncata (L.) 3 shells and some fragments.
Balanus balanus DA COSTA 4 shells.

The clay has been deposited under Arctic climatic conditions.

Quvnerssuaq south of Kangeq. Here was a terrace:

Outer edge 5 m. above sea level. Inner edge 8.5 m. above sea level.

Igdluluarssuit island. At the south point of the same name the following section was measured:

2.5 m.— 5.0 m. above sea level. Terrace.
5.0 m.— 8.5 m. — - — Slope.
8.5 m.—11.0 m. — - — Poorly developed terrace.
at about 16 m. — - — Well developed terrace flat, gravelly.

Atâ. At the boat-harbour the following terrace section was measured:

Outer edge 5.5 m. above sea level. Inner edge 11.0 m. above sea level.
— — 14.5 m. — - — — — 16.0 m. — - —
— — 18.7 m. — - — — — 21.5 m. — - —
— — 25.5 m. — - — — — 29.0 m. — - —
— — 30.5 m. — - — — — 34.0 m. — - —
— — 55.0 m. — - — — — 58.0 m. — - —

2 delta fronts measured at 60 m. above sea level had corresponding tops at 70 m. above sea level. Terrace notches were furthermore observed at 105.0 m. and 120.0 m. and about 160—170 m. above sea level. Clayey sediment was found up to 185 m. above sea level.

Atâ. Taserssuaq. At the south end of the lake the following terrace section was surveyed:

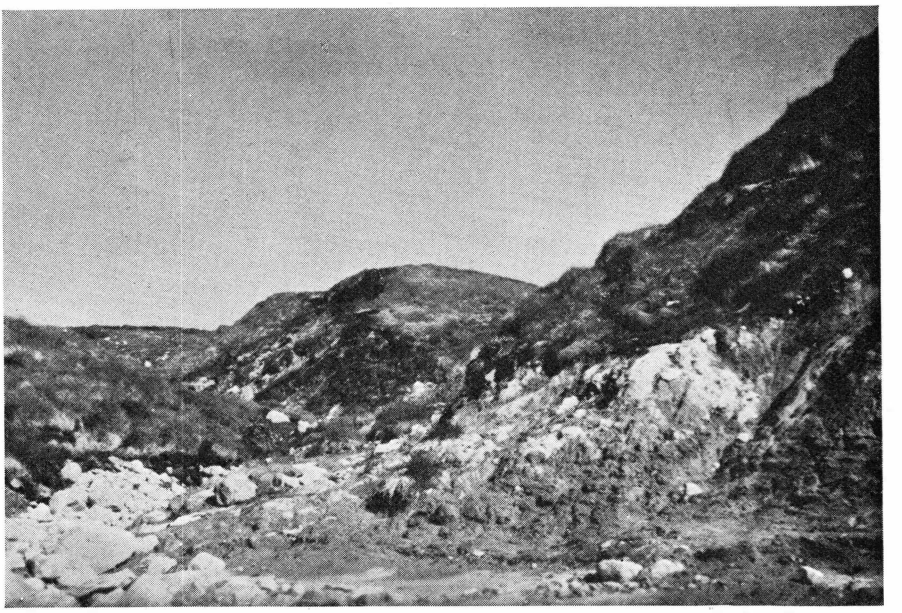
The surface of the lake. 6 m. above sea level.
Outer edge about 9.0 m. above sea level. Inner edge 10.5 m. above sea level
— — — 14.3 m. — - — — — blurred.
— — — 18.8 m. — - — — — 21.0 m. — - —
— — — 23.6 m. — - — — — 25.0 m. — - —
— — — 30.0 m. — - — — — 39.0 m. — - —
— — — 53.5 m. — - — — — 68.6 m. — - —
— — — 76.0 m. — - — — — 81.5 m. — - —

The island in Kangerdluarssuk. Here is a terrace with outer edge at 3 m. above sea level and inner edge at 4 m. above sea level. Above is a terrace flat at 5—6 m. above sea level. Determination of outer and inner edges was not possible.

Kûgssuaq south of Kangerdluarssuk. On its south side were some rather weak terraces. To the north-east was a system of terraces which were obviously better developed.

The hinterland behind Nordre Næs north of Jakobshavn. The coast from Jakobshavn to Spraglenæs consists exclusively of gneissic rocks. Behind the rocks is a large clay plain with characteristic naked clay circles. Where the plain abuts against the coastal rocks the altitude is about 50 m. above sea level. The plain slopes gently upwards to Akínaq up to nearly 60 m. above sea level. No shells were found in the clay.

Sermermiut. (Fig 1). The place is known as an archaeologic locality, and in 1939 a little collection was undertaken by Professor A. ROSEN-



Auct. phot. 7.-8.-1946.

Fig. 1. Sermermiut. In the foreground the *Portlandia* clay. The sand layer is seen in middle distance. At both places the culture layer has slumped down over the marine layers.

KRANTZ at the place (41, p. 119). A rivulet cuts down through the ruined dwelling place and forms a small V-shaped valley, in the sides of which there was at 22 m. above sea level a sand layer, superposing a layer of fat clay with shells. Towards the coast the sand layer emerges into a sandy clay horizon. Lowest down in this clay horizon there is a predominance of *Macoma calcaria*. Further up *Mya truncata* appears and becomes dominating. In the direction of the coast the lowest horizon of fat clay reaches up to the Eskimo culture layer, as the other layers have tapered off. The culture layer is very thick, at places up to 2.5 m. The following shells were collected:[1])

In sandy clay, at 15 m. above sea level.
Serripes groenlandicum (CHEMN.) 1 fragment.
Macoma calcaria (CHEMN.) 1 specimen, 30 shells and many fragments, often of rather large specimens.
Saxicava arctica (L.) 5 shells and some fragments.
Mya truncata (L.) Many fragments.
Mya truncata (L.) forma *ovata* JENSEN. 2 shells.

[1]) Here and throughout this report it should be observed that shells, which have been carried into the deposit by some form or other of contamination, are not included in the list of fossils.

The climatic conditions have been Arctic, when the layer was being deposited. In the clay at 4 m. above sea level the following species were collected, the same as earlier collected by ROSENKRANTZ:

Portlandia arctica (GRAY). 1 shell.
Macoma calcaria (CHEMN.) 9 shells and some fragments.

The clay was deposited under high-arctic climatic conditions.

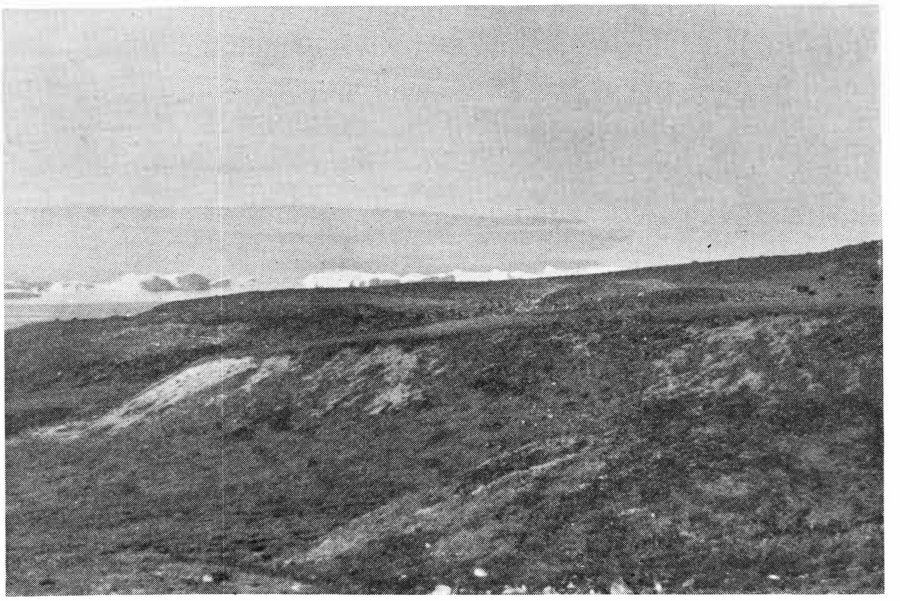
Christianshaab District.

Qarsortoq. This locality is situated just south of the outlet of Qarsortup kûa, which rises on the south slope of Iviangernat (444 m.). Here clay was found at the coast, directly deposited on the gneiss. On the almost whity-grey rocks, washed clean by the sea, appeared striae with chatter marks, which showed an east-west glacial movement. The clay stood as a fresh wall facing the sea as a cliff 15 m. high. The clay was rather fat. Shells were collected at about 2—10 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 1 shell and some fragments.
Leda pernula (MÜLL.) 1 specimen, 2 shells and some fragments.
Yoldia hyperborea LOVÉN. 1 specimen.
Portlandia arctica (GRAY). Several hundred specimens and shells and many fragments. Some shells drilled by *Natica*. The shells were without periostracum.
Cardium ciliatum FABR. 5 shells and many fragments.
Macoma calcaria (CHEMN.) About 100 shells, large and solid, some drilled by *Natica*. Many fragments.
Saxicava arctica (L.) 32 shells and many fragments.
Mya truncata (L.) Some small shells and a few fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 1 shell.
Lepeta coeca (MÜLL.) 1 specimen.
Natica clausa BROD. and SOW. 6 somewhat damaged specimens.
Buccinum sp. 1 fragment.

The clay was deposited under high-arctic climatic conditions.

North of Qarsortup kûa the clay cliffs continue along the coast, everywhere resting on the gneiss, which also here shows many striae and chatter marks. The length of the cliff is about 300 m., and it is about 15 m. high. The clay of the cliff becomes sandy upwards unlike the cliff at the river. The following shells were collected at 5—15 m. above sea level:



Auct. phot. 2.-8.-1946.

Fig. 2. Qarsortup kûa. The outer edge of terrace 3 (43—75 m. above sea level). The beach line is seen a little to the right of the middle of the picture.

Portlandia arctica (GRAY). 8 specimens, 28 shells and some fragments. Some shells were drilled by *Natica*, none with periostracum.

Cardium ciliatum FABR. 2 shells and 4 big fragments.

Macoma calcaria (CHEMN.) 98 shells, some of which were rather large, and more than 100 fragments. Some drilled by *Natica*.

Saxicava arctica (L.) 8 shells and some fragments.

Mya truncata (L.) 2 small shells, adults, 5 fragments of small shells.

Lyonsia arenosa (MØLL.) 1 shell and 1 fragment.

The clay has been deposited under high-arctic climatic conditions.

On the slope of the cliff just at the top were furthermore found as loose-lying shells:

Pecten islandicus MÜLL. 1 small shell.

Mya truncata (L.) 1 shell of an almost *ovata*-like form.

These two shells are a contamination from younger layers, of which, however, no trace was found.

Father to the north some clay is still found under a slumped-down concentration of closely packed boulders with sand. Clay was not found north of Nordre Huse.

Auct. phot. 2.-8.-1946.

Fig. 3. Qarsortup kûa. The inner edge of terrace 3. This beach line must be considered very typical, rising above the terrace flat with the big boulders on the surface.

A series of terraces was found inland by following Qarsortup kua:

Outer	edge	5 m.	above	sea	level.	Inner	edge	10 m.	above	sea	level.
—	—	20 m.	—	-	—	—	—	36 m.	—	-	—
—	—	43 m.	—	-	—	—	—	75 m.	—	-	—

A marked beach line consisting of big boulders was found at 49 m. above sea level. Below this the terrace showed a steeper slope than above (fig. 2 and 3). Above 75 m. above sea level was a portion where the terrace picture was obscured by projecting gneiss knobs. The terraces which had formed above these knobs were without definite outer- and inner edges on account of solifluction. A survey was only made when the surveyor was judged to be in the middle of the terrace flat. The figures for 5 terraces were:

145 m.	above	sea	level.
160 m.	—	-	—
165 m.	—	-	—
170 m.	—	-	—
174 m.	—	-	—

Similarly the upper marine limit was roughly measured to be 185 m. above sea level, which is by no means too high.

The whole area behind Iviangernat up to Taserssuaq was subjected to investigation, but no trace was found of marine Quaternary. On the other hand there were many evidences of an earlier glaciation of the area.

Claushavn. STEENSTRUP has here, as at a number of other places, by levelling fixed a point with the aim of being able to determine the subsidence of the land (76, p. 240). In an earlier paper the present writer has published some remeasurements of these points (41, p. 100 ff.), in which he stated a subsidence of 1.17 m., 1.17 m. and .58 m. for Ritenbenk, Jakobshavn and Godhavn respectively during a century. The last mentioned figure is based on measurements by FRODA (18). By a way of measuring somewhat different to that of FRODA and on the basis of a remeasurement in 1949 EGEDAL has found the subsidence during a century to be 1.08 m. (15). It was also the intention of the present writer to continue the remeasurements, which, however, appeared to be very difficult, as some of STEENSTRUP's points were no more to be found. For instance, mention may be made of the conditions at Claushavn, but similar conditions were met with at other places, where economical development has led to extentions of harbours, by which for instance the previously employed ringbolts, frequently used by STEENSTRUP for fixed points, were covered with earth, concrete etc.

STEENSTRUP reports (76, p. 242) for Claushavn: "Ringbolt below Assistant's House, 1.6 m. above normal high tide, March 1880." At the search for this ringbolt at Claushavn it appeared that the statement was very vague, as the present writer found 2 ringbolts R_1 and R_3 together with the hole of a third R_2 below the house (fig. 4). Of these R_1 is not very old, the bolt being fixed to the rock by cement, while R_3 has been fixed to the rock by lead, which was common in former times. In the hole of R_2 there was no trace of cement, but lead was supposed to be present on the bottom of the hole. The possibility of the presence of still another ringbolt or more at the now used landing-place, which was cemented after STEENSTRUP's visit to the outpost, cannot, however, be left out of consideration. A remeasurement was made of all three present possibilities. The measurement was made at normal high tide, and it was commenced half an hour before the time when the tide was estimated to reach its climax. The rise of the water was observed and measurements did not finish until the fall of the water was noticeable. The altitudes above normal high tide of the three ringbolts were: R_1 2.16 m., R_2 1.80 m., R_3 1.23 m. As it is proved a submergence of between 1.08 and 1.17 m. (average 1.125 m.) a century in this area, STEENSTRUP's ringbolt should now be found at about 85 cm. above normal high tide. The difference in altitude between the three ringbolts concerned and that of STEENSTRUP's

is so great that there cannot be any doubt that STEENSTRUP's measurement is not connected with any of the now existing ringbolts.

It is impossible entirely to ignore the difficulty of determining the level of high tide, in 1880 as well as nowadays. Furthermore attention must be drawn to possible errors attached to such measurements as are made at different times, by different persons and with different instruments. Add to this that, as stated, it is difficult to find STEENSTRUP's fixed points again, and it will be understood that the writer has desisted

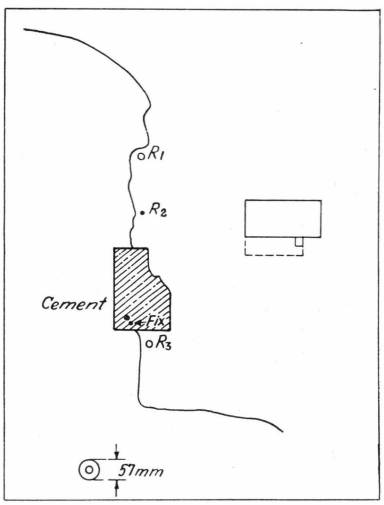


Fig. 4. Sketch of the landing-place at the outpost of Claushavn with statement of the old ringbolts and the situation of the new fixed point. Below: form and dimension of the new fixed point.

from further checks on the old fixed points, the more so because another Danish State Institution, viz. Meteorologic Institute, Copenhagen, is undertaking tide-gaugings at various localities in Greenland. A gauging like this has not been commenced at Claushavn, and therefore a new fixed point was set up on July 20, 1946. The new fixed point is the southernmost eye-bolt in the rock, to which the crane post is fastened. The height of the bolt is 57 mm. (fig. 4), and the measurements were made up to the top of the bolt. This point is placed at 3.10 m. above normal high tide.

Clay with shell fragments was found in the small bay "Kirkegaardsbugten" north of the outpost. The section is very much covered with scree and contaminated by the traffic of people and dogs. Behind the outpost is a plain (Lersletten) which rises evenly from the coast up to 50 m. above sea level. Large clay circles can be seen at the more desiccated places of the surface. Shells were not found. The coast south-

ward to Sandbugten is rocky, and the hinterland up to Tasiussaq is characterized by gneissic outcrops.

Sandbugten south of Claushavn. (Fig. 5). Along the eastern part of the bay, a little north of the sandy headland, no longer existing, but marked on Geodetic Institute map 69 V. 2, the present writer observed a cliff, about 200 m. long and 15 m. high, which consists exclusively of sand and gravel with big boulders, a typical delta formation. At the head of the bay a river debouches, forming a rather large delta. The land

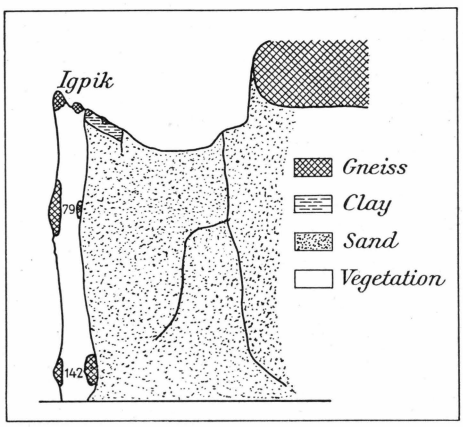


Fig. 5. Sketch of Sandbugten south of Claushavn. Drawn from point 79 m. and Pinguarssûp qáqâ (142 m.).

behind consists of flat plains that stretch as far as down to Maagefjeld (Gr. Naujánguit) and Uglefjeld (Gr. Ugpiup qáqâ). The surface in the area nearest to Sandbugten consists of large vegetation-free stretches, cut up by the river and its tributaries. The deposit seems to be composed exclusively of sand and gravel. The surface and gully sides are covered with stones of the size of walnuts. Whether there was a clay core in the deposits, could not be ascertained, even if there were many cuttings in the layers, beautiful V-shaped gullies, fashioned by rain and melt water. There can be no doubt that one is here confronted with a delta formation of very considerable dimensions. The delta gradient stood out distinctly, particularly on the portions sloping down to the coast. The altitude of the surface was measured at numerous places to be 25 m. above sea level. A gneissic knob (79 m. above sea level) rises above the plain in the neighbourhood of Igpik, from which there is a fine view of the whole plain, just as one can look along the coast of Disko Bugt from Igpik to Maagefjeld.

As far as the eye reaches the ground rises from the sea in 4 terraces:

Auct. phot. 31.-7.-1946.

Fig. 6. View of the coast cliff between Igpik and Pinguarssûp qâqâ below the latter locality, showing delta structure.

Outer	edge	5 m.	above	sea	level.	Inner	edge	10 m.	above	sea	level.
—	—	15 m.	—	-	—	—	—	22 m.	—	-	—
—	—	32 m.	—	-	—	—	—	40 m.	—	-	—
—	—	50 m.	—	-	—	—	—	55 m.	—	-	—

At the bottom the coastal cliff is built of sand with stones that upwards emerges into gravel and big boulders (fig. 6). In Sandbugten on its southern bank the cliff passes, after some interruptions of gneissic projections, into a low cliff which at the base is composed of fat clay, superposed by stratified sand. The clay juts right out into the bay where it forms the bottom over a large area. The following shells were found in the clay:

Leda pernula (MÜLL.) 1 large fragment.
Portlandia arctica (GRAY). 1 specimen.
Serripes groenlandicum (CHEMN.) 1 large fragment.
Macoma calcaria (CHEMN.) Several hundred shells, from rather large (35 mm.) to quite small, and many fragments.
Buccinum sp. 1 fragment.

The clay has been deposited under high-arctic climatic conditions. No shells were found in the sand.

Lerbugten (Marrait) south of Claushavn. The above-mentioned sand and gravel deposits inside Sandbugten extend farther southward down to the northern side of Pinguarssûp qáqâ (142 m. above sea level). South of this they pass into the large Lersletten (Clay plain), which stretches from the coast up to the head of Tasiussaq in the east and all the way to Maagefjeld and Uglefjeld in the south. The coast from Igpik southward to the section off Pinguarssûp qáqâ is built of low sandy, gravelly and bouldery cliffs, varying about 5—10 m. in height. Clay does not occur anywhere on this stretch, but gneissic outcrops jut out at small intervals from the cliff. South of this section 3 bays cut into the coast. In the literature they are mentioned under the name of Lerbugten south of Claushavn. By the Greenlanders the northernmost of the three bays is named Pinguarssuk, a name i. a. used by HAMMER (20). The cliffs facing these bays are for the main part built of clay and sand with shells. In Pinguarssuk, where Pinguarssûp kûa debouches, the writer found the following cliff structure (fig. 7): The portion from a to b is clearly stratified fine and coarse sand, which at the upper part of the cliff passes into gravel layers and layers with big boulders, and this leaves a very stony beach when the cliff is eroded, so that a regular stony head forms off the cliff. From b to c and from c to d the layers become more and more clayey and some shells occur. The portion a—b is a typical delta formation. Originally the whole stretch a—d has been built of clay, but a big stream rising in Tasiussaq, of which Pinguarssûp kûa is the last remnant, has eroded through the layers as the land rose. Simultaneously the coast line moved outward, and fine sand, coarse sand, gravel and at last the coarsest material were deposited.

At the bottom the cliffs in the middle bay (fig. 8) are composed of fat clay up to about 10 m. above sea level. There are very few shells in the clay. A big clay sample of 20 kg. contained:

Portlandia arctica (GRAY). 4 large specimens.
Cardium ciliatum FABR. 3 fragments.

Upwards the clay becomes somewhat sandy, but it was not possible to distinguish any definite horisontal division. Scattered in the layer at about 15 m. above sea level the following shells were collected:

Nucula tenuis (MONT.) var. *expansa* REEVE. 1 shell and 1 fragment.
Cardium ciliatum FABR. Some fragments of large shells.
Serripes groenlandicum (CHEMN.) Some fragments of a very large shell.
Macoma calcaria (CHEMN.) 67 unbroken shells, equally many slightly damaged, and some fragments. 2 shells drilled by *Natica*.

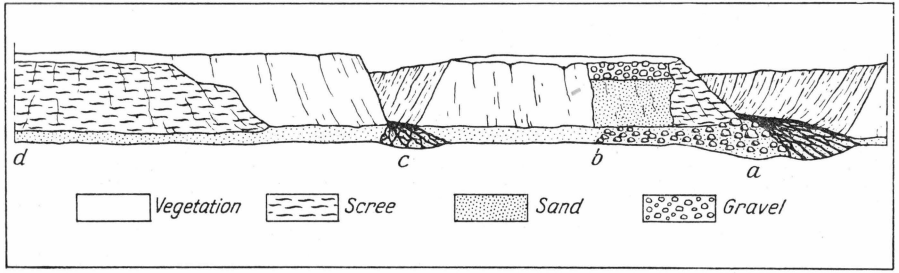


Fig. 7. Section of the coast cliff in the bay of Pinguarssuk. The river Pinguarssûp kûa debouches at a.

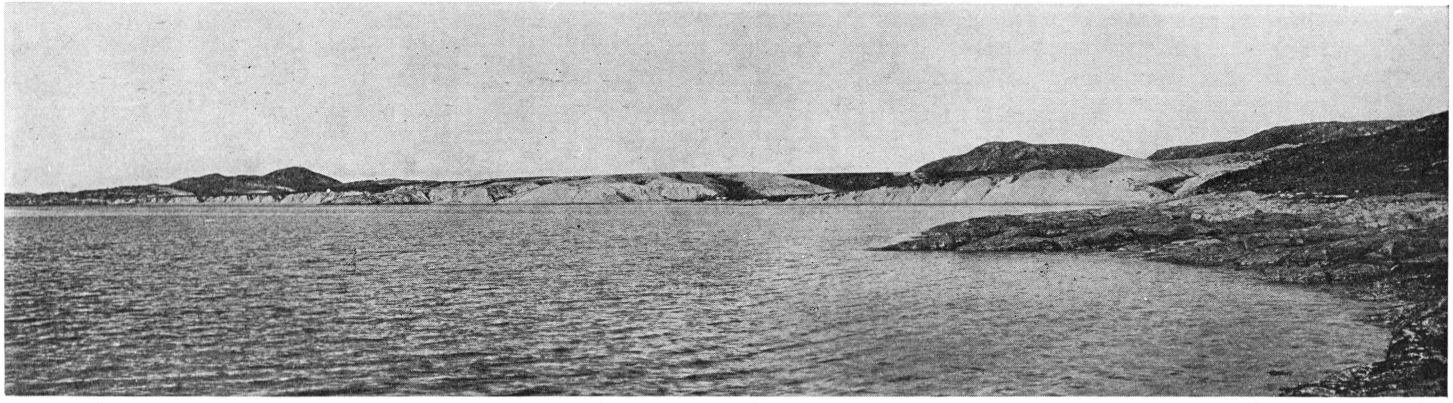
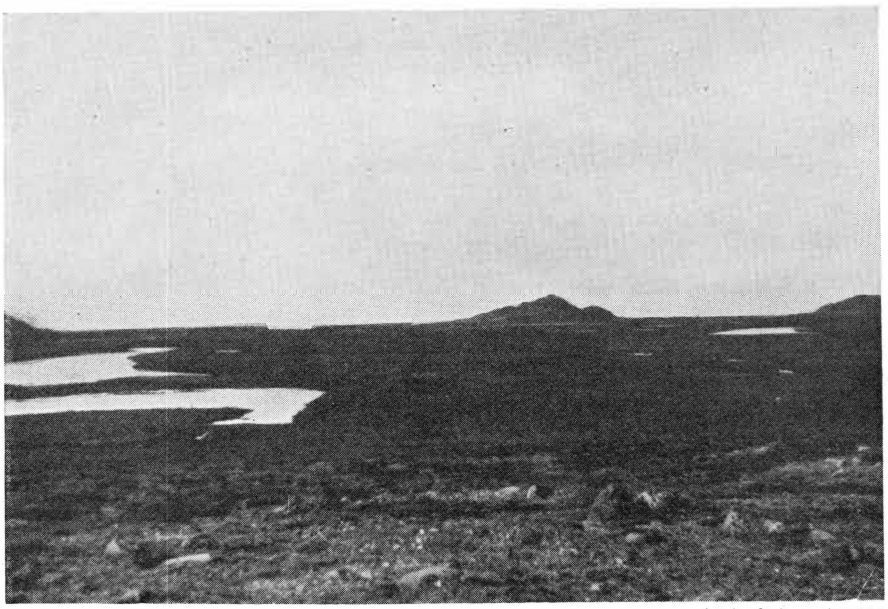


Fig. 8. The midmost and the southernmost bays of Lerbugten. (POUL HARDER phot. 1906).



Auct. phot. 26.-7.-1946.

Fig. 9. View of Lersletten from Tasiussaq towards Disko Bugt. In the background Pinguarssûp qáqâ. To the left of Pinguarssûp qáqâ the river notch in the terrace edge.

Saxicava arctica (L.) 12 shells and some fragments.
Mya truncata (L.) 12 shells, many fragments and remnants of siphons.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Balanus crenatus BRUG. 1 shell.
Strongylocentrotus drøbachiensis (MÜLL.) 1 fragment.
Bryozoa sp. 1 specimen.

While the clay has been deposited under high-arctic climatic conditions, the sandy clay must be deposited under more favourable conditions, which is indicated by the occurrence of *Balanus hammeri.*

The layers of clay are superposed by a sand layer 4—5 m. thick showing a fine stratification. This was succeeded by gravel of varying thickness, which was again overlain by drift-sand. The top of the cliff at this place was 25 m. above sea level. It appears very clearly from the upper part of the sequence that one is confronted with one of the impressive outfalls of the big river, which was once an agent in fashioning the surface of the large Lerslette. This is also obvious when one stands in the middle of the plain and looks towards the coast, where a conspicuous cut in the edge of the plain indicates the old outfall. (Fig. 9).

In the southernmost of the three bays three sections were surveyed, one southernmost in the bay, one in the middle, and one at the northern

end of the bay. The three sections show great conformity. The lowest layer of the cliffs is made up of clay, which reaches up to about 10 m. above sea level. The clay becomes more and more sandy upwards. In the southernmost section a regular beach formation with pebbles and a concentration of shells were found at 15 m. above sea level. In the overlying horizon was fine sand with another concentration of shells containing seaweeds, *Pectinaria* siphons and shells. The altitude of the southernmost section extended up to 40 m. above sea level, but the uppermost ten metres or so consisted of slumped-down gravel and fair-sized boulders. From the top edge of the section the ground sloped gently up to the terrace surface at 50 m. above sea level. The middle section is situated at a gully. Fat clay constitutes the lowest layer up to just under 10 m. above sea level. It is superposed by sandy clay, which upwards becomes more sandy until about 20 m. above sea level, where there is fine sand. This is overlain by regular layers of gravel up to the top of the section, with the exception of a clay band, 10 cm. thick, at 30 cm. under the top, which is here 28 m. above sea level. The northernmost of the sections resulted from a shaft excavation. The altitude of the cliff was here 26 m., and over that is a gentle slope up to the terrace flat. The sequence of the northernmost section was as follows:

0.0— 9.3 m. Clay, sometimes with sand bands. Contains shells.
9.3—16.2 m. Clay, somewhat sandy, with interspersed irregular sand smears. Contains shells.
16.2—19.8 m. Sandy clay bed with few shells.
19.8—21.5 m. Hard clay (shale) with big-fragmented clay, a few shells.
21.5—23.8 m. Clay with sand smears up to 10—15 cm.
23.8—24.6 m. Sandy clay without shells.
24.6—25.2 m. Sandy clay with few shells.
25.2—25.5 m. Sand bed with many shells.
25.5—26.0 m. Sand bed.

This table may be taken as a pattern of the total structure of the cliff.

The shells collected in the sections were the following:

2.5 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 2 shells and some fragments. 1 shell is drilled by *Natica*.
Leda pernula (MÜLL.) 2 fragments.
Yoldia hyperborea LOVÉN. 5 fragments.
Portlandia arctica (GRAY). 2 shells and 5 fragments.
Cardium ciliatum FABR. 10 fragments or so.
Serripes groenlandicum (CHEMN.) About 30 fragments of rather large shells.

Macoma calcaria (CHEMN.) About 100 specimens and shells, large and medium, and some fragments. Some shells drilled by *Natica*, some with periostracum preserved.
Saxicava arctica (L.) 3 shells.
Mya truncata (L.) 3 small shells, some fragments and remnants of siphons.
Balanus balanus DA COSTA. 1 shell.

4.0 m. above sea level:

Portlandia arctica (GRAY). Fragments.
Serripes groenlandicum (CHEMN.) 2 fragments.
Macoma calcaria (CHEMN.) 1 specimen, 2 shells, and fragments of rather large shells.
Saxicava arctica (L.) 3 specimens and many fragments.
Mya truncata (L.) 1 shell and some fragments of a few small shells.

9.5 m. above sea level:

Portlandia arctica (GRAY). Many specimens and shells with periostracum preserved, and many fragments. Maximum shell length 21 mm.
Cardium ciliatum FABR. 2 small fragments.
Macoma calcaria (CHEMN.) 10 fragments or so.
Mya truncata (L.) Some few, small fragments.
Lyonsia arenosa (MØLL.) 1 shell and 1 fragment.

15 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 1 shell and some fragments.
Leda minuta (MÜLL.) 2 fragments.
Yoldia hyperborea LOVÉN. 1 fragment.
Serripes groenlandicum (CHEMN.) Some fragments.
Macoma calcaria (CHEMN.) Some fragments.
Mya truncata (L.) Some fragments.
Balanus sp. 1 shell (juvenile).

16.2 m. above sea level:

Macoma calcaria (CHEMN.) Some fragments.
Mya truncata (L.) Many fragments.
Balanus sp. 2 shells.

19.8 m. above sea level:

Portlandia arctica (GRAY). 1 specimen.
Macoma calcaria (CHEMN.) 1 shell and 4 fragments.
Mya truncata (L.) 3 fragments.

22.4 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 2 specimens and 2 fragments.
Portlandia arctica (GRAY). 6 fragments.
Macoma calcaria (CHEMN.) 3 shells and 1 fragment.
Mya truncata (L.) 2 fragments.

23.4 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 2 crushed specimens.
Yoldia hyperborea LOVÉN. 3 fragments.
Serripes groenlandicum (CHEMN.) Fragments of a shell.
Macoma calcaria (CHEMN.) 18 shells and some fragments.
Saxicava arctica (L.) 2 shells and some fragments. A couple of them with two ridges on the hind part.
Mya truncata (L.) A great number of fragments with periostracum preserved.

25.25 m. above sea level:

Nucula tenuis (MONT.) var. *expansa* REEVE. 1 shell.
Serripes groenlandicum (CHEMN.) 1 fragment.
Macoma calcaria (CHEMN.) 3 shells and 1 fragment.
Saxicava arctica (L.) 2 shells and 3 fragments.
Mya truncata (L.) 1 shell and some fragments.

Approximately 26 m. above sea level. Southern section:

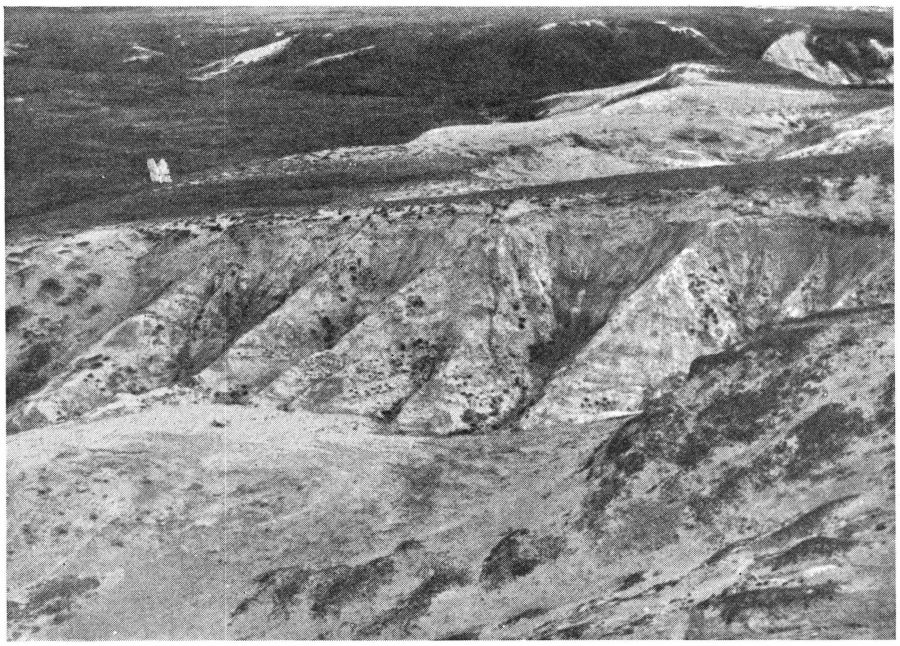
Mytilus edulis L. 3 shells and fragments of 2 shells.
Serripes groenlandicum (CHEMN.) 1 specimen and some fragments.
Macoma calcaria (CHEMN.) 1 shell and 3 fragments with periostracum.
Saxicava arctica (L.) 1 specimen and 1 shell.
Mya truncata (L.) 3 shells and 2 large fragments.

26.3 m. above sea level. Southern section:

Mytilus edulis L. Some shells and many fragments with periostracum.
Serripes groenlandicum (CHEMN.) 1 specimen, about 50 shells and many fragments, all with periostracum preserved.
Saxicava arctica (L.) 3 shells and many fragments.
Mya truncata (L.) Some large and small shells and fragments.
Bryozoa sp. 2 specimens.
Pearls 2 specimens.

26 m. above sea level. Northern section:

Mytilus edulis L. Some fragments.



Auct. phot. 27.-7.-1946.

Fig. 10. View of one of the gullies on Lersletten at the Pinguarssuk bay.

Modiolaria discors (L.) 1 fragment.
Cardium ciliatum FABR. 1 very large shell and 4 fragments.
Serripes groenlandicum (CHEMN.) 2 shells and some fragments.
Macoma calcaria (CHEMN.) 106 shells and many fragments. Some shells drilled by *Natica*.
Saxicava arctica (L.) 14 shells and some fragments.
Mya truncata (L.) 32 shells and some fragments.
Natica clausa BROD. and SOW. 2 somewhat damaged specimens.

As stated above, Lersletten abuts to the north against Pinguarssûp qáqâ and to the south against Maagefjeld and Uglefjeld, whereas to the east, it extends all the way to Tasiussaq. The altitude of this large plain is 50 m. above sea level, at the edge facing Disko Bugt usually 51 m. on account of drift-sand formations. The plain is traversed at several places on its western part by rain-water streams which have cut deep clefts. They all lead out to Pinguarssûp kûa. The gullies were investigated, they are all of a uniform structure (figs. 10 and 11). Clay is found lowest down up to 18 m. above sea level with bands of sand up to 50 cm. thick. Shells were very scarce in these layers. In the sections drift-sand of varying thickness is found superposing the sandy clay. In the drift-sand there were a number of layers of dead plants. The drift-sand abuts against

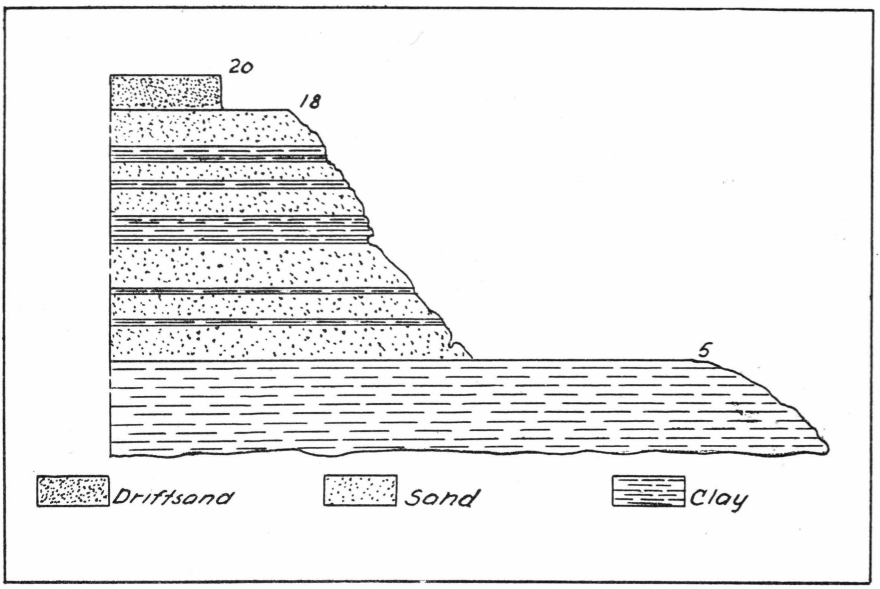


Fig. 11. Section of a nose in one of the clefts.

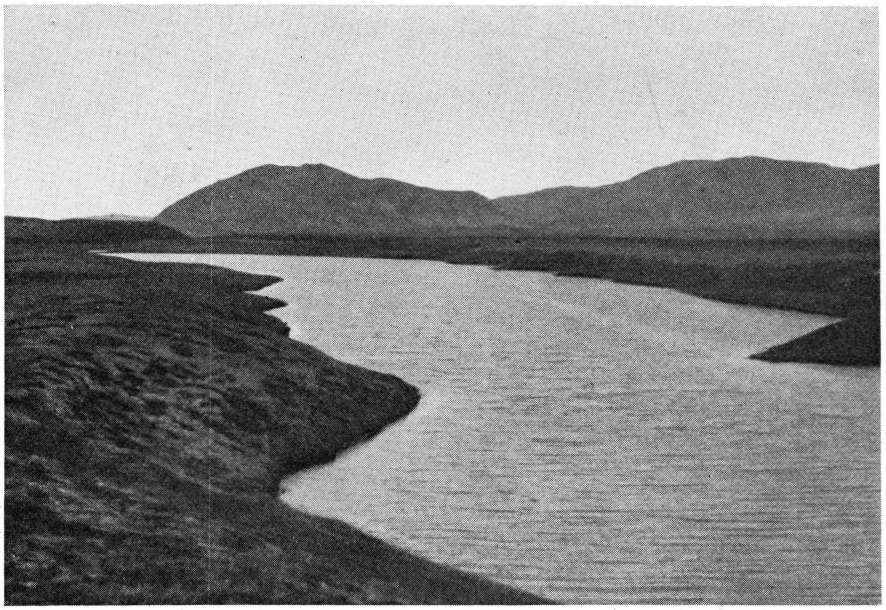
the surface of the plain in a gentle slope. In the lowermost layer of clay the following shells were collected at 4—5 m. above sea level:

Yoldia hyperborea LOVÉN. 1 specimen.
Portlandia arctica (GRAY). 117 specimens, 58 shells and many fragments, generally large shells.
Cardium ciliatum FABR. 4 small specimens and some fragments.
Macoma calcaria (CHEMN.) 44 specimens, 39 shells and many fragments, large specimens, the largest measured 41.7 mm., 37,4 mm., 37.0 mm., 35.0 mm., 33.3 mm. in height. Incipient concretion.
Saxicava arctica (L.) 19 specimens, 12 shells and many fragments.
Mya truncata (L.) 1 small specimen and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 1 specimen and 2 shells.
Buccinum sp. 1 fragment.
Balanus balanus DA COSTA. 1 shell.

In the sandy clay were collected:

Yoldia hyperborea LOVÉN. $^1/_2$ specimen.
Portlandia arctica (GRAY). 2 specimens.
Saxicava arctica (L.) 3 specimens and 2 shells.
Mya truncata (L.) 1 specimen and 1 fragment.

Both layers have been deposited under high-arctic climatic conditions.



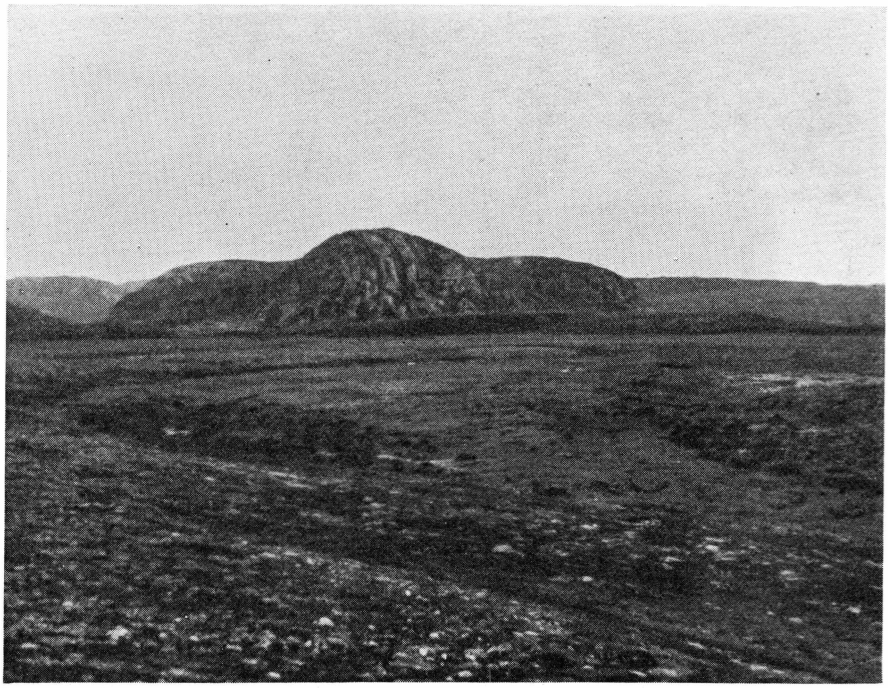
Auct. phot. 26.-7.-1946.

Fig. 12. Elongated lake in old river branch, Lersletten. (Cf. fig. 9).

In one of the small water-carrying gullies the writer observed a small discharge of natural gas from the clay. The gas oozed out from the clay at several places and formed combustible bubbles on the surface of the water, which moreover had a film, showing Newton's rings. Similar discharges were also observed at some places on the beach itself, and still another could be seen out in the bay a few metres from land. On the plain Pinguarssûp kûa runs in a wide valley, on the north side flanked by high cliffs, which seem to be built of fluviatile material: sand in cross and false bedding and gravel with stones of all sizes up to big boulders. The altitude of these cliffs is at places 40 m. By a closer examination it appeared that the cliffs had a core of clay. On the southern side of the river the valley slope is characterized by a system of river terraces—about ten—, they are vegetation-covered and somewhat obliterated by solifluction.

In places the plain is occupied by large, shallow ponds. Clay circles, characteristic of the clay plains of Greenland, were seen in many places. At the southernmost of the lakes, indicated on the Geodetic Institute map 69 V. 2, there is at 46 m. above sea level a small section in sandy clay 3—4 m. high. The following shells were collected from the section:

Portlandia arctica (GRAY). 9 specimens, generally rather small.
Portlandia lenticula (MØLL.) 6 specimens.
Serripes groenlandicum (CHEMN.) 6 somewhat crushed specimens.



Auct. phot. 26.-7.-1946.

Fig. 13. Dead branch of the former river which ran through Lersletten. In the background Ugpiup qáqâ i. e. Uglefjeld (Owl Hill).

Macoma calcaria (CHEMN.) 30 specimens, 10 shells and some fragments.

Saxicava arctica (L.) 75 specimens. Some of the shells, which are usually rather large, have two ridges at the back with worn spines on them. Incipient concretion.

Mya truncata (L.) forma *ovata* JENSEN. 5 somewhat crushed specimens.

Cylichna alba (BROWN). 1 specimen.

On the stretch around Tasiussaq the plain is occupied by elongated lakelets, which are undoubtedly old river branches (fig. 12). Furthermore there were many "dead" branches (fig. 13) with a luxuriant bog vegetation, especially of *Eriophorum sp.* There is no doubt that the former river has run in serpentines, and that it rose at the head of Tasiussaq. At this fjord branch the same phenomenon can be observed as at Lerbugten, viz. that two ridges, which abut against the rocks on both sides of the fjord and which are parallel to the head of Tasiussaq, have been cut in the middle.

Facing Tasiussaq the plain terminates in cliffs similar to those at the coast. A section was surveyed and showed the following stratification:

0—18 m.	above	sea	level.	Clay without shells.
18—22 m.	—	-	—	Fine stratified sand.
22—25 m.	—	-	—	Sandy clay.
25—40 m.	—	-	—	Sand.
40—47 m.	—	-	—	Beach gravel.
47—50 m.	—	-	—	Vegetation-covered scree.

Shells were found in the sand at 35—40 m. above sea level:

Macoma baltica (L.) 18 shells and some fragments. The largest one measured 21.8 mm. Periostracum preserved on most of them.
Macoma calcaria (CHEMN.) 1 shell 51.2 mm.
Mya truncata (L.) forma *ovata* JENSEN. 1 shell.
Balanus crenatus BRUG. 1 shell.

The occurrence of *Macoma baltica* indicates a higher temperature under the deposition of this layer than at any other locality in this area. The climatic conditions were boreal when the layer was deposited.

In the area at Maagefjeld the terraces occur again, after an absence of them on the stretch along the three bays. Below Maagefjeld three terraces were measured:

Outer edge		24 m.	above	sea	level.	Inner edge		32 m.	above	sea	level.
—	—	75 m.	—	-	—	—	—	89 m.	—	-	—
—	—	95 m.	—	-	—	—	—	102 m.	—	-	—

From the uppermost terrace the ground slopes gently upwards to the rock. It was not possible to find any trace of the upper marine terrace or the upper marine limit.

In a small gully it was possible to see the stratification in the lowest terrace (fig. 14). At the foot of it is clay, which rests directly on the gneiss and which reaches up to 26 m. above sea level. The clay is superposed by stratified sand of a thickness of 5 m. Gravel 1 m. thick overlies this sand layer. Shells were found in the clay:

Nucula tenuis (MONT.) var. *expansa* REEVE. 2 shells.
Leda minuta (MÜLL.) 1 fragment.
Portlandia arctica (GRAY). 22 shells and some fragments.
Cardium ciliatum FABR. 4 fragments.
Macoma calcaria (CHEMN.) 4 shells and some fragments.

In the sand overlying the clay was a concentration of closely packed shells, from which the following shells were collected:

Mytilus edulis L. 2 fragments.
Serripes groenlandicum (CHEMN.) 1 fragment.

Macoma calcaria (CHEMN.) 2 fragments.
Mya truncata (L.) Some large fragments.
Mya truncata (L.) forma *ovata* JENSEN. 1 shell.

While the clay layer has been deposited under high-arctic climatic conditions, the sand must have been deposited under more favourable conditions, which the occurrence of *Mytilus edulis* shows. A summary

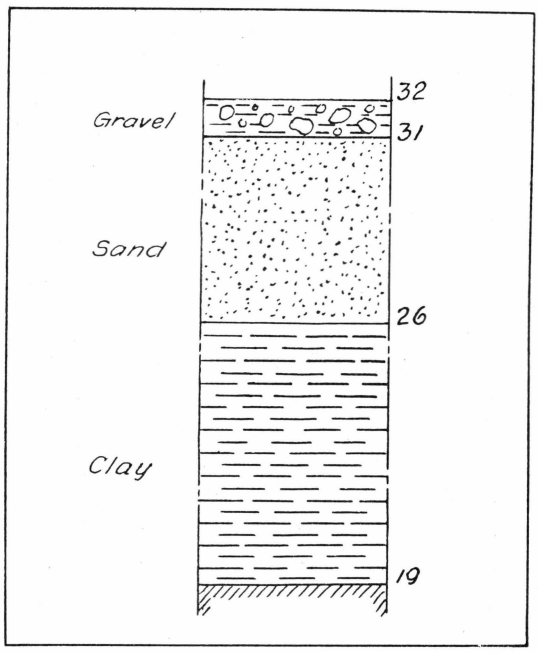


Fig. 14. Section of the layers at Maagefjeld.

of the climatic development of the whole area, and of the relative position of the layers will be given later (p. 97).

Big, domed gneissic rocks (roches moutonnées) which constitute the coast, carried striae with chatter marks. There were two systems: one older and one younger, and their orientation was determined by bearings. The older system shows an east to west orientation, while the younger is orientated E. 40° S., and is thus parallel to the main orientation of the fjords, valleys, and elongated lakes in the area south of it.

Quilik (Tranøen), Christianshaab. The cliffs round Christianshaab Fjord were investigated. Shell deposits in a low section of sand were found on Quilik. The following shells were collected at 7 m. above sea level:

Pecten islandicus MÜLL. 6 fragments of small, thin-shelled specimens.
Mytilus edulis L. About ten fragments.

Macoma baltica (L.) 1 shell.
Macoma calcaria (CHEMN.) 14 shells and some fragments.
Saxicava arctica (L.) 10 shells and some fragments.
Mya truncata (L.) Some thin shells and fragments.
Balanus balanus DA COSTA. 20 large solid shells.

Macoma baltica indicates that the layer has been deposited under warmer climatic conditions than the present ones, viz. boreal.

Orpigsôq. This classic locality has been thoroughly described by JENSEN and HARDER (30), and HARDER, JENSEN, and LAURSEN (21). It will therefore be unnecessary to go into details, particularly as the supplementary information to JENSEN's and HARDER's investigations has been worked out and published by JENSEN and the present writer in 1949 (21). Thus it only remains to deal with the observations and collections, which were still unprepared, when the above-mentioned paper was finished. This is a question partly of investigations made at other localities than those visited by JENSEN and HARDER, partly of the result of the collections.

Zirphaeahalvøen. On the Zirphaeapynten, a locality minutely investigated by JENSEN and HARDER, the present writer made some collections of very big samples of about 25 kg. each from the different layers. The following shells were found:

Lowest layer of clay:

Nucula tenuis (MONT.) var. *expansa* REEVE. 4 shells and some fragments.
Portlandia arctica (GRAY). Some fragments.

Clayey layer under the *Pecten* layer:

Leda minuta (MÜLL.) 1 shell and a few fragments.
Pecten islandicus MÜLL. Many fragments.
Thyasira flexuosa (MONT.) 2 shells.
Cardium ciliatum FABR. Many fragments.
Macoma calcaria (CHEMN.) Some fragments.
Saxicava arctica (L.) 3 shells and many fragments.
Mya truncata (L.) Many fragments.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Balanus crenatus BRUG. 4 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.
Foraminifera sp.

The *Pecten* layer (the weight of the sample about 40 kg.):

Leda minuta (MÜLL.) 1 shell and some fragments.

Pecten islandicus MÜLL. Hundreds of shells and fragments, large and small.
Astarte montagui (DILL.) 7 shells, of which 2 juvenile, and some fragments.
Thyasira flexuosa (MONT.) 2 shells.
Cardium ciliatum FABR. Some shells and many fragments.
Serripes groenlandicum (CHEMN.) Some fragments of medium-sized specimens.
Macoma calcaria (CHEMN.) 9 shells and some fragments. 1 drilled by *Natica*.
Saxicava arctica (L.) 7 shells and many fragments.
Mya truncata (L.) 7 shells and a great number of fragments.
Puncturella noachina (L.) 1 specimen.
Lepeta coeca (MÜLL.) 5 specimens.
Littorina palliata SAY. 1 specimen and some fragments.
Balanus balanus DA COSTA. About 10 shells.
Balanus hammeri (ASCAN.) BROWN. 1 small, somewhat disintegrated fragment.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines and fragments.

The *Zirphaea* layer:

Pecten islandicus MÜLL. A few small fragments.
Mytilus edulis L. Many fragments.
Modiolaria discors (L.) var. *laevigata* GRAY. 1 fragment.
Cardium ciliatum FABR. 2 specimens and some fragments.
Serripes groenlandicum (CHEMN.) Some fragments of small and large shells.
Macoma baltica (L.) More than 100 shells and many fragments.
Macoma calcaria (CHEMN.) 1 specimen, 4 shells and some fragments.
Saxicava arctica (L.) Many shells and many fragments.
Mya truncata (L.) Many shells and fragments.
Mya truncata (L.) forma *ovata* JENSEN. 1 specimen, 23 shells and 2 large fragments.
Zirphaea crispata (L.) Many specimens, many shells and fragments.
Chiton sp. 2 shells.
Puncturella noachina (L.) 6 specimens.
Acmaea testudinalis (MÜLL.) A number of specimens.
Moelleria costulata (MØLL.) Some specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. Many specimens.
Littorina obtusata L. 2 specimens.
Sipho togatus (MØRCH). 1 specimen.

Buccinum groenlandicum CHEMN. 6 specimens.
Balanus balanus DA COSTA. 5 specimens and a great number of shells.
Balanus hammeri (ASCAN.) BROWN. Some shells and basal plates.
Balanus crenatus BRUG. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.

The *Portlandia* noses (ridges) at the Ilulialik river:

Nucula tenuis (MONT.) var. *expansa* REEVE. 11 specimens and some fragments.
Portlandia arctica (GRAY). 12 specimens and some fragments.
Portlandia lenticula (MØLL.) 1 specimen.
Thyasira flexuosa (MONT.) 79 specimens and many fragments.
Cardium ciliatum FABR. Many specimens and shells, often with incipient concretion.
Macoma calcaria (CHEMN.) 12 specimens with incipient concretion.
Saxicava arctica (L.) 8 specimens with incipient concretion.
Mya truncata (L.) Some large and many small specimens with incipient concretion.
Mya truncata (L.) forma *ovata* JENSEN. About 10 specimens with incipient concretion.
Ophiura sp. Some specimens partly concreted.

The *Balanus* horizon:

Cardium ciliatum FABR. 3 specimens.
Saxicava arctica (L.) 1 specimen with incipient concretion.
Mya truncata (L.) 5 crushed specimens.
Balanus hammeri (ASCAN.) BROWN. 5 specimens and hundreds of shells.

The *Zirphaea* layer up behind the *Balanus* horizon:

Leda minuta (MÜLL.) 1 shell with periostracum.
Pecten islandicus MÜLL. 29 shells and some fragments.
Mytilus edulis L. Fragments of some shells.
Cardium ciliatum FABR. Fragments of about 50 small and large shells.
Serripes groenlandicum (CHEMN.) Fragments of ten shells.
Macoma baltica (L.) 12 shells, a little damaged.
Macoma calcaria (CHEMN.) 14 shells and some fragments, 1 drilled by *Natica*.
Mya truncata (L.) Many shells, among them 23 juvenile and many fragments.

Mya truncata (L.) forma *ovata* JENSEN. 1 shell.
Puncturella noachina (L.) 1 specimen.
Acmaea testudinalis (MÜLL.) 1 specimen.
Littorina palliata SAY. 1 specimen.
Natica clausa BROD. and SOW. 1 specimen.
Trophon truncatus (STRØM). 1 specimen.
Cylichna alba (BROWN). 1 specimen.
Hemithyris psittacea (GML.) 1 fragment.
Balanus balanus DA COSTA. 1 shell.
Balanus hammeri (ASCAN.) BROWN. 3 fragments of shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.

Contrary to the view, formerly held by HARDER, JENSEN and LAURSEN (21, p. 27–28), this deposit must be regarded as being laid down under boreal climatic conditions, which is indicated by the occurrence of *Macoma baltica.*

Where the Ilulialik river bends to the east a valley runs westward. The valley floor is covered with grey sandy clay, which could be observed up to 93 m. above sea level. No shells were found in the valley itself, but at its outlet both on the north and the south side were sections, built of clay, which upwards passed into more sandy layers. In the northern section the following shells were collected:

Cardium ciliatum FABR. 4 specimens and some fragments.
Serripes groenlandicum (CHEMN.) 1 specimen, 1 shell and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 19 specimens and some fragments.

In the southern section:

Cardium ciliatum FABR. 44 specimens, 8 shells and some fragments.
Serripes groenlandicum (CHEMN.) 36 specimens, 1 shell and some fragments.
Macoma calcaria (CHEMN.) 45 specimens.
Saxicava arctica (L.) 4 specimens.
Mya truncata (L.) 36 specimens and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 37 specimens.

As regards all the shells in question from both localities, it must be stated that they are all characterized by incipient concretion. The layer has been deposited under Arctic climatic conditions.

The deposits inland. At the northern bank of the river mouth is a typical delta deposit with a terrace altitude of 13 m. above sea level.

The delta is built of sand, gravel, and big boulders. This deposit extends some way to the west and is here succeeded by deposits of sand and gravel. Opposite the Zirphaeapynten is a small section, reaching up to the above lying terrace flat which here has an altitude of 7 m. above sea level. The surface of the terrace is characterized by naked, hard clay circles, about 1 square metre large—the distintive feature of the clay deposits—with a luxuriant vegetation between the circles. A furrow was dug in the surface of the section. Lowest down was sand with discordant stratification. The sand was interbedded with some clay bands of varying thickness. The sand reaches up to 2 m. above sea level, and is superposed by clay extending up to the top of the section. In the clay the following shells were collected:

Yoldia hyperborea LOVÉN. 2 specimens.
Cardium ciliatum FABR. 13 specimens, 2 shells and some broken specimens and casts.
Serripes groenlandicum (CHEMN.) 2 specimens, 1 shell and some fragments.
Macoma calcaria (CHEMN.) 15 specimens, 1 shell and some broken specimens. Incipient concretion.
Saxicava arctica (L.) Several hundred specimens and shells. Incipient concretion.
Mya truncata (L.) Some specimens, all crushed.
Mya truncata (L.) forma *ovata* JENSEN. Some crushed specimens.
Buccinum groenlandicum CHEMN. var. *patula* SARS. 1 specimen.
Balanus hammeri (ASCAN.) BROWN. 1 shell.

The layer has been deposited under Arctic climatic conditions.

The terrace can be followed to a cove at the waterfall in the river from Orpigsûp tasia kitdleq. The material, of which it is built, is still clay, and the contents of shells are the same as in the above-mentioned section.

At the outlet of Orpigsûp tasia kitdleq the so-called "Engell's Profil" is to be found. From the upper edge of the section the ground slopes gently inland. The surface is stony with many isolated shells, and in that respect it perfectly resembles the northwestern part of the Zirphaeahalvøen, where the *Zirphaea* layer reaches up to the surface. Among the shells *Mytilus edulis* is dominant. At the outlet of the river from the lake a cliff section was surveyed along the west side of the lake, 400 m. in length (fig. 15).

From the outlet of the river to the streamlet, sand with *Mytilus edulis* and *Zirphaea crispata* was found uppermost, superposing a clay band of a thickness varying from a few cm. to 1 dm. At the streamlet the clay was considerably thicker, overlying here a sandy layer, which con-

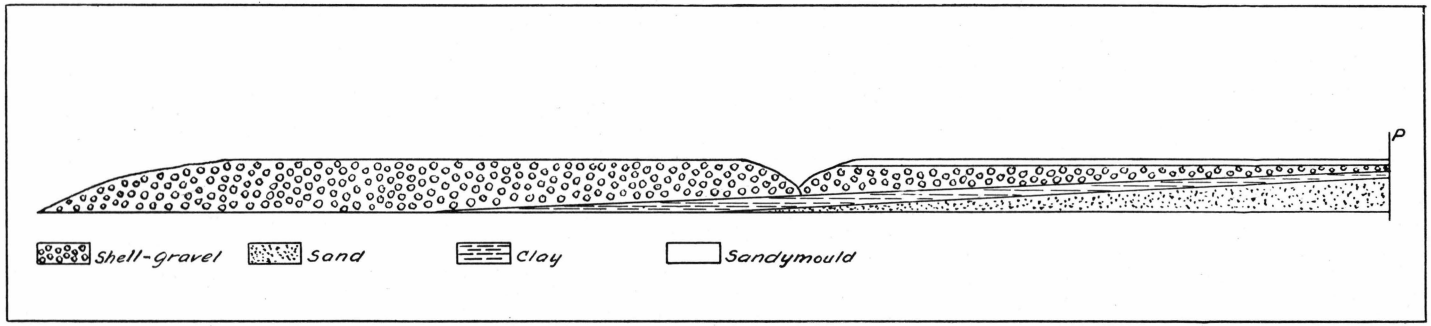


Fig. 15. Orpigsûp tasia kitdleq. Section of the coast cliff on the west side of the lake. The length of the section is about 500 m. The height about 4 m. At *P* the place where the detailed section was surveyed. (Cf. fig. 16).

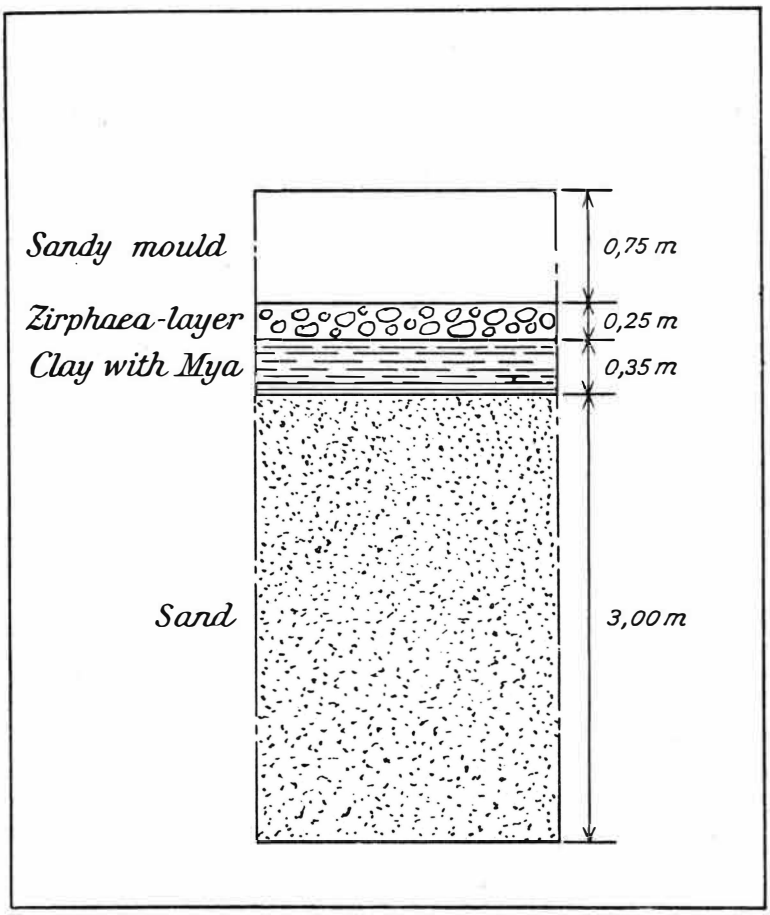


Fig. 16. Detailed section from the coast section on the west side of Orpigsûp tasia kitdleq.

stitutes the lowermost part of the section. This sandy layer increases in thickness northeastward.

The altitude of the section is 4 m. above the water-level of the lake. As this lies at 36 m. above sea level, it corresponds to 40 m. above sea level. A detailed section was surveyed about 400 m. from the outlet of the river (fig. 15. P), the structure of which will appear from fig. 16.

In the *Zirphaea* layer in "Engell's Profil" the following shells were collected:

Pecten islandicus MÜLL. 5 shells and many large fragments.
Mytilus edulis L. 68 shells and great quantities of fragments.
Serripes groenlandicum (CHEMN.) 1 shell.
Macoma baltica (L.) 14 shells.

Saxicava arctica (L.) 38 shells and many fragments. Some shells are "pinched".
Mya truncata (L.) 37 shells and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 1 specimen, 2 shells and some large fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 4 shells.
Zirphaea crispata (L.) Some large fragments and some apophyses.
Acmaea rubella (FABR.) 2 specimens and some fragments.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 3 specimens.
Littorina palliata SAY. 12 specimens and some fragments.
Buccinum groenlandicum CHEMN. 8 specimens and some fragments.
Balanus hammeri (ASCAN.) BROWN. 2 shells.
Balanus crenatus BRUG. 3 shells.
Stongylocentrotus drøbachiensis (MÜLL.) Spines.

About 25 m. inland on the terrace an excavation was made down to the fresh layer, and in a sample of this were:

Mytilus edulis L. 1 shell and a number of fragments, some of which of very large specimens.
Axinopsis orbiculata SARS. 1 shell.
Macoma baltica (L.) 10 shells and some fragments.
Saxicava arctica (L.) 93 shells and many fragments.
Mya truncata (L.) 1 adult, 10 juvenile shells and some fragments.
Acmaea testudinalis (MÜLL.) 4 specimens and some fragments.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Littorina palliata SAY. 28 specimens and some fragments.
Buccinum groenlandicum CHEMN. 5 specimens and some fragments.
Balanus crenatus BRUG. 12 shells.
Strongylocentrotus drøbachiensis (MÜLL.) 1 fragment and some spines.
Cranial bone of a fish.

In the bank at the bed of the streamlet were found in the same layer:

Mytilus edulis L. 2 shells and fragments in great numbers.
Macoma baltica (L.) 15 shells and some fragments.
Saxicava arctica (L.) 50 shells and many fragments.
Mya truncata (L.) 1 shell and some fragments.
Zirphaea crispata (L.) 1 shell.
Puncturella noachina (L.) 2 specimens.
Acmaea testudinalis (MÜLL.) 10 specimens, of which 3 very large ones.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Littorina palliata SAY. 16 specimens.

Trophon truncatus (STRØM). 1 specimen.
Buccinum groenlandicum CHEMN. 6 specimens and some fragments.
Balanus crenatus BRUG. 6 shells.

In the section mentioned p. 43 the following shells were collected:
In the sandy layer:

Saxicava arctica (L.) 30 shells and some fragments.
Mya truncata (L.) 10 shells.
Mya truncata (L.) forma *ovata* JENSEN. 10 shells. Some of the shells are apparently transition forms between the *truncata* and the *ovata* forms.

In the clayey layer:
Cardium ciliatum FABR. 3 small fragments.
Macoma calcaria (CHEMN.) 2 shells and a few fragments.
Saxicava arctica (L.) 6 shells and some fragments.
Mya truncata (L.) 13 shells and many fragments.
Acmaea rubella (FABR.) 1 specimen.
Balanus crenatus BRUG. 2 shells.

In the *Zirphaea* layer:

Pecten islandicus MÜLL. 1 small fragment.
Mytilus edulis L. Many big fragments of large shells.
Macoma baltica (L.) 85 shells and many fragments.
Saxicava arctica (L.) Several hundred shells, many drilled by *Natica*. Great quantities of fragments.
Mya truncata (L.) 3 shells and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 2 shells and many fragments.
Puncturella noachina (L.) 8 specimens.
Acmaea rubella (FABR.) 85 specimens and some fragments.
Margarita helicina (PHIPPS). 3 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 14 specimens.
Littorina palliata SAY. Several hundred specimens.
Buccinum groenlandicum CHEMN. 2 specimens.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.
Vertebrae of fish. 2 pieces.

The position and the climatic conditions of the layers will be dealt with later in this report (p. 93).

Orpigsôq fjord. Small cove south-south-west of the island in the middle of the fjord. A small section is to be found at the head of the

cove. Lowermost is *Portlandia* clay, resting directly on the gneiss and 3 m. thick. It is superposed by a sand bed, 1 m. thick. The sand bed is overlain by a bed of clay, creeping out over the section.

In the lower bed of clay the following shells were collected:

Nucula tenuis (MONT.) var. *expansa* REEVE. 22 specimens, 12 shells and some fragments, all with periostracum preserved.
Leda pernula (MÜLL.) 1 specimen.
Yoldia hyperborea LOVÉN. 1 specimen and $^1/_2$ specimen.
Portlandia arctica (GRAY). 48 specimens, 41 shells and some fragments.
Cardium ciliatum FABR. 4 specimens, 2 shells and some fragments.
Macoma calcaria (CHEMN.) 56 specimens, of which 4 with periostracum and ligamentum preserved, 13 shells and some fragments. The specimens were filled with clay, but there was no incipient concretion. Largest specimen measured 34 mm.
Saxicava arctica (L.) 1 specimen and 1 shell, rather small.
Mya truncata (L.) 2 specimens and some large fragments.
Cylichna alba (BROWN). 1 specimen.

The climatic conditions have been high-arctic, when the layer was being deposited.

In the bed of the streamlet, debouching in the head of the cove, there is some way upstream, a similar section, the top of which at 7 m. above sea level forms the outer edge of a terrace, extending up to 20 m. above sea level. Above this there is another terrace with the outer edge at 30 m. above sea level and the inner edge at 40 m. above sea level. The surfaces of the terraces were composed of clay. No further terraces could be seen. The ground above the terraces consists of gneiss, carrying striae in great quantities, orientated from the mouth of the Ilulialik river to the south end of Akugdlît island. Numerous boulders appear on the gneissic surface, but moraine material and possible other loose material have been washed away. Rock-pools occur in great numbers in the area. A big lake extends across the peninsula at 54 m. above sea level, and practically divides it into two.

Egedesminde District.

The south coast of Sydostbugten has been investigated by JENSEN and HARDER in 1906 (30) and described in details by HARDER, JENSEN, and LAURSEN (21). To establish, if possible, a correspondence with the occurrences found farther south, the present writer investigated the coasts along the Egedesminde archipelago and Nivâp suvdlua. In this predominantly gneissic area Quaternary formations occur at very few

places as they have usually been washed away. They have remained only in broad gullies. As a rule a terrace occurs uppermost in the gully (fig. 17). Sections can be observed in coves and bays only, where the material has been protected against being washing out, but is still exposed to the erosion of the sea.

Nivâq. In the small bay on the eastern side of the narrow there is a section ranging from the level of the sea up to 12 m. above sea level. Lowest is a bed of clay, 2 m. thick, which is superposed by shelly gravel.

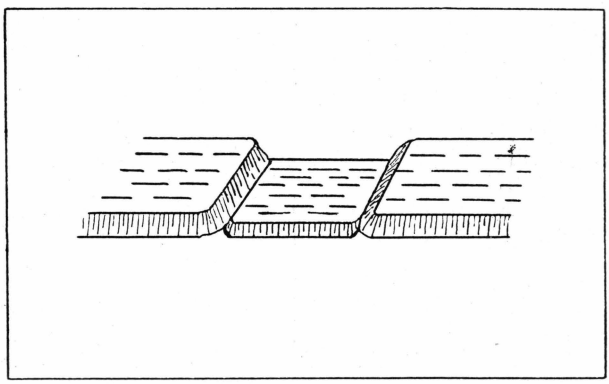


Fig. 17. Sketch of the occurrence of the marine Quaternary in the gneissic ground (Cf. fig. 18).

The thickness of this could not be determined, as the upper part of the section was vegetation-covered, and it was impossible to dig because the ground was frozen. The clay was somewhat sandy and contained many stones up to the size of walnuts, only a few were bigger. The shells, contained in the clay, were greatly crushed. The species were as follows:

Pecten islandicus MÜLL. Some fragments of very small and thin shells.
Mytilus edulis L. About 10 small fragments.
Modiolaria discors (L.) Some small fragments.
Astarte montagui (DILL.) Fragments of some adult shells and some shells of juvenile specimens. This is characteristically with the many small shells.
Cyamium minutum (FABR.) 1 shell.
Macoma calcaria (CHEMN.) 4 fragments.
Saxicava arctica (L.) Many fragments of adult shells and shells of juvenile specimens.
Mya truncata (L.) Many fragments.
Puncturella noachina (L.) A dozen specimens.

Lepeta coeca (MÜLL.) 2 fragments.
Moelleria costulata (MØLL.) 5 specimens.
Cingula castanea (MØLL.) 1 specimen.
Marsenina glabra (COUTH.) 1 specimen.
Trophon fabricii MØLL. 3 specimens and 3 large fragments.
Hemithyris psittacea (GML.) 1 small fragment.
Balanus balanus DA COSTA. 4 shells.
Balanus hammeri (ASCAN.) BROWN. Many shells of large and small specimens.
Balanus crenatus BRUG. 3 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and several hundred spines.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.
Foramnifera sp. 1 specimen and 1 fragment.

The climate was Arctic when the layer was being deposited.

The shelly gravel consists almost entirely of shells with stones up to 2 cm. in diameter. Many of the shells were drilled by *Natica*. A sample was taken at 3 m. above sea level. It contained the following shells.

Leda minuta (MÜLL.) 1 juvenile specimen, 1 shell and 1 fragment.
Pecten islandicus MÜLL. Some fragments of both large and small specimens.
Lima subauriculata (MONT.) 7 specimens and many fragments.
Crenella decussata (MONT.) 3 shells.
Mytilus edulis L. Some fragments.
Modiolaria discors (L.) 3 fragments.
Astarte montagui (DILL.) var. *striata* (LEACH) SARS. 11 shells and many fragments.
Cyamium minutum FABR. 1 shell.
Macoma calcaria (CHEMN.) 3 shells.
Saxicava arctica (L.) 20 shells and many fragments. Some shells "pinched". They seem, however, to be washed out from older layers.
Mya truncata (L.) 12 shells and many fragments.
Thracia myopsis (MØLL.) 1 shell.
Chiton sp. Many shells.
Scissurella crispata FLEM. 1 specimen.
Puncturella noachina (L.) 35 specimens.
Acmaea rubella (FABR.) 6 small specimens.
Solariella obscura (COUTH.) 2 specimens.
Solariella obscura (COUTH.) var. *bella* VERK. 1 specimen.
Moelleria costulata (MØLL.) 9 specimens.

Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 4 small specimens.
Littorina palliata SAY. 2 small specimens.
Cingula castanea (MØLL.) Some small specimens.
Natica sp. 3 small fragments.
Trophon truncatus (STRØM). 12 specimens and some fragments.
Bela tenuicostata SARS. 1 specimen.
Balanus balanus DA COSTA. 9 shells.
Balanus hammeri (ASCAN.) BROWN. 5 shells.
Balanus crenatus BRUG. 4 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.
Serpula sp. Many specimens.
Bryozoa sp. Some specimens.

The climatic conditions were Arctic when this layer was deposited.

Akúnâq. Opposite the outpost a terrace was observed at 22 m. above sea level. The outer and inner edges could not be determined. A section was found on a small slope. Uppermost there was a podsolic layer, a few cm. thick, with roots. Under that there was a shelly layer, 25 cm. thick, brownish, which superposed a bed of sand, 5—10 cm. thick, without shells. The sand bed overlay a bed of shelly gravel, the thickness of which could not be determined on account of scree and vegetation. The shells in the upper shell horizon were for the most part crushed. The following species were found:

Pecten islandicus MÜLL. 3 small fragments.
Mytilus edulis L. 2 shells and some large and small fragments.
Cyamium minutum (FABR.) 7 shells.
Saxicava arctica (L.) 3 small shells and some fragments.
Mya truncata (L.) 1 small fragment.
Puncturella noachina (L.) 2 specimens.
Acmaea rubella (FABR.) 2 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 5 specimens.
Littorina palliata SAY. 6 small specimens.
Onoba aculeus (GOULD). 1 specimen.
Balanus balanus DA COSTA. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.
Serpula sp. 12 specimens.
Bryozoa sp. I. 2 specimens.
Bryozoa sp. II. 1 specimen.

The climatic conditions were Arctic when the layer was deposited.

In the lowermost gravel layer, where there were many pebbles, the following were found:

Pecten islandicus MÜLL. 1 large shell.
Mytilus edulis L. 2 shells and many fragments.
Cyamium minutum (FABR.) 14 shells.
Saxicava arctica (L.) 8 shells and many fragments.
Chiton sp. 1 shell.
Acmæa rubella (FABR.) 4 specimens and some fragments.
Margarita helicina (PHIPPS). 1 specimen.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 7 specimens and some fragments.
Balanus balanus DA COSTA. 5 large shells.
Balanus crenatus BRUG. 10 shells and many fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Many fragments and spines.
Serpula sp. 5 specimens.
Bryozoa sp. 2 specimens.
Pearl on a shell fragment of *Mytilus edulis.*

The climatic conditions were Arctic when the layer was deposited.

In the bay at the harbour the writer observed a section, 16 m. high, consisting of layers of sand with concentrations of closely packed stones interchanging with shelly gravel. A sample, taken at the top of the section, contained much shingle and entirely fragmentary shells which were much rolled. The following species were found:

Mytilus edulis L. Some fragments.
Saxicava arctica (L.) Some fragments.
Mya truncata (L.) Some fragments.
Balanus crenatus BRUG. Some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) 1 shell fragment and some spines.
Serpula sp. Some specimens.

The climate was Arctic when the layer was being deposited.

The section bore the impression of being much frequented by people and animals. For that reason it was difficult to find places, where samples were obtainable without impurities from the overlying layers, but an excavation down to a fresh layer of shelly gravel at 5 m. above sea level was successful. The layer consisted of shelly gravel with isolated stones up to the size of walnuts. The following shells were found:

Pecten islandicus MÜLL. 3 small fragments.
Mytilus edulis L. Some fragments.

Astarte montagui (DILL.) 2 small fragments.
Saxicava arctica (L.) 4 small fragments.
Mya truncata (L.) 2 fragments.
Puncturella noachina (L.) 1 fragment.
Acmaea rubella (FABR.) 1 fragment.
Balanus balanus DA COSTA. 6 shells.
Balanus crenatus BRUG. 10 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many shells and spines.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.

The climatic conditions were Arctic when the layer was deposited.

Hunde Ejland. On the island where the outpost is situated, some hundred metres behind the manager's residence, the writer observed a cut in the rock about 15 m. wide. Here were great quantities of shelly gravel. A section was taken at 20 m. above sea level. It consisted almost entirely of crushed shells with a little gravel. The shelly gravel is very much like the shelly gravel of Akúnâq at 22 m. above sea level. The sample contained the following species:

Pecten islandicus MÜLL. 1 fragment.
Mytilus edulis L. Vast quantities of fragments.
Modiolaria discors (L.) var. *substriata* GRAY. 1 shell.
Cyamium minutum (FABR.) 3 shells.
Saxicava arctica (L.) Many shells and numerous fragments.
Acmaea rubella (FABR.) 6 species.
Solariella obscura (COUTH.) 4 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 5 specimens and 2 fragments.
Littorina palliata SAY. 10 specimens and some fragments.
Cingula castanea (MØLL.) 1 specimen.
Onoba aculeus (GOULD.) 2 specimens.
Natica sp. 1 juvenile specimen, much rolled and a little broken.
Trophon truncatus (STRØM). 2 specimens and some fragments.
Balanus balanus DA COSTA. 7 shells.
Balanus crenatus BRUG. 22 shells and some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) 1 shell fragment and some spines.
Serpula sp. 3 specimens.

The layer was deposited under Arctic climatic conditions.

On the flat below the church 4—500 m. west of the harbour a sample was taken at 16 m. above sea level. It consisted almost exclusively of

crushed and rolled material; it was highly brown-coloured and contained a number of stones and some sand with mica. This indicates a typical marine deposit from a surf-beaten shore. The following species were found:

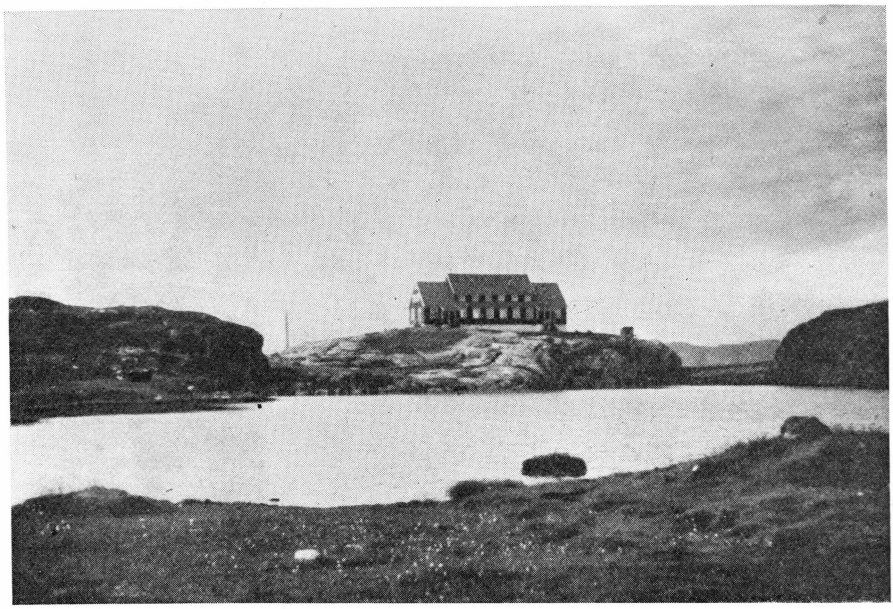
Pecten islandicus MÜLL. 7 small fragments.
Mytilus edulis L. Half a dozen shells and immense quantities of fragments.
Cyamium minutum (FABR.) 3 shells.
Saxicava arctica (L.) 17 shells and many fragments.
Chiton sp. 1 shell.
Puncturella noachina (L.) 3 specimens.
Acmaea rubella (FABR.) 4 specimens.
Margarita groenlandica (CHEMN.) 2 shell fragments.
Solariella obscura (COUTH.) 2 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 3 specimens.
Littorina palliata SAY. 8 specimens and some fragments.
Cingula castanea (MØLL.) 1 specimen.
Trophon truncatus (STRØM). 1 specimen.
Balanus balanus DA COSTA. 1 shell.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and many spines.
Serpula sp. About 10 specimens.
Pearl. 1 specimen.
Otolith of fish.

The climatic conditions were Arctic when this layer was deposited.

Egedesminde. At the settlement STEENSTRUP had fixed 3 points for the determination of the subsidence of the land (76 p. 242). Expansions of the harbour, as late as during the years of war 1940—45, have, however, caused that these points do not exist any longer.

In the neighbourhood of the settlement remnants of old emerged terraces occur at a few places. An instance of this is a broad cleft with shelly gravel just behind the building of "Efterskolen" (i. e. Continuation School). The altitude of the terrace is 6 m. (fig. 18). On its inside a big sample was collected. The deposit resembles very much the shelly layers at Orpigsûp tasia kitdleq, Akúnâq, and Igíniarfik further south, as well as at Holsteinsborg and Sukkertoppen.

The shelly gravel contains almost entirely fragments, but is especially characterized by vast quantities of barnacle remains, particularly many small shells. The following species were found in the sample:



Auct. phot. 9.-9.-1946.

Fig. 18. The "Efterskolen" (i. e. Continuation School) of Egedesminde as seen from the "Engen" (i. e. the Meadow). To the right of the school a cleft in the gneiss, in which the marine Quaternary forms a terrace.

Pecten islandicus MÜLL. 2 fragments.
Mytilus edulis L. Numerous small and large fragments.
Cyamium minutum (FABR.) 80 shells.
Saxicava arctica (L.) 5 shells and some fragments.
Mya truncata (L.) 1 juvenile shell and fragments of adult shells.
Chiton sp. 2 shells.
Puncturella noachina (L.) 9 specimens.
Acmaea virginea (MÜLL.) 6 specimens.
Solariella obscura (COUTH.) 4 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 9 specimens and some fragments.
Littorina palliata SAY. 5 specimens and some fragments.
Cingula castanea (MØLL.) 2 specimens.
Trophon truncatus (STRØM). 1 specimen.
Balanus balanus DA COSTA. 12 shells, some very large.
Balanus crenatus BRUG. A great number of shells.
Strongylocentrotus drøbachiensis MÜLL. Some shell fragments and many spines.
Serpula sp. Many specimens.

The occurrence of *Acmaea virginea* indicates that the climatic conditions were boreal when this layer was being deposited.

Excavations were made at some places on the so-called "Eng" (meadow) behind "Efterskolen". Under the vegetation cover is sand. A few shells were found in one of the excavations. The altitude was 5 m. above sea level. The species were:

Pecten islandicus MÜLL. 1 shell and 2 fragments.
Mytilus edulis L. 2 fragments.
Axinopsis orbiculata SARS. 1 shell.
Saxicava arctica (L.) 1 fragment.
Trophon fabricii MØLL. 1 specimen.
Balanus balanus DA COSTA. 3 shells.
Balanus crenatus BRUG. 8 shells and some fragments.

The layer corresponds with the locality just behind "Efterskolen", and it must therefore be assumed that it has been deposited under similar climatic conditions.

Naternaq, north of Amitsuarssuk in Arfersiorfik Fjord. The locality is situated at a lakelet on Lersletten in Lat. 68°17' N, Long. 52°03' W, about 100 m. above sea level, and was investigated by State Geologist, K. MILTHERS, Ph. D. The southern part of the big clay plain resembles perfectly the northern portion at Sydostbugten, which has been described by HARDER, JENSEN, and LAURSEN (21). A sample, taken from one of the characteristic clay circles, contained the following species:

Portlandia arctica (GRAY). 4 small specimens.
Cardium ciliatum FABR. 3 specimens.
Macoma calcaria (CHEMN.) 10 specimens.
Some clay concretions.

The climate was high-arctic when this layer was deposited.

Agto. Behind the outpost at 22 m. above sea level is a terrace, the outer edge of which lies a little lower, whereas the inner edge is about 32 m. above sea level. The outer edge of the next terrace is at 42 m. above sea level, but the inner edge could not be determined. An excavation was made in the lower terrace, as there were no natural sections. The upper half metre consists of sand, overlying clay. In the clay the following shells were collected:

Pecten islandicus MÜLL. 4 fragments.
Mya truncata (L.) 1 shell and some fragments.
Hemithyris psittacea (GML.) 6 shells.
Balanus hammeri (ASCAN.) BROWN. 11 shells.

In the sand:

Pecten islandicus MÜLL. 18 fragments.
Lima subauriculata MONT. 4 fragments.
Mytilus edulis L. 14 fragments.
Astarte borealis (CHEMN.) 2 shells and 3 large fragments.
Astarte montagui (DILL.) var. *striata* (LEACH) SARS. 3 shells and some fragments.
Macoma calcaria (CHEMN.) 7 shells and some fragments.
Saxicava arctica (L.) 15 shells and some fragments. Some of the shells are "pinched", commonly as if they were double.
Mya truncata (L.) 14 shells and many fragments.
Chiton sp. 1 shell.
Puncturella noachina (L.) 1 specimen.
Acmaea rubella (FABR.) 1 specimen.
Lepeta coeca (MÜLL.) 1 specimen.
Trophon fabricii MØLL. 1 juvenile specimen.
Hemithyris psittacea (GML.) 19 fragments.
Balanus balanus DA COSTA. 14 shells.
Balanus hammeri (ASCAN.) BROWN. 4 shells.
Balanus crenatus BRUG. 10 shells.
Strongylocentrotus drøbachiensis (MÜLL.) 1 shell fragment and many spines.
Serpula sp. Many specimens.
Bryozoa sp. Some specimens.
Bryozoa sp. Some specimens.

The climatic conditions were Arctic when both layers were being deposited.

Giesecke Sø. The lake is situated in the Egedesminde South district. K. L. GIESECKE, the geologist, who visited Greenland in 1806—13, and after whom the lake has been named, has never been near it. Investigations at the lake were not made until 1911 by State Geologist, V. NORDMANN, Ph. D., who has briefly described it (57, p. 47). From the shell banks situated at the south-west end of the lake, Dr. NORDMANN brought home a rich material which has been worked out and puslished by the present writer (41, p. 36 ff.). The lake debouches through a salmon river (Eqalugssuit) into the bay just south of Gamle Egedesminde, by NIELS EGEDE called Laksebugten (i. e. salmon bay) (16, p. 24—25) (fig. 19). At the mouth of the river is an old terrace with a scarp of sand, 3 m. high. The surface of the terrace bears witness to a very rich life in former times: tent rings, meat caches, and kippering kilns lie scattered over the small plain which is traversed by old paths leading to the lake. The length of

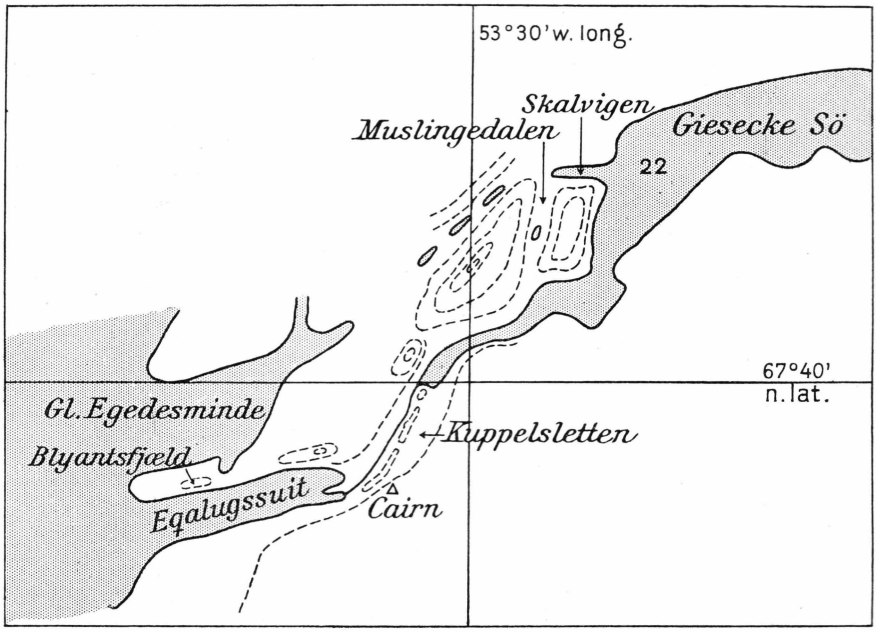


Fig. 19. Sketch-map of the Giesecke Sø area, drawn by the writer on the basis of older maps.

the valley from the bay to the lake is about 1,5 km. Some remains of marine deposits occur in the valley. They consist of clay at the river, and of gravel at the rock wall which bounds the valley. In the clay the following shells were found at 32 m. above sea level:

Leda minuta (MÜLL.) Some fragments.
Pecten islandicus MÜLL. Many shells and fragments.
Lima subauriculata MONT. Many shells and fragments.
Crenella decussata (MONT.) Many shells and fragments.
Modiolaria discors (L.) 1 fragment.
Astarte montagui (DILL.) 3 juvenile shells.
Serripes groenlandicum (CHEMN.) Some fragments.
Macoma calcaria (CHEMN.) Some fragments.
Saxicava arctica (L.) 4 shells, some fragments and many juvenile shells, of which some are drilled by *Natica*.
Mya truncata (L.) 16 shells, some fragments and juvenile shells.
Chiton sp. Many shells.
Scissurella crispata FLEM. Many specimens.
Puncturella noachina (L.) Many specimens.
Acmaea testudinalis (MÜLL.) Many specimens.
Margarita groenlandica (CHEMN.) Many specimens.
Margarita olivacea (BROWN). Many specimens.

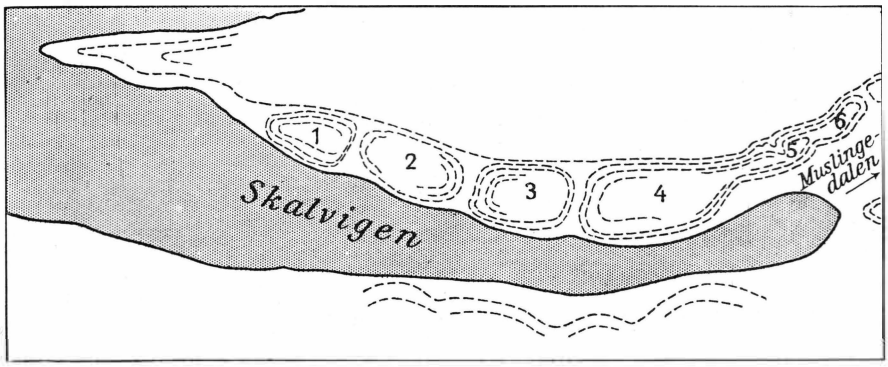


Fig. 20. Sketch-map of Skalvigen with the localities of knolls 1—5. (Cf. figs. 21—23).

Cingula castanea (MØLL.) Many specimens.
Alvania weyville-thomsoni (FR.) Some specimens.
Lunatia pallida (BROD. and SOW.) 3 specimens.
Natica clausa BROD. and SOW. 1 defective specimen.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (STRØM). Many specimens.
Bela cinerea (MØLL.) 2 specimens.
Bela decussata (COUTH.) 2 specimens.
Hemithyris psittacea (GML.) Some shells.
Balanus balanus DA COSTA. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

Based on 8 measurements by Paulin Aneroid the altitude of the lake was determined to be 22 m. above sea level. The lake meanders like a fjord through the country, generally surrounded by high rocks, rising steeply from the surface of the lake. A small valley, called Muslingedalen, runs in a northerly direction. It is full of lakelets, and its sides and floor are covered with marine Quaternary material. The valley is bounded on the east by a rocky knob, 93 m., jutting out into the lake. Its northern side is bounded by a small bay, called Skalvigen, which cuts in from the lake on the west. From the head of Skalvigen two valleys branch off, one is the above mentioned Muslingedal, leading to Giesecke Sø, the other runs out to Ikerasaussaq. Like Muslingedalen the latter is occupied by a series of lakelets. On the south bank of Skalvigen the writer observed great quantities of marine Quaternary material. It is this locality Dr. NORDMANN visited in 1911.

The shell deposit forms a terrace, which slopes gently upwards to Muslingedalen. The terrace has been cut up into 4 knolls, 3 small ones and a big one, by 3 small gullies. These knolls were investigated, a number of excavations being made, so that it was possible to survey sections at several places in fresh material. (Fig. 21 and 22).

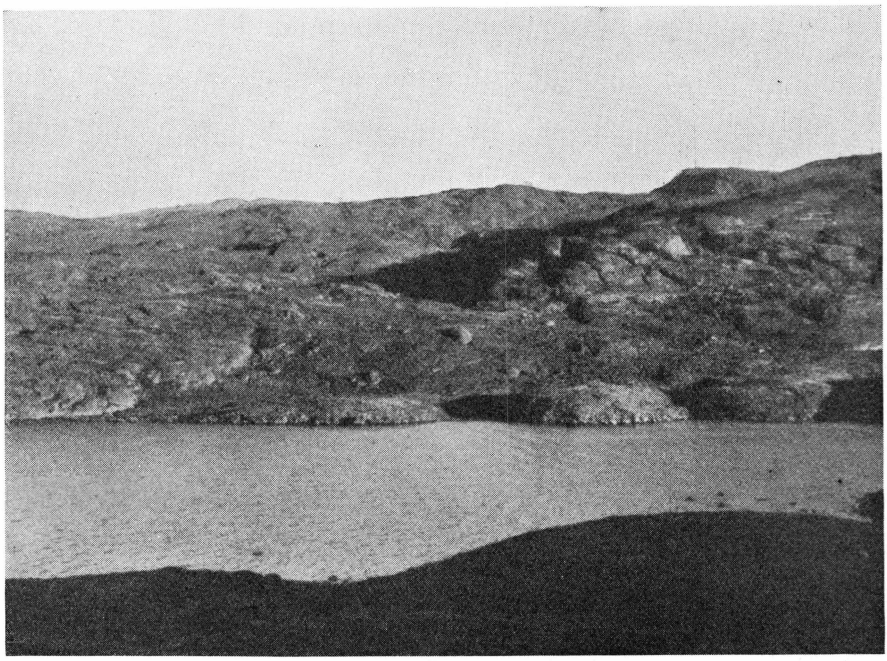
Knoll 1, the top of which is 2 m. above the level of the lake, corresponding to 24 m. above sea level, consists entirely of shelly gravel with many stones both big and small. 4 samples were taken from knoll 1:

At the level of the lake were found:

Pecten islandicus MÜLL. 4 very small fragments.
Mytilus edulis L. Many fragments of large shells.
Astarte montagui (DILL.) 2 juvenile shells.
Saxicava arctica (L.) A few juvenile shells and many fragments of adult shells.
Mya truncata (L.) Some fragments.
Puncturella noachina (L.) 2 specimens.
Acmaea virginea (MÜLL.) 2 specimens.
Margarita groenlandica (CHEMN.) 2 specimens.
Margarita helicina (PHIPPS). 1 specimen.
Moelleria costulata (MØLL.) 1 specimen.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 juvenile specimen.
Trophon truncatus (STRØM). 6 specimens.
Balanus balanus DA COSTA. Many shells.
Balanus hammeri (ASCAN.) BROWN. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.
Pearls 6 pieces.

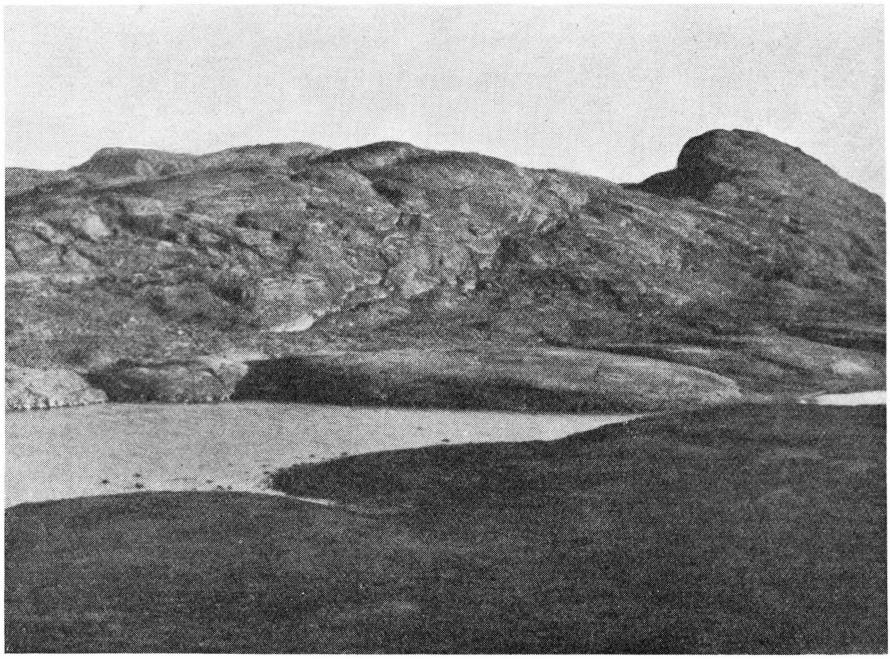
.5 m. above the level of the lake, i. e. 22.5 m. above sea level:

Pecten islandicus MÜLL. Some fragments.
Lima subauriculata MONT. 2 fragments.
Mytilus edulis L. Huge numbers of fragments.
Astarte montagui (DILL.) 1 fragment with umbo, drilled by *Natica*.
Saxicava arctica (L.) 5 small shells and some fragments of small shells, some drilled by *Natica*.
Mya truncata (L.) Some fragments.
Chiton sp. 1 shell.
Scissurella crispata FLEM. 1 specimen.
Acmaea virginea (MÜLL.) 1 specimen.
Margarita helicina (PHIPPS). 2 specimens.
Solariella obscura (COUTH.) 2 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 fragment.
Buccinum sp. 1 fragment.
Bela decussata (COUTH.) 1 specimen.
Balanus balanus DA COSTA. 1 shell.
Balanus hammeri (ASCAN.) BROWN. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many shell fragments and spines.



Auct. phot. 29.-8.-1946.

Fig. 21. Skalvigen with the localities of knolls 1—2 and 3 (from left to right).



Auct. phot. 29.-8.-1946.

Fig. 22. Skalvigen with the localities of knolls 2—3—4—5 and 6.

Serpula sp. 2 specimens.
Pearls 4 pieces.

1 m. above the level of the lake, i. e. 23 m. above sea level.

Pecten islandicus MÜLL. A few small fragments.
Lima subauriculata MONT. 2 fragments.
Mytilus edulis L. Some fragments.
Saxicava arctica (L.) Some fragments.
Mya truncata (L.) Some fragments.
Puncturella noachina (L.) 3 specimens.
Trophon truncatus (STRØM). 5 specimens.
Balanus balanus DA COSTA. 2 shells.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and spines.

Excavation in the top of the knoll at 24 m. above sea level:

Pecten islandicus MÜLL. 1 shell and many fragments.
Lima subauriculata MONT. 2 fragments.
Mytilus edulis L. Many fragments.
Modiolaria discors (L.) var. *laevigata* GRAY. 4 fragments with umbos.
Modiolaria nigra GRAY. 6 fragments with umbos.
Modiolaria faba (MÜLL.) FABR. 8 fragments with umbos.
Saxicava arctica (L.) 14 shells, of which 4 drilled by *Natica*, and some fragments.
Mya truncata (L.) 7 shells and some fragments. 1 shell drilled by *Natica*.
Chiton sp. 10 shells.
Scissurella crispata FLEM. 2 specimens.
Puncturella noachina (L.) 25 specimens and some fragments.
Acmaea rubella (FABR.) 18 specimens, 1 drilled by *Natica*.
Margarita groenlandica (CHEMN.) 1 specimen and 2 fragments.
Solariella obscura (COUTH.) 7 specimens.
Moelleria costulata (MØLL.) 4 specimens.
Cingula castanea (MØLL.) 8 specimens.
Alvania jan-mayeni (FR.) 1 specimen.
Lunatia pallida (BROD. and SOW.) 1 specimen.
Natica clausa BROD. and SOW. 1 specimen.
Trophon clathratus (L.) 1 large fragment.
Trophon truncatus (STRØM). 27 specimens.
Buccinum groenlandicum CHEMN. 2 specimens.
Bela cinerea (MØLL.) 1 specimen.

Balanus balanus DA COSTA. 15 large shells and 4 fragments.
Balanus hammeri (ASCAN.) BROWN. 12 shells and many fragments.
Balanus crenatus BRUG. 7 shells and 4 fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and many spines.
Serpula sp. 12 specimens.
Pearls. 5 pieces.

Lowermost in knoll 2 the writer found shelly gravel, a little more than 1 metre thick, superposed by clayey sand up to the top of the knoll. A number of samples were taken.

.5 m. above the level of the lake, i. e. 22.5 m. above sea level:

Pecten islandicus MÜLL. 4 small fragments.
Mytilus edulis L. 1 large and many small fragments.
Modiolaria faba (MÜLL.) FABR. 1 fragment with umbo.
Astarte montagui (DILL.) 1 juvenile shell.
Saxicava arctica (L.) 4 shells and some fragments.
Mya truncata (L.) 2 shells and some fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 1 specimen.
Chiton sp. 2 shells.
Puncturella noachina (L.) 1 specimen.
Acmaea rubella (FABR.) 1 specimen.
Margarita helicina (PHIPPS). 2 specimens.
Cingula castanea (MØLL.) 1 specimen.
Natica clausa BROD. and SOW. Some fragments.
Trophon truncatus (STRØM). 2 specimens and 2 large fragments.
Hemithyris psittacea (GML.) 1 small shell.
Balanus hammeri (ASCAN.) BROWN. Some shells and some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

1 m. above the level of the lake, i. e. 23 m. above sea level:

Pecten islandicus MÜLL. Some small shells and many fragments.
Astarte montagui (DILL.) 1 juvenile shell.
Saxicava arctica (L.) Many large shells and many fragments, many drilled by *Natica.*
Mya truncata (L.) Many shells and fragments.
Chiton sp. 1 shell.
Acmaea rubella (FABR.) 2 specimens.
Buccinum sp. 1 fragment.
Balanus balanus DA COSTA. Many large shells.
Balanus hammeri (ASCAN.) BROWN. Many large shells.

Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and many spines.
Serpula sp. Many specimens.
Otolith. 1 piece.

The top of the knoll 4 m. above the level of the lake i. e. 26 m. above sea level:

Pecten islandicus MÜLL. 3 shells and many fragments.
Saxicava arctica (L.) 30 shells and many fragments, some shells are "pinched", 2 drilled by *Natica.*
Mya truncata (L.) 43 large and rather thick shells, some fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 9 large, thick shells.
Chiton sp. 1 shell.
Natica clausa BROD. and SOW. 1 juvenile specimen and some fragments.
Hemithyris psittacea (GML.) About 50 shells and many fragments.
Balanus balanus DA COSTA. 17 shells and some fragments.
Balanus hammeri (ASCAN.) BROWN. 5 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.
Serpula sp. Some specimens.

Lowermost the excavated section in knoll 3 displayed shelly gravel 1 m. thick with big and small stones, superposed by a clayey sand bed about 20 cm. thick. On top of this is a layer in which *Mytilus edulis* predominates. The lowest portion of this layer is actually a concentration of closely packed shells with very large shells. The *Mytilus* layer extended up to about 50 cm. under the top of the knoll. It was overlain by a bed of sand, 40 cm. thick, without shells, which was succeeded by a podsolic shell layer. Uppermost is a vegetation layer a few cm. thick.

An excavation a little inwards in the cove displayed lowermost a bed of sand, 40 cm. thick, superposed by a layer with immense quantities of *Mytilus.* It appears particularly from these two excavations that the layers at the cove incline from the head of this towards the mouth. 3 samples were taken in knoll 3.

Shelly gravel at .5 m. above the level of the lake, i. e. 22.5 m. above sea level.

Pecten islandicus MÜLL. Some fragments.
Mytilus edulis L. 1 shell and vast quantities of fragments.
Astarte borealis (CHEMN.) 3 shells and 1 fragment.
Saxicava arctica (L.) Several hundred shells, rather small. Some shells are drilled by *Natica.* Many fragments.
Mya truncata (L.) 1 shell and 5 fragments.
Chiton sp. 8 shells.

Puncturella noachina (L.) 9 specimens.
Acmaea virginea (MÜLL.) 9 specimens.
Acmaea rubella (FABR.) 11 specimens.
Margarita groenlandica (CHEMN.) 7 specimens.
Margarita helicina (PHIPPS). 9 specimens.
Margarita olivacea (BROWN). 1 specimen.
Solariella obscura (COUTH.) var. *bella* VERK. 1 specimen.
Moelleria costulata (MØLL.) 3 specimens.
Littorina palliata SAY. 5 specimens and many fragments.
Cingula castanea (MØLL.) 1 specimen.
Natica sp. A few small fragments.
Trophon truncatus (STRØM). Many specimens.
Balanus balanus DA COSTA. Some shells.
Balanus hammeri (ASCAN.) BROWN. Many shells.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Several hundred spines. Pearls. 6 pieces.

1 m. above the level of the lake, i. e. 23 m. above sea level.

Pecten islandicus MÜLL. Some shells and many fragments.
Mytilus edulis L. Many fragments.
Astarte montagui (DILL.) 1 shell.
Saxicava arctica (L.) Some shells, of which some are "pinched". A few shells seem to have been crushed or broken and grown together again.
Mya truncata (L.) Many shells and many fragments. Some drilled by *Natica*.
Mya truncata (L.) forma *uddevallensis* HANC. 6 shells.
Puncturella noachina (L.) 1 specimen and some fragments.
Acmaea testudinalis (MÜLL.) 4 specimens.
Lepeta coeca (MÜLL.) 5 specimens.
Trophon clathratus (L.) 2 specimens.
Trophon truncatus (STRØM). 1 specimen and 1 large fragment.
Hemithyris psittacea (GML.) 2 shells and some fragments.
Balanus balanus DA COSTA. Some shells.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.

In the shelly gravel under the clayey sand about 1 m. above the level of the lake, i. e. about 23 m. above sea level.

Pecten islandicus MÜLL. Some small fragments.
Lima subauriculata MONT. 1 shell and 1 fragment.

Mytilus edulis L. Some fragments.
Modiolaria discors (L.) var. *substriata* GRAY. 1 fragment with umbo.
Saxicava arctica (L.) A great many fragments.
Mya truncata (L.) Some fragments.
Chiton sp. 7 shells.
Scissurella crispata FLEM. 3 specimens.
Puncturella noachina (L.) Some specimens and fragments.
Acmaea rubella (FABR.) 2 specimens and some fragments.
Solariella obscura (COUTH.) 4 specimens.
Moelleria costulata (MØLL.) 1 specimen.
Cingula castanea (MØLL.) 6 specimens.
Trophon truncatus (STRØM). 20 specimens.
Hemithyris psittacea (GML.) 1 fragment.
Balanus balanus DA COSTA. 1 shell and some fragments.
Balanus hammeri (ASCAN.) BROWN. Some shells and fragments.
Balanus crenatus BRUG. Some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and several hundred spines.
Serpula sp. Half a dozen specimens.
Pearls. 11 pieces.

In the transition layer at 1.5 m. above the level of the lake, i. e. 23.5 m. above sea level.

Pecten islandicus MÜLL. Some large shells and some fragments.
Mytilus edulis L. Some fragments.
Modiolaria faba (MÜLL.) FABR. 1 small fragment with umbo.
Saxicava arctica (L.) 12 large, thick shells and some fragments. 1 shell drilled by *Natica*. 2 shells completely deformed.
Mya truncata (L.) 50 shells, large, solid, very thick, many fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 8 large, solid shells.
Chiton sp. 1 shell.
Acmaea rubella (FABR.) 2 specimens.
Lepeta coeca (MÜLL.) 4 specimens.
Hemithyris psittacea (GML.) 1 fragment.
Balanus balanus DA COSTA. 5 shells.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Balanus crenatus BRUG. A few shells.
Serpula sp. Many specimens.
Bryozoae. Many and large specimens, partly individual, partly forming a cover.

3 m. above the level of the lake, i. e. 25 m. above sea level.

Pecten islandicus MÜLL. 5 small fragments, one drilled by *Natica*.
Mytilus edulis L. Great quantities of fragments of all sizes.
Astarte borealis (CHEMN.) 1 small shell.
Saxicava arctica (L.) 18 shells and many fragments, some drilled by *Natica*.
Mya truncata (L.) Fragments of many, solid shells.
Puncturella noachina (L.) 1 specimen.
Acmaea virginea (MÜLL.) 2 specimens.
Acmaea rubella (FABR.) 2 specimens.
Littorina palliata SAY. 1 specimen and some fragments.
Trophon truncatus (STRØM). 1 specimen.
Balanus balanus DA COSTA. 8 shells.
Balanus hammeri (ASCAN.) BROWN. Many shells.
Balanus crenatus BRUG. More than 100 shells and a great many fragments.

The podsolic layer at 5.5 m. above the level of the lake, i. e. 27.5 m. above sea level.

Pecten islandicus MÜLL. Some few fragments.
Mytilus edulis L. Numerous fragments.
Astarte borealis (CHEMN.) 1 small specimen.
Saxicava arctica (L.) Some fragments.
Mya truncata (L.) Some fragments.
Alvania sp. 1 fragment.
Gastropoda sp. Some heavily disintegrated fragments.
Balanus balanus DA COSTA. Many fragments.
Balanus crenatus BRUG. Many fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.
Pearl. 1 piece.
Vertebra of fish. 1 piece.

In knoll 4 the writer found shelly gravel in which *Mytilus edulis* predominated. Sand beds up to 20 cm. thick occur in the layer, irregularly interbedded. The shelly gravel extended almost to the top of the knoll, being superposed by a sand bed, 20—25 cm. thick, which was again overlain by a podsolic layer 5 cm. thick. Uppermost a few cm. of vegetation layer. At some places the sandy layer overlying the shelly gravel had a fairly great thickness—up to 1.5 m. Towards Muslingedalen the podsolic shelly layer increases in thickness; it is still superposing the sandy layer, which ultimately passes into a veritable concentration of closely packed stones the size of hens' eggs. The concentration of stones is resting on the shell horizon which extends down to the level of the lake.

This sequence and development of the sandy layers suggest that the streamlet, running out into Skalvigen, at certain times has had a greater flow of water than at other times. To-day it is rather insignificant, but it must be supposed that after the knolls have been raised above the level of the lake, it has at one time had even a very great flow of water, as it has cut very deep into these raised layers. Some big samples were also taken in knoll 4.

Shelly gravel at .5 m. above the level of the lake, i. e. 22.5 m. above sea level.

Pecten islandicus MÜLL. Some ten rolled fragments.
Mytilus edulis L. Thousands of fragments of all sizes.
Astarte borealis (CHEMN.) 2 small shells and some fragments.
Astarte montagui (DILL.) 1 somewhat rolled fragment.
Saxicava arctica (L.) Several hundred shells of varying sizes. Some drilled by *Natica*.
Mya truncata (L.) 25 fragments, somewhat rolled.
Puncturella noachina (L.) 4 specimens.
Acmaea rubella (FABR.) 1 specimen.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 2 specimens.
Littorina palliata SAY. 3 specimens and some fragments.
Scalaria borealis BECH. 2 specimens.
Natica clausa BROD. and SOW. 1 specimen.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (STRØM). 2 specimens.
Balanus balanus DA COSTA. 30 shells.
Balanus hammeri (ASCAN.) BROWN. About 100 shells and fragments.
Balanus crenatus BRUG. 50 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.

Shelly gravel 1 m. above the level of the lake, i. e. 23 m. above sea level.

Pecten islandicus MÜLL. Some fragments.
Mytilus edulis L. Many fragments.
Axinopsis orbiculata SARS. 8 shells.
Serripes groenlandicum (CHEMN.) 1 shell and some fragments.
Macoma baltica (L.) 3 shells.
Saxicava arctica (L.) Some shells and many fragments.
Mya truncata (L.) Some fragments and some juvenile shells.
Puncturella noachina (L.) 3 specimens.
Acmaea rubella (FABR.) 2 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 12 specimens.
Littorina palliata SAY. 1 specimen.

Scalaria borealis BECH. 1 specimen.
Balanus hammeri (ASCAN.) BROWN. 2 shells.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.

Shelly gravel at 2.5 m. above the level of the lake, i. e. 24.5 m. above. sea level.

Pecten islandicus MÜLL. 2 large shells and some fragments.
Lima subauriculata MONT. 1 shell.
Crenella decussata (MONT.) 3 shells.
Mytilus edulis L. 2 shells and a great many fragments.
Astarte borealis (CHEMN.) 2 shells and 1 fragment.
Saxicava arctica (L.) 41 shells and many fragments.
Mya truncata (L.) 13 shells and some fragments.
Puncturella noachina (L.) 1 specimen.
Acmaea rubella (FABR.) 3 specimens.
Margarita helicina (PHIPPS). 1 specimen.
Solariella obscura (COUTH.) 1 specimen.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Littorina palliata SAY. 2 specimens and 3 fragments.
Scalaria borealis BECH. 1 specimen.
Trophon clathratus (L.) 1 fragment.
Buccinum groenlandicum CHEMN. 4 specimens, a little defective, and some fragments.
Balanus balanus DA COSTA. 2 specimens and some shells.
Balanus hammeri (ASCAN.) BROWN. A great many shells.
Balanus crenatus BRUG. A great many shells.
Pearls. 4 pieces.

Excavation in the top at 6 m. above the level of the lake, i. e. 28 m. above sea level.

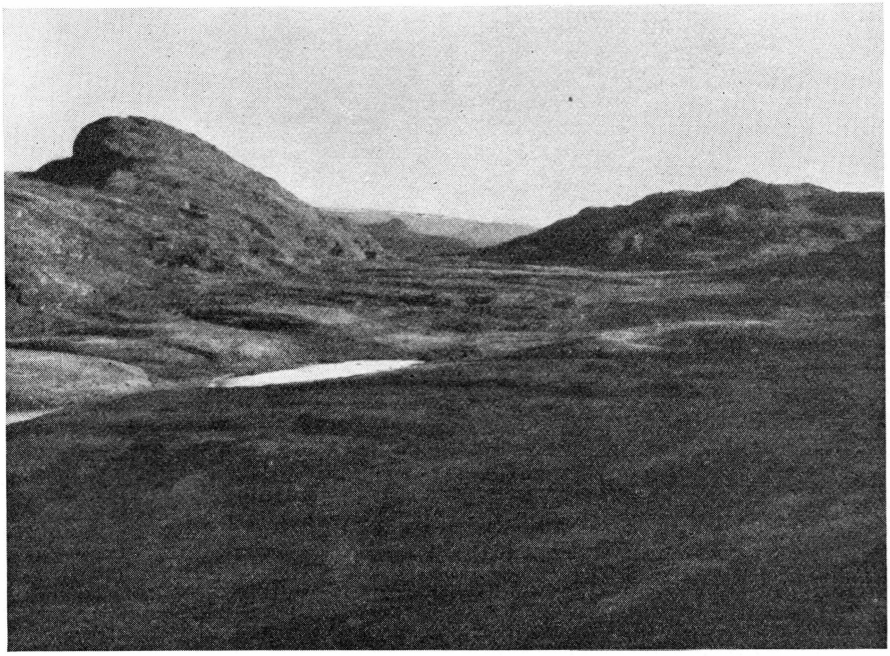
Pecten islandicus MÜLL. 2 shells and 6 fragments.
Mytilus edulis L. A great many fragments.
Astarte borealis (CHEMN.) 1 shell.
Astarte montagui (DILL.) 1 fragment.
Saxicava arctica (L.) 42 shells and many fragments, some drilled by *Natica*.
Mya truncata (L.) 13 shells and some fragments.
Chiton sp. 1 shell.
Puncturella noachina (L.) 1 specimen.
Acmaea virginea (MÜLL.) 3 specimens.
Acmaea rubella (FABR.) 7 specimens.
Margarita cinerea (COUTH.) 4 fragments.

Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 2 specimens.
Alvania jan-mayeni (FR.) 2 specimens.
Turritella erosa (COUTH.) 1 specimen.
Natica clausa BROD. and SOW. 3 somewhat defective specimens.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (STRØM). 2 specimens.
Buccinum sp. 4 fragments.
Balanus balanus DA COSTA. $^1/_2$ specimen, 22 shells, and some fragments.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Balanus crenatus BRUG. Hundreds of shells and large numbers of fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.

Knoll 5 and 6, which lie in immediate continuation of knoll 4 and at the entrance of Muslingedalen, had the same structure as knoll 4. On the opposite side of the cove there was a series of knolls, having a perfect resemblance to those mentioned above, from which they, however, differ essentially, as no shells were found in any of them at any levels, nor even the faintest trace of such.

The top of knoll 7, which lies at 29 m. above sea level, consisted of sandy, fossiliferous clay. Excavation in the top of the deposit was made here as at the subsequent localities. The following shells were found:

Leda minuta (MÜLL.) 1 specimen.
Pecten islandicus (MÜLL.) 3 specimens, of which 1 drilled by *Natica*, and many fragments.
Astarte montagui (DILL.) var. *striata* (LEACH) SARS. 1 shell.
Macoma calcaria (CHEMN.) 4 shells and 3 fragments.
Saxicava arctica (L.) Many shells and many fragments. Some of the shells were "pinched".
Mya truncata (L.) Many thick shells and many fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 7 large, thick shells.
Chiton sp. 5 shells.
Scissurella crispata FLEM. 2 specimens.
Puncturella noachina (L.) 5 specimens, 1 drilled by *Natica*.
Acmaea rubella (FABR.) Many specimens.
Lepeta coeca (MÜLL.) 17 specimens.
Moelleria costulata (MØLL.) 2 specimens.
Cingula castanea (MØLL.) 4 specimens.
Lunatia pallida (BROD. and SOW.) 1 specimen.
Natica clausa BROD. and SOW. 1 specimen.
Trophon truncatus (STRØM). 4 specimens and 3 fragments.
Hemithyris psittacea (GML.) 1 shell and some fragments.



Auct. phot. 29.-8.-1946.

Fig. 23. The interior of Skalvigen which continues into Muslingedalen with the localities knolls 7—14. Knoll 4 is seen farthest to the left.

Balanus balanus DA COSTA. 8 shells and some fragments.
Balanus hammeri (ASCAN.) BROWN. 4 shells and 1 fragment.
Balanus crenatus BRUG. 2 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.

Sandy clay at the top of knoll 8 at 32 m. above sea level.

Pecten islandicus MÜLL. About 10 fragments of very large shells.
Astarte montagui (DILL.) 1 shell.
Saxicava arctica (L.) 17 shells, of which 2 drilled by *Natica*.
Mya truncata (L.) 8 large, solid shells.
Puncturella noachina (L.) 1 specimen.
Acmaea rubella (FABR.) 2 specimens.
Lepeta coeca (MÜLL.) 1 specimen.
Natica clausa BROD. and SOW. 4 unbroken and 4 defective specimens, and some fragments.
Trophon truncatus (STRØM). 1 specimen.
Hemithyris psittacea (GML.) 5 fragments.

From knoll 8 and inland up the valley the sandy clay becomes more and more fat. Yet on the tops of the highest knolls at 36 m. above sea level the clay was not so fat as in the preceding knolls.

Top of knoll 9. Fat clay. 33 m. above sea level.
Portlandia arctica (GRAY). Some shells.
Macoma calcaria (CHEMN.) 2 shells and some fragments.
Saxicava arctica (L.) Many shells and fragments.
Mya truncata (L.) 5 thick shells and some fragments.

On the top of knoll 10 fat clay with insignificant amount of sand at 34 m. above sea level.

Pecten islandicus MÜLL. 1 shell and some fragments.
Axinopsis orbiculata SARS. 1 shell.
Macoma calcaria (CHEMN.) 5 shells and some fragments.
Saxicava arctica (L.) 54 shells and many fragments.
Mya truncata (L.) 10 large shells and some fragments.
Mya truncata (L.) forma *uddevalensis* HANC. 1 shell.
Chiton sp. 1 shell.
Puncturella noachina (L.) 2 specimens.
Lepeta coeca (MÜLL.) 5 specimens.
Trophon truncatus (STRØM). 1 fragment.
Bela decussata (COUTH.) 1 specimen.
Cylichna alba (BROWN). 1 defective specimen.
Hemithyris psittacea (GML.) 3 specimens, 21 shells and many fragments.
Balanus balanus DA COSTA. Several hundred shells.
Balanus hammeri (ASCAN.) BROWN. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and some spines.
Serpula sp. Some specimens.
Bryozoa sp. Many specimens.

The top of knoll 11 at 35 m. above sea level, clay with a little sand.

Pecten islandicus MÜLL. Some shells.
Crenella decussata (MONT.) 1 shell.
Astarte montagui (DILL.) 1 shell.
Saxicava arctica (L.) Many shells, some "pinched".
Mya truncata (L.) 4 shells.
Puncturella noachina (L.) 1 specimen.
Lunatia pallida (BROD. and SOW.) 1 specimen.
Hemithyris psittacea (GML.) Some shells.
Balanus balanus DA COSTA. Some shells.

The top of knoll 12 at 35 m. above sea level, clay with a little sand.

Pecten islandicus MÜLL. 1 fragment.
Macoma calcaria (CHEMN.) 2 shells.

Saxicava arctica (L.) 22 shells, large, thick-shelled.
Mya truncata (L.) 9 shells.
Hemithyrus psittacea (GML.) 1 specimen, 2 shells and some shells a little defective.
Balanus hammeri (ASCAN.) BROWN. 6 shells, of which 2 were unusually large and thick.
Bryozoa sp. Some specimens.

The top of knoll 13 at 36 m. above sea level, clay with sand.

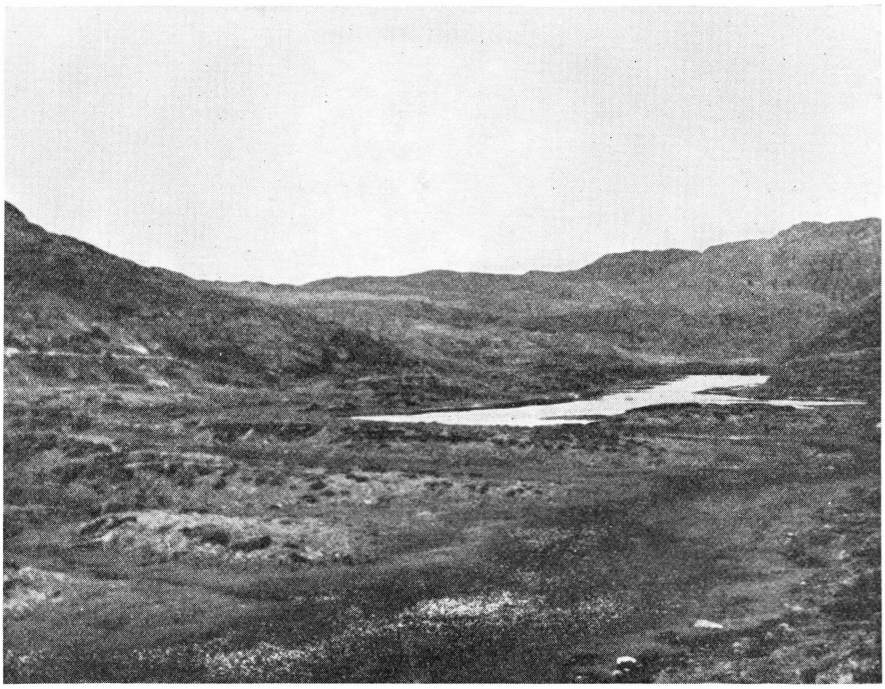
Pecten islandicus MÜLL. Some large shells.
Macoma calcaria (CHEMN.) 2 shells, one of which drilled by *Natica*.
Saxicava arctica (L.) Many shells, of which a great portion was severely "pinched".
Mya truncata (L.) 3 shells and some fragments.
Hemithyris psittacea (GML.) 2 shells.
Balanus balanus DA COSTA. 2 shells.
Balanus hammeri (ASCAN.) BROWN. 8 large shells.

The top of knoll 14 at 36 m. above sea level, clay with sand.

Leda pernula (MÜLL.) 1 shell.
Pecten islandicus MÜLL. Many large shells.
Astarte montagui (DILL.) 2 fragments.
Saxicava arctica (L.) Many shells.
Mya truncata (L.) 9 shells and some fragments.
Trophon clathratus (L.) 1 specimen and 1 fragment.
Hemithyris psittacea (GML.) 1 shell.
Balanus balanus DA COSTA. Many shells.
Balanus hammeri (ASCAN.) BROWN. 3 fragments.

Knoll 14 is bounded on the west by a lakelet (fig. 24). Behind this are a few knolls more, but without shells. Where Muslingedalen ends at Giesecke Sø there is a small section on each side. Both sections are identical in structure: lowermost sandy clay, which upwards gradually passes into sand, and uppermost gravel. In the western section the following shells were collected at 24 m. above sea level:

Pecten islandicus MÜLL. Many shells and fragments.
Lima subauriculata MONT. Some fragments.
Crenella decussata (MONT.) Many shells, some drilled by *Natica*.
Modiolaria discors (L.) Some fragments.
Astarte montagui (DILL.) Some juvenile specimens.
Macoma calcaria (CHEMN.) 2 fragments.



Auct. phot. 30.-9.-1946.

Fig. 24. The pass in Muslingedalen with the locality of knoll 14.

Saxicava arctica (L.) 2 large shells, one of which drilled by *Natica*, and a great many juvenile shells.
Mya truncata (L.) Many shells, both adult and juvenile ones.
Scissurella crispata FLEM. Many specimens.
Puncturella noachina (L.) Many specimens.
Acmaea testudinalis (MÜLL.) Many specimens.
Lepeta coeca (MÜLL.) 1 specimen.
Margarita helicina (PHIPPS). 5 specimens.
Solariella obscura (COUTH.) 5 specimens.
Moelleria costulata (MØLL.) Many specimens.
Cingula castanea (MØLL.) Many specimens.
Lunatia pallida (BROD. and SOW.) 3 small specimens.
Buccinum sp. 2 fragments.
Trophon truncatus (STRØM). 4 specimens.
Bela nobilis (MØLL.) 2 specimens.
Bela violacea (MIGH.) 5 specimens.
Balanus balanus DA COSTA. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

The section on the eastern side extended some ten metres into the the valley. A small melt-water stream from a snow-drift had here carved

its way down through the deposits, which resulted in a fresh section front. Here the following shells were collected at 24—26 m. above sea level:

Pecten islandicus MÜLL. 4 shells and 3 fragments.
Lima subauriculata MONT. 1 fragment.
Crenella decussata (MONT.) 1 shell and 2 fragments.
Mytilus edulis L. 1 small fragment.
Saxicava arctica (L.) 8 shells, of which 1 drilled by *Natica*. Some fragments.
Mya truncata (L.) 6 shells, of which 2 drilled by *Natica* and some fragments.
Chiton sp. 2 shells.
Emarginula fissura (L.) 1 specimen, which presumably belongs to the variety *incurva* JEFF., as apex curves right down to the frontal edge.
Puncturella noachina (L.) 8 specimens.
Acmaea rubella (FABR.) 4 specimens.
Solariella obscura (COUTH.) 2 specimens.
Moelleria costulata (MØLL.) 6 specimens.
Lunatia pallida (BROD. and SOW.) 1 specimen.
Natica sp. 1 fragment.
Trophon fabricii MØLL. 2 small specimens and a fragment of a large one.
Trophon truncatus (STRØM). 1 specimen.
Buccinum sp. I. 3 fragments.
Buccinum sp. II. 1 fragment.
Hemithyris psittacea (GML.) 1 shell and some fragments.
Balanus balanus DA COSTA. 6 specimens and 8 shells.
Balanus crenatus BRUG. 2 shells and some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) 4 spines.
Serpula sp. 2 specimens.
Bryozoa sp. Several specimens.

The valley leading from Giesecke Sø to Eqalugssuit, is on its eastern side bounded by a series of minor gneissic outcrops, which rise to about 75 m. above sea level. More or less halfway down the valley is a passage into the area between the lower gneissic projections and the steep rock wall behind. This area turned out to be a large plain, bounded on the south by the steep wall, the northern part of it extending down to Giesecke Sø. The plain is raised sea bottom, which has been cut up by the erosion of a number of streamlets into a series of minor patches, the sides of which are rounded on account of solifluction, so that each patch looks like a flattened dome. These are situated at an altitude of 30 m. above

sea level. Referring to the form of the surface of the plain it is called Kuppelsletten (i. e. plain of domes). Sections have formed in the sides of the domes by the erosion of the streamlets. These sections all show a uniform structure of the domes. They consist lowermost of fat clay in which no shells could be found. The fat clay is superposed by sandy clay with shell bands. The tops of the domes consist of sand, which has apparently been deposited in running water. At several places concentrations of closely packed stones the size of hens' eggs were observed under the sand. The thickness of the sand ranges up 1.5 m.

At the biggest of the streamlets which traverse the plain a number of samples were taken.

Locality 1. Sample from the sandy clay.

Pecten islandicus MÜLL. 2 shells, one of which drilled by *Natica*, the other quite overgrown with *Bryozoa sp.* Furthermore some fragments of large and medium-sized shells.
Lima subauriculata MONT. 1 shell and 4 fragments.
Crenella decussata (MONT.) 1 fragment.
Mytilus edulis L. 1 very small fragment.
Astarte montagui (DILL.) 6 shells.
Macoma calcaria (CHEMN.) 5 shells, of which 1 drilled by *Natica.*
Saxicava arctica (L.) 9 shells and many fragments.
Mya truncata (L.) 25 shells and many fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 5 shells.
Chiton sp. 4 shells.
Puncturella noachina (L.) 8 specimens and some fragments.
Acmaea rubella (FABR.) 7 specimens and 2 fragments.
Lepeta coeca (MÜLL.) 6 specimens and some fragments.
Moelleria costulata (MØLL.) 2 specimens.
Cingula castanea (MØLL.) 2 specimens.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (STRØM). 5 specimens.
Hemithyris psittacea (GML.) 5 fragments.
Balanus balanus DA COSTA. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many spines.

Locality 2 is situated about 50 m. higher up the bed of the streamlet. Lowermost in the section was fat clay without shells superposed by sandy clay with shells emerging into a concentration of closely packed shells, 10—15 cm. thick. On the top of that sand without shells. In a sample from the sandy clay the following shells were found:

Pecten islandicus MÜLL. Many large shells.
Lima subauriculata MONT. 2 shells and many fragments.

Crenella decussata (MONT.) Many shells and fragments.
Mytilus edulis L. Some small and large fragments.
Astarte montagui (DILL.) 1 shell and 1 fragment.
Macoma calcaria (CHEMN.) 2 shells and 2 fragments.
Saxicava arctica (L.) Many adult and juvenile shells.
Mya truncata (L.) Many adult and juvenile shells.
Chiton sp. Some shells.
Scissurella crispata FLEM. Some specimens.
Puncturella noachina (L.) Many specimens and fragments.
Acmaea testudinalis (MÜLL.) Many specimens.
Margarita helicina (PHIPPS). 2 specimens.
Moelleria costulata (MØLL.) Many specimens.
Littorina obtusata L. 1 juvenile specimen.
Cingula castanea (MØLL.) Many specimens.
Alvania jeffreysi (WALL.) Many specimens.
Natica clausa BROD. and SOW. 2 specimens.
Trophon truncatus (STRØM). 2 specimens.
Bela nobilis (MØLL.) 1 specimen.
Hemithyris psittacea (GML.) 1 fragment.
Balanus balanus DA COSTA. Many shells and a great many juvenile specimens.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and many spines.
Serpula sp. Many specimens.
Bryozoa sp. Many specimens.

A very big sample was taken in the concentration of packed shells. The layer was rich in gravel and big boulders. The shells, especially the *Mya* shells, are very solid and thick, which inevitably suggests that the layer must have been deposited in a surf-beaten zone. The shells contained were as follows:

Pecten islandicus MÜLL. 6 large shells and some fragments.
Lima subauriculata MONT. 1 shells and many fragments.
Crenella decussata (MONT.) 3 shells and some fragments.
Mytilus edulis L. 2 very small fragments.
Modiolaria discors (L.) var. *laevigata* GRAY. 1 fragment with umbo.
Modiolaria discors (L.) var. *substriata* GRAY. 4 fragments with umbos.
Astarte montagui (DILL.) 1 shell and 1 fragment.
Axinopsis orbiculata SARS. 2 shells.
Saxicava arctica (L.) 1 adult shell and some juvenile ones. Many fragments.
Mya truncata (L.) 49 large, solid shells and many fragments.

Mya truncata (L.) forma *uddevallensis* HANC. 5 shells.
Thracia myopsis (MØLL.) 1 shell and 1 fragment.
Chiton sp. Many shells.
Scissurella crispata FLEM. 10 specimens.
Puncturella noachina (L.) 23 specimens and some fragments.
Acmaea rubella (FABR.) 23 specimens.
Lepeta coeca (MÜLL.) 3 specimens.
Margarita groenlandica (CHEMN.) 5 specimens and 3 fragments.
Margarita cinerea (COUTH.) var. *juvenilis* SARS. 1 specimen.
Solariella obscura (COUTH.) 15 specimens.
Solariella obscura (COUTH.) var. *bella* VERK. 1 specimen.
Moelleria costulata (MØLL.) 22 specimens.
Littorina palliata SAY. 1 juvenile specimen.
Cingula castanea (MØLL.) 25 specimens.
Trophon clathratus (L.) 1 juvenile specimen and fragments of 2 adult ones.
Trophon fabricii MØLL. 2 specimens and some fragments.
Trophon truncatus (STRØM). 5 specimens and some fragments.
Hemithyris psittacea (GML.) Some fragments.
Balanus balanus DA COSTA. Many shells.
Balanus crenatus BRUG. 2 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and hundred of spines.
Serpula sp. Several hundred specimens.
Bryozoa sp. Some specimens.
Foraminiferae sp. Some specimens.

An excavation was made about 60 m. farther up the bed of the streamlet. Lowermost was the fat clay, seemingly without shells. Superposing this layer was sandy clay with shells, overlain by a purple to reddish-coloured concentration of closely packed shells. The sandy clay contained many small and large boulders and the shell material was rather crushed. In the clay was some mica. The layer was also characterized by vast quantities of *Serpula sp.* and *Strongylocentrotus* spines. In the sandy clay the following shells were found:

Leda minuta (MÜLL.) 5 small fragments.
Pecten islandicus MÜLL. 5 shells and some fragments.
Lima subauriculata MONT. 1 fragment.
Crenella decussata (MONT.) 1 fragment.
Astarte montagui (DILL.) 3 shells and 1 fragment, 1 shell drilled by *Natica.*
Macoma calcaria (CHEMN.) 3 shells and some fragments.
Saxicava arctica (L.) 6 shells and some fragments.

Mya truncata (L.) 1 specimen, 17 shells and some fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 7 shells.
Thracia myopsis (MØLL.) 2 shells.
Chiton sp. Some shells.
Scissurella crispata FLEM. 3 specimens.
Puncturella noachina (L.) 1 fragment.
Acmaea rubella (FABR.) 3 specimens.
Lepeta coeca (MÜLL.) 5 specimens.
Solariella obscura (COUTH.) 1 specimen.
Moelleria costulata (MØLL.) 3 specimens.
Cingula castanea (MØLL.) 2 specimens.
Natica clausa BROD. and SOW. 1 specimen.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (STRØM). 2 specimens.
Hemithyris psittacea (GML.) 5 specimens, some shells and some fragments.
Balanus balanus DA COSTA. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Many shell fragments and hundreds of spines.
Serpula sp. Hundreds of specimens.
Bryozoa sp. Many specimens.

A big sample from the concentration of packed shells contained:

Pecten islandicus MÜLL. About twenty fragments.
Lima subauriculata MONT. 7 shells and some fragments.
Crenella decussata (MONT.) 2 shells.
Mytilus edulis L. 2 small fragments.
Modiolaria discors (L.) var. *laevigata* GRAY. 4 fragments.
Modiolaria faba (MÜLL.) FABR. 1 fragment.
Astarte montagui (DILL.) 2 fragments.
Cyamium minutum (FABR.) 2 shells.
Saxicava arctica (L.) 7 shells and a great number of juvenile shells, of which many were drilled by *Natica*. Fragments.
Mya truncata (L.) 4 shells and some fragments.
Thracia myopsis (MØLL.) 2 shells, both drilled by *Natica*.
Chiton sp. Many shells.
Scissurella crispata FLEM. 25 specimens.
Puncturella noachina (L.) 17 specimens and many fragments.
Acmaea rubella (FABR.) 19 specimens.
Lepeta coeca (MÜLL.) 6 specimens.
Margarita groenlandica (CHEMN.) 6 specimens and some fragments.
Margarita helicina (PHIPPS). Some specimens.
Solariella obscura (COUTH.) 16 specimens.

Moelleria costulata (MØLL.) 22 specimens, some of which with striated base.
Lunatia pallida (BROD. and SOW.) 2 specimens.
Velutina velutina (MÜLL.) var. *schneideri.* FR. 1 specimen.
Trophon clathratus (L.) 1 specimen and some fragments.
Trophon truncatus (STRØM). 4 specimens and some fragments.
Pyrene rosacea GOULD. 3 specimens.
Bela pyramidalis (STRØM). 4 specimens and some fragments.
Hemithyris psittacea (GML.) 1 specimen and 1 shell.
Balanus balanus DA COSTA. Many large shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and many spines.
Serpula sp. Many specimens.

As mentioned above, Kuppelsletten extends down to Giesecke Sø. 3 terraces facing the latter were measured:

Outer edge 30 m. above sea level. Inner edge 31 m. above sea level.
— — 36 m. — - — — — 45 m. — - —
— — 47 m. — - — — — 53 m. — - —

The localities in the Giesecke Sø area will be discussed in a later chapter.

Holsteinsborg District.

Eqalugsugssuit qínguat, Nordre Isortoq, 2 m. above sea level. Investigations and collections have been made by State Geologist, K. MILTHERS, Ph. D. The section, the height of which does not exceed 10 m., consists of alternating layers of sand and clay. The layers incline 10°—15° from the side of the valley towards the middle. From a sandy layer at 2 m. above sea level a sample supplied the following shells:

Pecten islandicus MÜLL. Fragment of a very large shell.
Cardium ciliatum FABR. Fragments of large shells.
Macoma calcaria (CHEMN.) 2 fragments.
Mya truncata (L.) Some fragments.
Balanus balanus DA COSTA. 1 very large shell.

Qôrorssuaq kitdleq, Nordre Isortoq. At 2 m. above sea level State Geologist, K. MILTHERS, Ph. D., collected:

Mya truncata (L.) Some fragments.

The settlement of Holsteinsborg. The plateau behind the settlement is old raised sea bottom. At about 70 m. above sea level a collection was

made in some large holes, dug by the Greenlanders. The layers are typical unstratified shell bank layers, the shells are heavily crushed and all of them are characterized by being rolled. In the deposit some big and small boulders were met with. The sample collected contained the following shells:

Pecten islandicus MÜLL. Few fragments.
Mytilus edulis L. Some fragments.
Macoma calcaria (CHEMN.) 2 fragmentary shells.
Saxicava arctica (L.) Few fragments.
Mya truncata (L.) Few fragments.
Chiton sp. Some shells.
Puncturella noachina (L.) 1 specimen.
Acmaea rubella (FABR.) 3 specimens.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Littorina palliata SAY. 6 specimens.
Balanus balanus DA COSTA. Many shells.
Balanus crenatus BRUG. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some shell fragments and spines.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.

A drainage canal has been dug round the cemetery of the settlement. Under the vegetation cover is sand about 50 cm. thick, superposing a layer of shelly gravel. A sample from this layer contained:

Pecten islandicus MÜLL. Some fragments.
Crenella decussata (MONT.) 4 shells.
Mytilus edulis L. Some fragments.
Astarte montagui (DILL.) 1 fragment.
Saxicava arctica (L.) A few fragments.
Mya truncata (L.) 1 shell and great quantities of fragments, many drilled by *Natica.*
Lepeta coeca (MÜLL.) Some fragmentary specimens.
Balanus balanus DA COSTA. Many shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.

In a small bay on the north side of Holsteinsborg Bugt, called Magnetsandsbugten, some samples were collected from shell-bearing sand by Miss EVA LA COUR in 1946 and Mr. K. ELLITSGAARD RASMUSSEN in 1948. Especially the first sample is very remarkable, as it contains *Zirphaea crispata*, which is here found for the first time outside the Orpigsôq

area. The first sample was taken from sand at about 6 m. above sea level and contained:

Pecten islandicus MÜLL. 1 small fragment.
Mytilus edulis L. Vast quantities of fragments.
Axinopsis orbiculata SARS. 1 shell.
Saxicava arctica (L.) 1 shell and some fragments.
Zirphaea crispata (L.) 1 shell.
Natica clausa BROD. and SOW. Some specimens, somewhat defective.

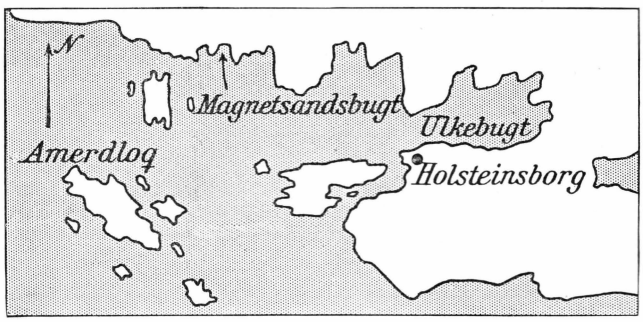


Fig. 25. Sketch of the neighbourhood of Holsteinsborg with the locality of Magnetsandsbugt. (After KORNERUP (38) table 7, fig. 8).

Trophon truncatus (STRØM). 1 specimen
Bela sp. 1 juvenile specimen.
Balanus crenatus BRUG. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

The second sample was taken at 7 m. above sea level and contained:

Pecten islandicus MÜLL. 2 fragments.
Mytilus edulis L. Some fragments, some of large shells.
Serripes groenlandicum (CHEMN.) Fragments of large shells.
Saxicava arctica (L.) 3 shells and some fragments.
Mya truncata (L.) Some fragments.
Margarita groenlandica (CHEMN.) 1 fragment.
Amauropsis islandica (GML.) 1 specimen.
Lunatia pallida (BROD. and SOW.) 1 specimen.
Balanus balanus DA COSTA. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

The presence of *Zirphaea crispata* in the layer at 6 m. above sea level indicates that this deposit has been laid down under boreal climatic conditions.

Amerdloq. At a locality at this fjord (Fig. 26) a sample was taken by Miss EVA LA COUR from sand at 2 m. above sea level, and it contained the following shells:

Pecten islandicus MÜLL. Many fragments.
Serripes groenlandicum (CHEMN.) 1 fragment.
Mya truncata (L.) 2 shells and many fragments.
Mya truncata (L.) forma *uddevallensis* HANC. 1 large fragment.

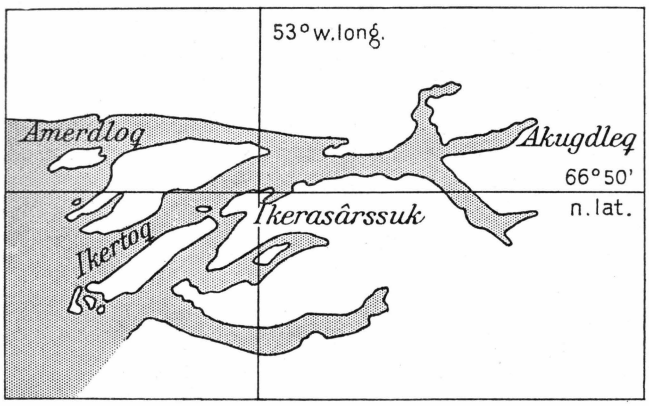


Fig. 26. Sketch of the Ikertôq fjord. (After JENSEN (36), table 9).

Akugdleq, Ikertôq fjord. Akugdleq is the central one of 3 branches which form the head of Ikertôq fjord. Its innermost part consists of 3 big coves. Investigations and collections in the southernmost of these coves were made by Mr. K. ELLITSGAARD RASMUSSEN in 1946 and 1947. A sample from sandy clay was taken at 2—3 m. above sea level, and it contained the following shells:

Pecten islandicus MÜLL. Some small fragments.
Mytilus edulis L. Many small fragments.
Astarte montagui (DILL.) 1 small fragment.
Macoma calcaria (CHEMN.) Some large fragments.
Mya truncata (L.) 2 shells and many fragments.
Balanus balanus DA COSTA. Some shells.
Balanus crenatus BRUG. Some shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

In the northernmost cove is a deposit of gravel, 6 m. thick. Here a sample was taken, which contained:

Axinopsis orbiculata SARS. 1 specimen.
Macoma calcaria (CHEMN.) 1 large shell fragment.
Mya truncata (L.) Some shells and many fragments.

The whole of the Amerdloq area bears witness to a higher level of water in former times. Terraces are seen at many places up to more than 100 m. above sea level, often whole systems with 5—6 terraces, one above the other. Deposits of sand and clay ridges occur at some places, and it must be supposed that it will be possible to find shells at many localities.

Itivdleq, Søndre Strømfjord. At the head of the fjord is a section of sandy clay, about 10 m. high. At the foot the section is covered with scree, but at 6 m. it is uncontaminated, and shells can be found in situ. From this altitude samples were taken at every 25 cm. The shell material is on the whole badly preserved in the more sandy portions which occur in the section. The shells contained in the samples were as follows:

6.00 m.

Mytilus edulis L. 1 small fragment.
Serripes groenlandicum (CHEMN.) 2 shells and some fragments.
Macoma calcaria (CHEMN.) Some fragments.
Mya truncata (L.) 2 shells and many fragments.
Gastropoda sp. A few fragments.
Balanus hammeri (ASCAN.) BROWN. 3 shells and some fragments.

6.25 m.

Mytilus edulis (L.) Many fragments.
Saxicava arctica (L.) 3 fragments.
Balanus hammeri (ASCAN.) BROWN. 2 shells and 1 fragment.

6.50 m.

Mytilus edulis L. Some fragments of large shells.
Macoma calcaria (CHEMN.) 2 fragments.
Mya truncata (L.) Some fragments.

6.75 m.

Mytilus edulis L. Some fragments.
Macoma calcaria (CHEMN.) 3 shells and some fragments.
Mya truncata (L.) 4 shells.
Balanus hammeri (ASCAN.) BROWN. 4 fragmentary shells.

7.00 m.

Pecten islandicus MÜLL. 1 large fragment.
Mytilus edulis L. Some fragments.
Macoma calcaria (CHEMN.) 4 shells and some fragments.
Mya truncata (L.) 1 shell and some fragments.
Margarita helicina (PHIPPS). 1 specimen.
Gastropoda sp. Some fragments.
Balanus hammeri (ASCAN.) BROWN. Fragments of some shells.

7.25 m.

Pecten islandicus MÜLL. 2 small fragments, injured by *Polydora sp.*

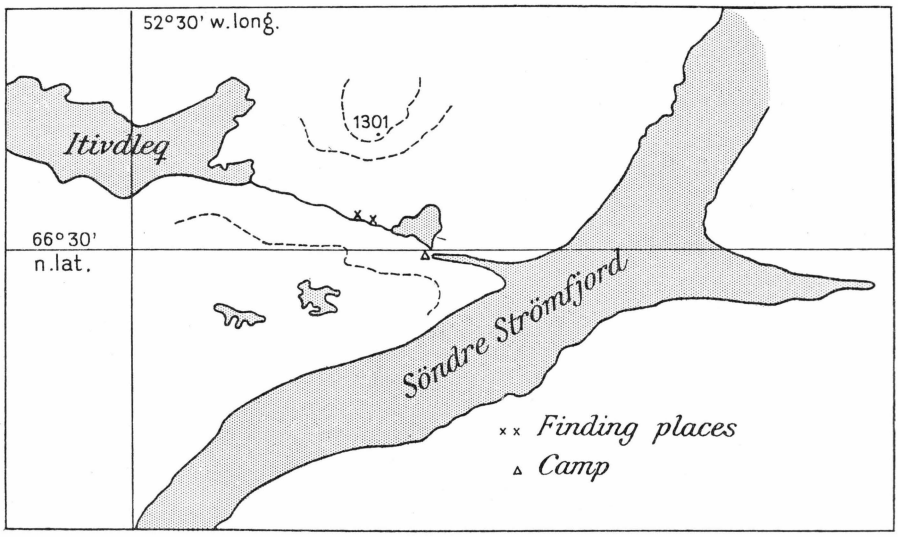


Fig. 27. Sketch of the area between Itivdleq and Søndre Strømfjord, made by Miss Eva la Cour. (×× Finding places. △ Camp at Itivdlínguaq).

Mytilus edulis L. Many fragments.
Macoma calcaria (Chemn.) 1 shell and some fragments.
Saxicava arctica (L.) 1 small shell.
Balanus hammeri (Ascan.) Brown. 6 fragments of shells.

7.50 m.

Mytilus edulis L. 3 small, thin shells.
Saxicava arctica (L.) 1 small shell.
Mya truncata (L.) Some fragments.
Balanus hammeri (Ascan.) Brown. 3 fragments of shells.

7.75 m.

Mytilus edulis L. Some fragments.
Cardium ciliatum Fabr. 5 fragments.
Macoma calcaria (Chemn.) 2 fragments.
Saxicava arctica (L.) 1 shell.
Mya truncata (L.) Some fragments.
Balanus sp. 2 fragments.

8.00 m.

Mytilus edulis L. Some fragments.
Macoma calcaria (Chemn.) 16 shells.
Mya truncata (L.) 1 shell.
Balanus hammeri (Ascan.) Brown. 1 shell.

8.25 m.

Mytilus edulis L. A dozen small shells and some fragments of large ones.

Saxicava arctica (L.) 1 shell.
Mya truncata (L.) 6 shells, 5 of them juvenile ones, and some fragments.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Balanus crenatus BRUG. 2 half specimens.
Strongylocentrotus drøbachiensis (MÜLL.) 1 shell fragment and some spines.
Bryozoa sp. 1 specimen.

8.50 m.

Leda pernula (MÜLL.) 1 shell.
Pecten islandicus (MÜLL.) 1 fragment.
Mytilus edulis L. 20 small shells and fragments of some large ones.
Astarte sulcata DA COSTA. 1 shell.
Axinopsis orbiculata SARS. 50 shells.
Macoma calcaria (CHEMN.) 21 shells.
Saxicava arctica (L.) 6 small shells.
Mya truncata (L.) Some shells.
Littorina palliata SAY. 1 specimen.
Gastropoda sp. 2 fragments.
Balanus hammeri (ASCAN.) BROWN. Some large shells.
Balanus crenatus BRUG. 1 shell.
Strongylocentrotus drøbachiensis (MÜLL.) 4 spines.

8.75 m.

Pecten islandicus MÜLL. 1 fragment.
Mytilus edulis L. Fragment of a large shell.
Astarte sp. 1 fragment.
Mya truncata (L.) Some fragments and unbroken juvenile shells.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Balanus hammeri (ASCAN.) BROWN. Some fragments of shells.
Balanus crenatus BRUG. 2 small specimens.

9.00 m.

Mytilus edulis L. 1 large fragment.
Macoma calcaria (CHEMN.) 1 shell and 1 fragment.
Saxicava arctica (L.) 2 small shells, of which 1 is drilled by *Natica*.
Mya truncata (L.) Some shells, very elongated, almost *ovata* forms.
Balanus balanus DA COSTA. 4 shells.
Balanus hammeri (ASCAN.) BROWN. 3 shells.

9.25 m.

Mytilus edulis L. Fragments of very large shells.
Saxicava arctica (L.) 2 small shells.
Mya truncata (L.) 2 small shells.
Balanus hammeri (ASCAN.) BROWN. 3 shells.
Balanus crenatus BRUG. 1 shell.

By an examination of the species found at the various levels it will be seen that there is no essential difference in faunistic respect between the samples collected. The species found indicate that the layers have been deposited in a sea under Arctic climatic conditions.

Itivdlínguaq. In the area between the head of Itivdleq and Søndre Strømfjord there is a small plain at 35 m. above sea level. On the plain is a lakelet, from which a river runs down to Itivdleq, whereas there is no connection between the lakelet and Søndre Strømfjord. (Fig. 27). The river meanders through the valley between high sand deposits. Shells were collected by Miss Eva la Cour at 2 localities, partly from the 3 m. high cliff in the river valley, partly on the plain where the layers are more gravelly. The locality has formerly been visited by Bendixen (33). The following shells were collected in the sand:

Pecten islandicus Müll. 2 fragments.
Astarte borealis (Chemn.) 7 shells.
Serripes groenlandicum (Chemn.) 1 fragment.
Macoma baltica (L.) 1 large fragment.
Saxicava arctica (L.) 3 shells and some fragments.
Mya truncata (L.) Some fragments.
Littorina saxatilis (Olivi) var. *groenlandica* Møll. 1 specimen.
Cerithiopsis costulata (Møll.) 1 specimen.
Buccinum groenlandicum Chemn. 1 specimen.
Balanus hammeri (Ascan.) Brown. Many shells.

In the gravel the following shells were collected:

Pecten islandicus Müll. 2 fragments.
Mytilus edulis L. Some fragments.
Astarte montagui (Dill.) var. *striata* (Leach) Sars. 1 shell.
Serripes groenlandicum (Chemn.) 1 fragment.
Cyprina islandica L. 1 fragment with umbo and hinge.
Macoma baltica (L.) 2 shells and 1 fragment.
Saxicava arctica (L.) Many shells and fragments.
Littorina saxatilis (Olivi) var. *groenlandica* Møll. 3 specimens and 1 fragment.
Trophon clathratus (L.) 1 specimen.
Trophon truncatus (Strøm). 1 specimen.
Balanus balanus da Costa. Some shells.
Balanus hammeri (Ascan.) Brown. Some shells.
Balanus crenatus Brug. Some shells.
Strongylocentrotus drøbachiensis (Müll.) Some spines.

The presence of *Cyprina islandica* and *Macoma baltica* indicates that the layers have been deposited under boreal climatic conditions.

Sukkertoppen District.

Angujartorfik on the south side of Søndre Strømfjord. At this locality Mr. K. ELLITSGAARD RASMUSSEN found a deposit of alternating layers of clay and fine sand. Coarse sand and fine gravel and isolated boulders occur scattered in the deposit. The following shells were collected in clay at 2 m. above sea level:

Nucula delphinodonta MIGH. and AD. 1 specimen.
Astarte montagui (DILL.) var. *striata* (LEACH) SARS. 1 specimen
Cardium ciliatum FABR. 1 specimen.
Serripes groenlandicum (CHEMN.) Some fragments.
Macoma calcaria (CHEMN.) 1 shell and some fragments.
Saxicava arctica (L.) 4 shells and some fragments.
Mya truncata (L.) 1 shell and some fragments.
Mya truncata (L.) forma *ovata* JENSEN. 1 shell.
Balanus crenatus BRUG. Some shells.

In clay ranging from 2—15 m. above sea level shells were also found. The shells were partly filled with material which had concreted. Some shells had preserved the periostracum. The following shells were found in the sample:

Portlandia arctica (GRAY). 18 specimens, 1 shell and some fragments.
Portlandia intermedia (SARS). 2 shells.
Macoma calcaria (CHEMN.) Some specimens and shells with incipient concretion.
Mya truncata (L.) Some large fragments with incipient concretion.
Clay concretions without shells.

The settlement of Sukkertoppen. On the north side of the harbour runs a path, which leads along the rock to some meadows. At several places the rock testifies to a higher level of water in former times, as it is wave-cut over a considerable stretch. The wave-cutting ranges from about 3 to about 5 m. above sea level. Marine layers with shells abut against the rock where it turns away from the harbour. A sample from these layers was taken at 2.5 m. above sea level. It contained the following shells:

Pecten islandicus MÜLL. Some fragments.
Mytilus edulis L. Some fragments.
Macoma calcaria (CHEMN.) Some fragments.
Saxicava arctica (L.) Some fragments.
Mya truncata (L.) Some fragments.
Puncturella noachina (L.) 1 specimen.

Lepeta coeca (MÜLL.) 2 specimens and some fragments.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. Numerous specimens.
Littorina palliata SAY. Numerous specimens.
Trophon clathratus (L.) 1 specimen.
Buccinum undatum (L.) 1 specimen.
Balanus balanus DA COSTA. Many shells.
Balanus crenatus BRUG. 2 shells.
Strongylocentrotus drøbachiensis MÜLL. Some shell fragments and spines.

In the valley north-east of the harbour the following species were collected from a gravel bed at 3.0 m. above sea level:

Leda minuta (MÜLL.) 1 specimen.
Pecten islandicus MÜLL. Some fragments.
Macoma calcaria (CHEMN.) 1 specimen.
Saxicava arctica (L.) Some shells and fragments.
Mya truncata (L.) Some shells and some fragments.
Puncturella noachina (L.) 2 specimens.
Lepeta coeca (MÜLL.) 6 specimens.
Trophon clathratus (L.) 1 specimen and some fragments.
Sipho togatus (MØRCH). 1 specimen.
Balanus balanus DA COSTA. Many shells.
Serpula sp. Some specimens.
Bryozoa sp. Some specimens.

Near the old cemetery there is a layer of shell gravel at 20 m. above sea level. There is only a very small amount of gravel and sand in the deposit, which is characterized by the occurrence of vast quantities of barnacle shells. A sample collected contained the following species:

Pecten islandicus MÜLL. 3 small fragments.
Mytilus edulis L. Some fragments, some of which show incipient pearl formation.
Saxicava arctica (L.) 20 shells and some fragments. Some shells were "pinched".
Mya truncata (L.) 3 shells and some fragments.
Chiton sp. 2 shells.
Puncturella noachina (L.) 1 specimen.
Natica clausa BROD. and SOW. 1 specimen.
Trophon truncatus (STRØM). 1 fragment.
Balanus balanus DA COSTA. A great many shells and fragments.
Balanus crenatus BRUG. 2 shells and some fragments.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

At the new cemetery shell gravel is found at 12 m. above sea level. It consists of shell fragments with a good portion of pebbles. Fragments of *Mytilus* and barnacles predominate. A sample contained the following species:

Mytilus edulis L. Many fragments.
Saxicava arctica (L.) 2 fragments.
Mya truncata (L.) 2 fragments.
Puncturella noachina (L.) 1 specimen.
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL. 1 specimen.
Balanus balanus DA COSTA. Some shells and a great number of fragments.
Balanus crenatus BRUG. 3 shells.
Strongylocentrotus drøbachiensis (MÜLL.) Some spines.

Earlier Investigations.

Some of the previous reports, published on the present subject, include fauna lists from various localities in the Jakobshavn, Egedesminde, Holsteinsborg, and Sukkertoppen districts. Some of these lists originate from places from which the present writer has had no opportunity of obtaining material. Thus they supplement those of the writer's, and as they are of importance to the understanding of the stratigraphy, they will be cited here.

Niaqornaq, Jakobshavn district. At Niaqornaq on Pâkitsup nunâ STEENSTRUP has found a terrace at 44.8 m. above sea level (76, p. 231). In the cliff of the terrace the following shells were found (op. cit., p. 235):

Nucula tenuis (MONT.) var. *expansa* REEVE.
Portlandia arctica (GRAY).
Arca glacialis (GRAY).
Macoma calcaria (CHEMN.)
Saxicava arctica (L.)
Mya truncata (L.)

The presence of *Portlandia arctica* indicates that the layer has been deposited under high-arctic climatic conditions.

Aumat, Egedesminde district. On this island PJETURSSON (64, p. 326) has found in shelly gravel at 4 m. above sea level:

Pecten islandicus MÜLL.
Mytilus edulis L.
Macoma baltica (L.) (AD. S. JENSEN det.)

Saxicava arctica (L.)
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL.
Balanus sp.

The presence of *Macoma baltica* indicates that the layer has been deposited under boreal climatic conditions.

Igíniarfik, Egedesminde district. The locality has been described by PJETURSSON (64, p. 333) and by LAURSEN (41, p. 35) the latter on the basis of the collections made by State Geologist V. NORDMANN, Ph. D. in 1911. According to LAURSEN the species found are:

Leda pernula (MÜLL.)
Anomia squamula L.
Pecten islandicus MÜLL.
Lima subauriculata MONT.
Crenella decussata (MONT.)
Mytilus edulis L.
Astarte borealis (CHEMN.)
Astarte montagui (DILL.)
Macoma calcaria (CHEMN.)
Saxicava arctica (L.)
Mya truncata (L.)
Boreochiton ruber LOWE.
Scissurella crispata FLEM.
Puncturella noachina (L.)
Acmaea rubella (FABR.)
Lepeta coeca (MÜLL.)
Margarita helicina (PHIPPS).
Margarita cinerea (COUTH.)
Solariella obscura (COUTH.) var. *bella* VERK.
Moelleria costulata (MØLL.)
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL.
Littorina palliata SAY.
Cingula castanea (MØLL.)
Scalaria borealis BECK.
Natica clausa BROD. and SOW.
Trophon clathratus (L.)
Trophon truncatus (STRØM).
Admete viridula (FABR.)
Bela pingeli (BECK).
Bela violacea (MIGH.)
Hemithyris psittacea (GML.)
Balanus balanus DA COSTA.

Balanus hammeri (ASCAN.) BROWN.
Balanus crenatus BRUG.
Strongylocentrotus drøbachiensis (MÜLL.)

Of these forms *Anomia squamula* deserves notice as it indicates that the layer has been deposited under boreal climatic conditions.

Lersletten at Depotbugt, Nordre Strømfjord, Egedesminde district. On the basis of collections made by O. BENDIXEN, former inspector of South Greenland, AD. S. JENSEN has described this locality and its fauna (33, p. 3 ff.). Only 2 species occur, viz.:

Portlandia arctica (GRAY).
Pecten groenlandicus SOW. var. *major* COLLIN.

but both of them indicate that the layer from which they have been taken has been deposited under high-arctic climatic conditions.

Nagssugtôq river, Nordre Strømfjord, Egedesminde district. In a low clay terrace at about 7 m. above sea level along the banks of the river, KORNERUP (38, p. 187) found the following shells:

Pecten islandicus MÜLL.
Astarte montagui (DILL.) var. *striata* (LEACH) SARS.
Cardium ciliatum FABR.
Macoma calcaria (CHEMN.)
Saxicava arctica (L.)
Mya truncata (L.)

This fauna is like the one now found off the coasts of West Greenland, and the climatic conditions were Arctic when the layer was being deposited.

Ikerasârssuk strait, Ikertôq, Holsteinsborg district. In raised layers J. A. D. JENSEN has made a collection at about 7 m. above sea level (36, p. 49). The sample contained the following shells:

Leda minuta (MÜLL.)
Anomia squamula L.
Pecten islandicus MÜLL.
Lima subauriculata MONT.
Crenella decussata (MONT.)
Mytilus edulis L.
Cyamium minutum (FABR.)
Cardium ciliatum FABR.
Macoma calcaria (CHEMN.)
Saxicava arctica (L.)

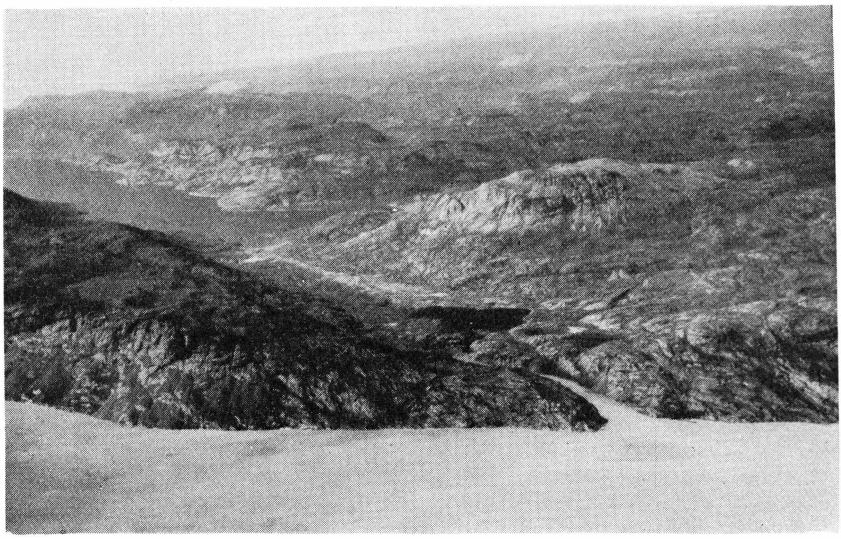


Fig. 28. Itivdlínguaq, the valley between Itivdleq fjord and Søndre Strømfjord, which is seen in the foreground of the picture. Behind the great lake in the valley is the finding places of the shells in the sand cliffs framing the river to Itivdleq fjord. To the right Qáqatorssuaq (1300 m.) Phot. July 1936 by the Geodetic Institute (No. 24562). The Geodetic Institute, copyright.

Mya truncata (L.)
Acmaea rubella (FABR.)
Littorina saxatilis (OLIVI) var. *groenlandica* MØLL.
Littorina obtusata L.
Cingula castanea (MØLL.)
Onoba aculeus (GOULD).
Trophon clathratus (L.)
Balanus balanus DA COSTA.
Strongylocentrotus drøbachiensis (MÜLL.)

The presence of *Anomia squamula* and *Littorina obtusata* indicates that the climatic conditions were boreal when the layer was being deposited.

Itivdleq between Itivdleq fjord and Søndre Strømfjord, Holsteinsborg district. The locality is identical with the one described p. 85 under the name of Itivdlínguaq. Here BENDIXEN has made a collection which has been determined and described by AD. S. JENSEN (33, p. 24). The species found are:

Pecten islandicus MÜLL.
Astarte borealis (CHEMN.)
Cardium ciliatum FABR.

Cyprina islandica L.
Panopaea norvegica (SPGL.)
Saxicava arctica (L.)
Mya truncata (L.)
Buccinum undulatum MØLL.
Balanus hammeri (ASCAN.) BROWN.

Cyprina islandica, which is a good boreal form, indicates that the layer has been deposited under boreal climatic conditions.

Nipisat, Evighedsfjord, Sukkertoppen district. From this locality J. A. D. JENSEN (36, p. 73) mentions a find of shells in shelly gravel in a cliff about 4.5 m. high. The shells brought home are:

Anomia squamula L.
Pecten islandicus MÜLL.
Mya truncata (L.)
? *Balanus balanus* DA COSTA.
Strongylocentrotus drøbachiensis (MÜLL.)

The presence of *Anomia squamula* in the layer indicates that this has been deposited under boreal climatic conditions.

STRATIGRAPHY

In a preliminary account AD. S. JENSEN and P. HARDER (30) have drawn up the following stratigraphic division for Orpigsôq[1]) and the south coast of Sydostbugt, on the basis of their investigations in these two areas (op. cit. p. 405):

Horizon	Orpigsôq	Sydostbugten
F	Strand-gravel with *Zirphaea*	—
E	Clayey sand with *Pecten*	—
D	Clay with *Yoldia*	Clay with *Yoldia*
C	Clay with *Mya ovata*	Sandy clay with *Balanus hammeri* etc.
B	Fine, clayey sand with *Balanus hammeri*	—
A	Glacial formations	Sandy clay with *Yoldia*

By a later preparation, made by AD. S. JENSEN and the present writer, of P. HARDER's and AD. S. JENSEN's notes and collections, the above table was drawn up in an extended and somewhat altered form on the basis of the old investigations, supplemented with new investigations which for this purpose were made by the writer in the summer of 1946 (21, p. 84). The stratigraphy of the somewhat enlarged area—viz. the south and east coasts of Disko Bugt—got the appearance given below:

[1]) Former designations of localities have been brought into accordance with those now used and acknowledged by "Stednavneudvalget for Grønland" (i. e. Place-name Committee of Greenland).

Horizon	Orpigsôq	Kangersuneq	Sydostbugten	Lerbugten
F	Beach gravel with *Zirphaea crispata*	Clay with *Mytilus edulis*	—	? Clay and sand with *Mytilus edulis*
E	Clayey sand with *Pecten islandicus*	Sediments with *Pecten islandicus*	—	? Clay and sand with *Pecten islandicus*
D	Clay with *Portlandia arctica*	Clay with *Portlandia arctica*	Clay with *Portlandia arctica*	Clay with *Portlandia arctica*
C	Clay with *Mya truncata* forma *ovata*	—	—	—
B	Fine clayey sand with *Balanus hammeri*	Fine clayey sand with *Macoma calcaria*	Sandy clay with *Balanus hammeri*	—
A	Delta sediments—Clay with *Portlandia arctica*	—	Sandy clay with *Portlandia arctica*	—

The present task will now be to find out whether the stratigraphy, drawn up above and based on a small section of the marine Quaternary on the long coast of West Greenland, can be transferred on the areas investigated up to this day.

The localities where it is possible with the greatest certainty to determine which horizons are represented, are those where extreme climatic conditions were prevailing when the layer was being deposited. Only 3 climates can be taken into consideration, viz. high-arctic, Arctic, and boreal. Among the extreme climates of the marine Quaternary of West Greenland must be reckoned the high-arctic and the boreal climates which are characterized separately by definite molluscs.

The leading fossils of the high-arctic horizons A and D are *Portlandia arctica* and *Pecten groenlandicus* var. *major*, as has been demonstrated by AD. S. JENSEN (33, p. 6 ff.).

As leading fossils of the boreal horizon F it is necessary to use the forms now extinct in Greenland, or the forms which at present occur farther south than under the above mentioned period of warmth. Of lamellibranchiata there are four: *Zirphaea crispata*, *Anomia squamula*, *Macoma baltica*, *Cyprina islandica*. These four species are not found together at all localities which belong to horizon F. *Zirphaea crispata* demands with its characteristic burrowing way of living a special substratum which in Greenland is the clay deposits of the Quaternary horizons. Where such were not present it would hardly have been possible for the species to live. *Cyprina islandica* has hitherto been found at one

locality only, and it can hardly be expected that it should occur in great numbers in the deposits. In Denmark, where it must be regarded as fairly common, its occurrence is generally limited to 2 or 3 specimens per square metre, often fewer (32, p. 113). It must be expected that the species has had a distribution extending farther north than the hitherto sure finds at Itivdlínguaq suggest. The find that has formerly been made on the sea bottom off Jakobshavn, points in that direction, as the shells in question must be washed-out ones, not recent ones, if not, as mentioned by Ad. S. Jensen, an interchange of labels has taken place (33, p. 25). As regards *Anomia squamula* and *Macoma baltica* similar conditions do not apply to them as to the two species mentioned above. They must therefore be reckoned the most predominant leading fossils.

Besides the four lamellibranchiata mentioned there are among the gastropoda three species which have not formerly been found in the Quaternary layers and which do not live at the coasts of Greenland any longer. They are *Emarginula fissura*, *Acmaea virginea*, and *Alvania jeffreysi*, and all three species have been found in the layers in the Giesecke Sø area. They have a lusitanian-boreal distribution and do not occur in Arctic seas. Of other lusitanian-boreal species to be met with is *Littorina obtusata*, which according to Posselt (66, p. 230) has been taken alive at Fiskenæsset (2 specimens) and Hunde Ejland, plus 10 specimens labelled "Grønland". It has a distribution similar to that of *Acmaea virginea* and partly to that of *Emarginula fissura* and *Alvania jeffreysi*. These species must also be regarded as leading fossils for the boreal horizon.

As the Giesecke Sø area is the locality where most leading fossils have been found, it is natural to go there to obtain, if possible, a confirmation of the claim that the stratigraphy drawn up for the area of Disko Bugt can be applied to other localities. By an examination of the fauna it will be seen that *Portlandia arctica* is found in the fat clay on knoll 9 in Muslingedalen. At a slightly higher level, viz. in knolls 10—14, are deposits with Arctic forms, superposed by the high-arctic horizon (fig. 29). This was again overlain by layers containing *Macoma baltica* and *Acmaea virginea*, i. e. layers with a boreal stamp. According to this, Muslingedalen must at a certain time, when the level of the sea was at least about 40 m. higher than at present, have been a shallow sound in the then existing fjord. The land has been emerging and the climate has been Arctic. While the uplift was going on, an aggravation of climate set in with the result that small quantities of material have been laid down in the fjord. As the highest point of Muslingedalen lies in the top of knoll 14, it is reasonable to suppose that Skalvigen already at that time has turned into a cove with calm water, so that it became possible for the fat clay to precipitate.

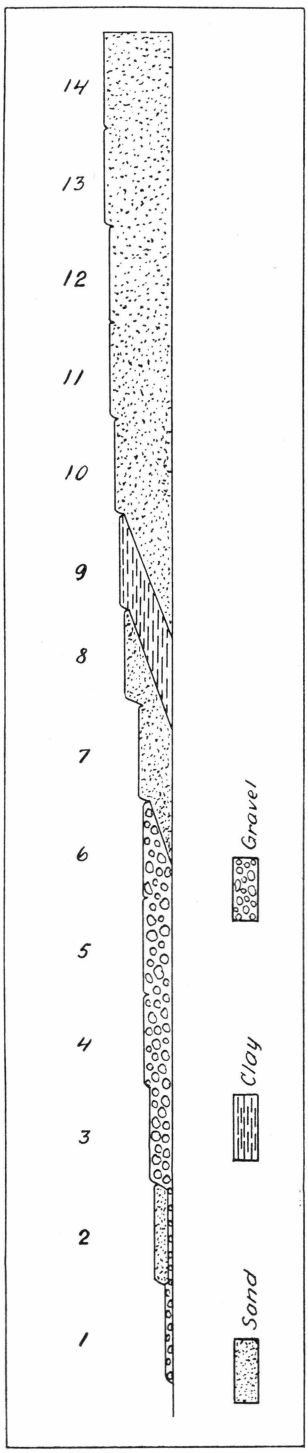


Fig. 29. Diagrammatic section through the layers in Muslingedalen and at Skalvigen, Giesecke Sø.

After this aggravation of climate a rise in temperature again occurs which determines the Arctic layers in knolls 7—8, and then by a further rise in temperature the boreal layers in knolls 1—6. The sandy layer in the top of knoll 2 suggests a tiny fall in temperature at one time during the maximum of heat.

Thus it must be taken for granted that the layers in knolls 1—6 belong to horizon F. The layers from knolls 7 and 8 must be referred to horizon E. The fat clay in knoll 9 to the high-arctic horizon D, the layers in knolls 10—14 to the Arctic horizon C.

Furthermore the two localities at the outlet of Muslingedalen at Giesecke Sø belong to the warm horizon, viz. the west section and the east section which are characterized by the occurrence of *Emarginula fissura*. The species has only been found in the east section, however, but as the two sections correlate in all other respects, there can hardly be any doubt that this is a case of the same horizon, the more so because the collections have been made at the same altitude. The layers on Kuppelsletten must furthermore be referred to horizon F. On account of great changes of the atmospheric pressure on the day when the investigations took place, and for want of a barograph, the exact altitude of the layers could not be determined, but the localities lie at about 25—26 m. above sea level. The occurrence of *Acmaea virginea* and *Littorina obtusata* indicates that the layers belong to horizon F.

The other area where some sure leading fossils have been found, is at Pinguarssuk, Lerbugten south of Claushavn. Already HARDER and JENSEN have investigated these layers, and their investigations, supplemented with a few observations by the present writer in 1946, led—although with a certain hesitation—to an extension of the table drawn up for Orpigsôq and Sydostbugten to comprise also Lerbugten, but only the horizons D, E, and F. The determination of the material brought home in 1946 indicates, however, that the lowermost layers at Lerbugten up to about 10 m. above sea level are characterized by *Portlandia arctica*. These are superposed by a layer fully 6 m. thick where *Balanus hammeri* occurs. From 16—20 m. are layers without shells, but in the subsequent layer *Portlandia arctica* occurs again and is found up to 22.5 m. above sea level. From this altitude up to a little more than 26 m. are layers with an Arctic fauna, but without a distinctive character. About 26 m. are sandy layers with *Mytilus edulis*, which here appears for the first time in the section. The appearance of *Mytilus edulis* suggests that a somewhat warmer climate than the hitherto prevailing set in. This has hardly been boreal, but it inaugurates this period, which is found more developed at a somewhat higher level at Tasiussaq where *Macoma baltica* occurs between 35—40 m. In other words all horizons are found at Lersletten. From 0 m. to about 10 m. horizon A. From about 10 m. to about

16 m. horizon B. Layers that may be identical with horizon C from about 16 m. to about 20 m. From about 20 m. to about 22.5 m. horizon D, from about 22.5 m. to about 26 m. horizon E and finally horizon F at any rate about 35 to 40 m. The last two horizons will only be found in the cliffs of Lersletten facing Disko Bugt and Tasiussaq respectively.

The conditions at the coasts of Ûmánaq Fjord have been dealt with by the present writer in a previous account (41), in which he made an attempt at a comparison with the results JENSEN and HARDER had obtained in the coastal areas of Disko Bugt. With the knowledge of the subject and of the conditions there which the writer possesses at the present time, it will be necessary to make an alteration of previously held points of view. After a renewed examination and revision of the material the writer has come to the conclusion that the layers which are found in the coastal cliffs along the fjord represent the horizons D and E only. The high-arctic layers in connection with the upper marine limit must still be reckoned as belonging to horizon A. The horizons B and C have not been found at the higher levels as the river cliffs at altitudes over 60—70 m., with a few exceptions, were covered with screes. The two horizons have not been found in the coast cliffs either, and it is the writer's opinion that the lowest three horizons have not been raised above the level of the sea along the present shore line in this part of West Greenland. Horizon D is found at Kugssineq on Svartenhuk in the lowest clay bed characterized by *Portlandia arctica*, and at Qaersuarssuk kitdleq in the clay bed characterized by *Pecten groenlandicus* var. *major*. There seems to be the possibility that the high-arctic layers with *Pecten groenlandicus* var. *major* at Qaersuarssuk kitdleq should be referred to horizon A and put in correlation with the same horizon at the upper marine limit. This is, however, hardly correct, for in that case another high-arctic layer with *Pecten groenlandicus* var. *major* should have been found at a higher level in the coast cliffs, but such a layer has not been observed, and the coast cliffs must be said to be very throroughly investigated. It is not, however, improbable that the climatic improvement, which, as indicated by horizon B, has taken place south of Nûgssuaq, has not been so pronounced in the waters north of the peninsula that it manifested itself in the extinction of the high-arctic species and in the immigration of the more warmth-loving forms. In that case only one high-arctic horizon will be found in the coast area of Ûmánaq Fjord, as horizons A, B, C, D will coincide.

The layers at Pátorfik river, Kløft II, Kløft III, and Mellemkløft must at any rate be referred to horizon E. The layers at these places are lowermost characterized by *Pecten islandicus*, uppermost by *Pecten islandicus* and *Mytilus edulis*. It is possible that part of the sections containing both *Pecten islandicus* and *Mytilus edulis* is to be referred to

horizon F, as this is the "warmest" deposit which on the whole has been found at Ûmanaq Fjord. At the present moment this question cannot be settled, renewed investigations being necessary. In this connection it must be mentioned that the writer previously (41, p. 110) as his opinion has declared that Nûgssuaq peninsula forms a limit between a northern and a southern part of the Quaternary area of West Greenland. This limit is difficult for the species to pass on account of the currents. There is furthermore the possibility that the conditions of temperature at Ûmánaq Fjord during the Quartenary period have never been so favourable that the boreal species have been able to live there.

By a consideration of the conditions in the 3 areas mentioned above it will be seen that the drawn-up stratigraphy of the Orpigsôq area can be extended to apply to the west coast of Greenland from Kugssineq on Svartenhuk to the area at Nordre Strømfjord at any rate, and it seems most likely that this stratigraphic division is applicable to the whole of the coast of West Greenland as suggested by some earlier and new collections south of Nordre Strømfjord.

It will then be of interest to examine 1) how the other localities not yet mentioned are to be placed in the sequence, and 2) how the various horizons have developed at the various localities.

Horizon A.

To this horizon it is possible to refer the following localities: Vibekes Elv 190 m. (41, p. 29); Sermermiut 4 m.[1]); Qarsortoq about 10 m.; Sandbugten south of Claushavn; Orpigsôq, small cove in the fjord; Depotbugt 70 m.; possibly Naternaq at about 100 m. is also to be classed with this horizon.

All the layers referred to horizon A contain *Portlandia arctica.* As this is also the case with layers belonging to horizon D, a confusion with the latter may occur. However, after what has hitherto been ascertained it is a fact that horizon A is only found at the highest levels in connection with the upper marine limit in the part of the area that lies north of Nûgssuaq, whereas layers belonging to horizon A are found south of this peninsula, partly connected with the upper marine limit, partly in the lowest layers of the cliff, which contain *Portlandia arctica.* In the southern part of the area these layers reach an altitude of about 10 m. above sea level. A deviation is the Zirphaeahalvøen, Orpigsôq. The section here shows lowermost (21, p. 19) 2 m. of clay with *Portlandia arctica*, superposed by .25 m. of clayey sand with *Saxicava arctica*, .50 m. of fine sand with a single clay band, and .25 m. of clayey sand

[1]) In an earlier account the writer has referred this locality to horizon D, which is not correct according to the latest investigations. (41, p. 119).

with *Pecten islandicus*. Imposed on that is 5 m. of beach gravel with *Zirphaea crispata*. The shells contained in the cliff clearly demonstrate that a gradual improvement of climate has taken place from the high-arctic *Portlandia* clay, found lowermost, to the deposit of beach gravel with *Zirphaea crispata*, found uppermost in the section. Nowhere between these two layers are traces indicating a high-arctic zone, and the *Portlandia* clay must at this locality be referred to horizon D. The reason why horizon A is not found lowermost in the section, as is otherwise the case in the cliffs, must be that the layers of the horizon have either been eroded away by the Ilulialik river or possibly they have not at all been deposited at this place. HARDER believes (30, p. 403, 21, p. 81) that glaciers have covered the area during the period of deposition, so that the layers have not been deposited, and he builds his assumption on the fact that moraine gravel and fluvio-glacial-like sand occur at a few places in the cliff along the Ilulialik river. In 1946 the present writer, as previously stated, investigated the area and the moraine gravel as well as the fluvio-glacial sand. It is the writer's belief that both deposits are typical delta formations of the same kind as the sand found in the section opposite Zirphaeapynten (p. 41), and which is superposed by clay belonging to horizon B. This belief is also supported by the well-developed delta formations that occur in the Ilulialik valley, partly opposite and at the same level as HARDER's moraine gravel, partly higher up the valley. It is therefore the writer's opinion that the layers of horizon A have been eroded away by the Ilulialik river, which by the rise in temperature that is indicated by horizon B, has got a much greater flow of water. This has gradually decreased, and the layers of horizon B have had a possibility of deposition in areas where there was no current any longer. The outlet of the river was situated almost as nowadays, yet with a more north-western direction. In support of this opinion the writer may also state the presence of the *Portlandia* clay in the cove in Orpigsôq fjord south-south-west of the island in the middle of the fjord. Here the *Portlandia* clay rests directly on the striated gneiss, consequently superposing neither moraine nor fluvio-glacial material, nor layers belonging to horizon B or C. It should be possible to find such layers when the extension and the position of the horizon in the area are taken into consideration.

Until now horizon A has been found in its largest extension in the area around Disko Bugt. This is probably a consequence of the fact that it is the best investigated area, but also that the coast here has been nearer the inland ice than the coastal areas farther south. At the outlets of the big melt-water streams at the open coast vast quantities of clay will be deposited at once when the fresh water meets the salt water, and the clay coagulates and settles. Where it is a question of outlets to big

fjord branches, as is the case farther south, great quantities of water in the fjords will be fresh and condition a greater amount of clay in the water, and clay will also be found at a greater distance from the coast, as already stated by PJETURSSON (64, p. 341) and NORDMANN (49, p. 25; 57, p. 45). There is hardly any doubt that deposits, referable to horizon A, may be found in the interior parts of the Egedesminde South district, the Holsteinsborg and Sukkertoppen districts. That clay beds occur at the heads of the big fjords may be seen in several concurrent reports (35, 36, 64), just as the geologists, who have made investigations in the interior of the fjords for G.G.U. during the years 1946—48, all mention great occurrences of clay. The possibilities of finding shells seem to be rather small according to older accounts (55, p. 1017; 64, p. 341). It is, however, noteworthy that KORNERUP (38, p. 187) found shells in a clay terrace at about 7 m. above sea level at the banks of Nagssugtôq river in the head of Nordre Strømfjord, as stated above (p. 90). This affords a well-founded hope that it will be possible to find further shell material.

High-arctic layers occur at 70 m. above sea level on Lersletten at Depotbugt, Nordre Strømfjord, as reported by AD. S. JENSEN (33). AD. S. JENSEN believes (op. cit. p. 34) that the deposit at this locality is to be referred to horizon D. This does not, however, agree with the occurrence of horizon D at Giesecke Sø (p. 95 ff.) at 33 m. above sea level. AD. S. JENSEN comes to his conclusion from the consideration that the considerable altitude of the layers above the sea shows that they have been deposited in a period when the greatest subsidence of the land took place. According to JENSEN and HARDER (30, p. 406) this happened during the deposition of horizon D. AD. S. JENSEN states (33, p. 32): "that the sea-level stood about 100 m. higher than at present." The present writer has, however, demonstrated that the greatest subsidence took place during the deposition of horizon A, as the latter is connected with the upper marine limit which is found at 230 m. above sea level at Ûmánaq Fjord, and at Vaigat at 200 m. above sea level (41, p. 98). It seems natural to assume that this is also the case farther south. Here the upper marine limit is, however, not established, but Mr. ELLITSGAARD RASMUSSEN has most kindly informed the writer that while surveying the Søndre Strømfjord area he registered terraces up to about 270 m. above sea level, so that the altitude of the upper marine limit must be supposed to be rather considerable in this area, if it appears that the terraces observed are marine. Is this the case, it tends to show that the locality in Depotbugt is referable to horizon A.

The locality on Naternaq possibly belongs to horizon A. This horizon has certainly not been found on the coast of Sydostbugten, but, as far as can be seen, no collections have ever been made at an altitude corres-

ponding to the locality on the south side of the plain. As the upper marine limit in the area must be estimated to be something more than 100 m. (64, p. 323), it is possible that the high-lying clay deposits on Naternaq are to be referred to horizon A, in accordance with the considerations stated above.

Horizon A is on the whole been uniformly developed at the various localities. The sediment, in which the shells are found, is fat clay which seldom contains greater sand bands. The uppermost portions of the clay may, however, be somewhat sandy, which is suggestive of an uplift during the deposition of horizon A.

The shells contained do not vary much. There are localities where *Portlandia arctica* only occurs together with one or two other species, but otherwise it is accompanied by 4—10 species. The most prevalent species in the layer besides *Portlandia arctica* are: *Macoma calcaria*, *Mya truncata*, *Saxicava arctica*, and *Cardium ciliatum*. The other species that occur are: *Nucula tenuis* var. *expansa*, *Leda pernula*, *Yoldia hyperborea*, *Portlandia lenticula*, *Pecten groenlandicus* var. *major*, *Thyasira flexuosa*, *Serripes groenlandicum*, *Mya truncata* forma *ovata*, *Mya truncata* forma *uddevallensis*, *Lyonsia arenosa*, *Lepeta coeca*, *Natica clausa*, *Onoba aculeus*, *Cylichna alba*, and *Balanus balanus*. Clay concretions occur at some localities. *Ophiuroidea* have been found in the clay concretions at a very few places.

The occurrence of *Portlandia arctica* in the horizon indicates that this is a typical high-arctic deposit. None of the remaining species contradict this determination.

Horizon B.

The following localities are referable to this horizon: Sermermiut 15 m.; Qarsortup kûa 15 m.; Lerbugten south of Claushavn about 10 to 16.2 m.; Orpigsôq, the *Balanus*-horisont and the section opposite the Zirphaeapynten.

The horizon is according to JENSEN and HARDER characterized by the occurrence of *Balanus hammeri*. The recent occurrence of this cirriped has been reported by AD. S. JENSEN (33, p. 29 ff.) who establishes the fact that it must be regarded both as a boreal and an Arctic species.

Horizon B appears everywhere as a sandy clay deposit. It has previously been observed at Orpigsôq, Sydostbugten, and Kangersuneq. To these localities have now been added: Sermermiut and Lerbugten south of Claushavn, and perhaps, the uppermost layers at Qarsortup kûa. *Balanus hammeri* has certainly only been found in the layers at Lerbugten, but the deposits at Sermermiut justify the reference of the sandy clay bed resting on the fat *Portlandia* clay to horizon B. The same considerations may be applied to the locality at Qarsortup kûa. The

presence of *Pecten islandicus* in the layer is apparently not in accordance with the fauna which is normally found in horizon B. The mentioned shell is, however, a small one, found loose on the surface on the uppermost metre of the cliff, so the possibility is natural that the shell originates from an overlying horizon (viz. C), where *Pecten islandicus* occurs, but has not been observed. It is hardly possible that the horizon with *Portlandia arctica*, which has been referred to horizon A, should be mistaken for horizon D, which is also characterized by *Portlandia arctica*. In that case the layer overlying the latter should be horizon E, in which *Pecten islandicus* occurs. But horizon E is wherever it has been met with, a horizon very rich in shells, with many species in great quantities and with large shells, so it would hardly have escaped the attention of the investigators. Nothing therefore remains but to refer the uppermost layer of the Qarsortup kûa section to horizon B. The horizon has hitherto not been found in the southern part of the area.

Horizon B is not rich in shells, and they occur only in negligible quantities with the exception of *Balanus hammeri*, which in spots may occur in even very great numbers. Other species that occur are: *Serripes groenlandicum*, *Macoma calcaria*, *Saxicava arctica*, and *Mya truncata* which predominate, whereas *Nucula tenuis* var. *expansa*, *Cardium ciliatum*, *Leda minuta*, *Yoldia hyperborea*, *Buccinum groenlandicum* var. *patula*, *Balanus crenatus*, and *Strongylocentrotus drøbachiensis* are rarer. Besides these some *Bryozoa* have been found.

The contents of shells in horizon B indicate that the layers have been deposited under climatic conditions which are Arctic. The presence of *Balanus hammeri* in the area north of Nordre Strømfjord furthermore shows that the climate, while the deposition was going on, has been somewhat milder than at present, as this species has not been found north of the mentioned fjord. Considering the rise in temperature taking place at present, it is just possible that the species will be found migrating northwards.

Horizon C.

This horizon is very difficult to determine, if not put in relation to other horizons. The deposits are sandy clay with a rather scanty occurrence of shells. The sandy clay becomes more and more fat upwards in the deposit and passes into the overlying horizon D without any sharp distinction. Horizon C has earlier been found at Orpigsôq only, as the position of the layer, originally reported by JENSEN and HARDER to be at Sydostbugten (30, p. 405), has later been corrected (21, p. 84). New localities are Muslingedalen at Giesecke Sø knolls 10—14, and Angujartorfik 2 m. above sea level.

According to JENSEN and HARDER the horizon is characterized by the presence of large shells of *Mya truncata* forma *ovata* (30, p. 403).

They do not, however,—and justly—attach much importance to this form, as *Thyasira flexuosa* is mentioned together with it. *Mya truncata* forma *ovata* is, however, used in the summaries and in the table (op. cit. p. 403 and 405), but it is not suitable as a leading fossil for a horizon, since it also occurs in the other horizons. This is also the case with *Thyasira flexuosa*, although in a less degree. This objection might also be stated against *Balanus hammeri* as a leading fossil for horizon B. But the fact is that this species succeeds the high-arctic horizon A, in which it does not occur, and it appears thus for the first time in the marine Quaternary layers. It will, however, hardly be possible to characterize some of the horizons by one species only, it will be necessary to consider the whole community of molluscs and compare it with the layers which lie over and under the horizon.

Nucula delphinodonta is the only shell occurring exclusively in this horizon, but as it must be supposed that this species will be found in the other horizons by continued investigations, it seems hardly justifiable to let this species act as a leading fossil for horizon C. Furthermore it is until now known from one locality only. Thus it is not yet possible to select one definite shell as a leading fossil for this horizon.

The horizon is somewhat differently developed in the northern part of the area compared with the southern part. In the layers at Disko Bugt only a few species are represented, and among them no gastropoda. Of lamellibranchiata are found: *Cardium ciliatum*, *Serripes groenlandicum*, *Macoma calcaria*, *Saxicava arctica*, and *Mya truncata* with forma *ovata*. In the layers at Giesecke Sø there is a comparatively great representation of shells. Besides those mentioned from the Disko Bugt area are: *Leda pernula*, *Pecten islandicus*, *Crenella decussata*, *Astarte montagui*, *Axinopsis orbiculata*, and *Mya truncata* forma *uddevallensis*. Of gastropoda the following species are found: *Chiton sp.*, *Puncturella noachina*, *Lepeta coeca*, *Lunatia pallida*, *Trophon clathratus*, *Trophon truncatus*, *Bela decussata*, and *Cylichna alba*. Furthermore: *Hemithyris psittacea*, *Balanus balanus*, *Balanus hammeri*, *Strongylocentrotus drøbachiensis*, *Serpula sp.*, and *Bryozoa*. No gastropoda, but *Balanus crenatus* were found at Angujartorfik.

It is not surprising that so many forms appear in this horizon otherwise so poor in shells, and especially so many gastropoda in the layers of the horizon that are found south of the Disko Bugt area, for as soon as one comes outside the area of the clay deposits proper, as for instance Lersletten south of Claushavn or Naternaq south of Sydostbugten, both lamellibranchiata and gastropoda appear in the layers in rather great quantities. They are distinguished not only by an abundance of species, but also by a great number of individuals.

The climatic conditions under which horizon C was being deposited have been Arctic, and the species occurring in the northern part of the

area, indicate, on the whole, a somewhat lower temperature than that which predominated during the deposition of horizon B. Very likely the climate then was as it is at present. This also applies to the southern part of the area. There is nothing strange about the presence of *Balanus hammeri* down here, it is here very near its climatic northern limit of to-day. This corroborates the assumption of a climate as at present during the deposition of the layers of horizon C.

Horizon D.

With this horizon the high-arctic climate occurs again, as already notified during the deposition of horizon C. The deposits, referred to horizon D, are characterized by *Portlandia arctica.* They are everywhere clay deposits, most often fat clay, but frequently with a perceptible woof of sand, which suggests that the subsidence of the land has not been so great as when horizon A was deposited.

Besides the familiar localities at Orpigsôq, Kangersuneq, Lerbugten south of Claushavn, and Sydostbugt, the localities of Kugssineq on Svartenhuk (41, p. 13), Qaersuarssuk kitdleq (41, p. 30), Niaqornaq, Lersletten at Claushavn, Maagefjeld, Muslingedalen knoll 9, and Angujartorfik 2—15 m. must be referred to this horizon. The layers at Lerbugten, in which *Portlandia arctica* has been found, lie from 19.8 to 22.4 m. On the same level is the clay bed at Maagefjeld, which, for that reason, can hardly be mistaken for a horizon A layer, the more so because the overlying layers contain *Mytilus edulis*, which does not occur anywhere in the layers of horizon B or C. The locality in Muslingedalen belongs no doubt to horizon D. The presence of over- and underlying layers exclude a misinterpretation. The same argument may be used about the locality at Angujartorfik with the difference that no overlying layers have been found here. The locality at the small lake on Lersletten south of Claushavn is also referred to horizon D, as the land, at the time when the layers of the horizon were being deposited, must be supposed to have been at any rate more than 50 m. lower at this place compared with conditions at present. The sediment at the locality is sandy clay, which also suggests that the locality must be referred to horizon D. The locality in Muslingedalen belongs undoubtedly to horizon D. The fact that layers, as stated above, are found both over and under the clay bed, is decisive. At Angujartorfik the horizon with *Portlandia arctica* is superposing a horizon deposited earlier in an Arctic climate, for which reason it must be referred to horizon D, as the substratum of horizon A is either bedrock, moraine or delta deposits.

Horizon D is, like the other high-arctic horizon, very poor in shells. Besides *Portlandia arctica* the following shells have been found: *Portlandia*

intermedia, *Nucula tenuis* var. *expansa*, *Leda minuta*, *Macoma calcaria*, *Cardium ciliatum*, and *Mya truncata*. No gastropoda or cirripedia were found.

Horizon E.

According to JENSEN and HARDER this horizon is characterized by the occurrence of *Pecten islandicus*. The deposits, which are referred to it, are clayey sand beds which suggest that the layers have been deposited in shallower water than the layers from the preceding horizon.

Horizon E has earlier been found at Orpigsôq, Kangersuneq, and with some reservation at Lerbugten south of Claushavn. It is now found at many places. With certainty it can be ascertained that it occurs at Lerbugten, Maagefjeld, Orpigsûp tasia kitdleq, Nivâq, Akúnâq, Hunde Ejland, Agto, Giesecke Sø area knolls 7 and 8, and the head of Itivdleq. According to the latest investigations it must furthermore be taken for granted that it is also found at Sydostbugten, viz. in the small cove west of the bay at Portussut island (21, p. 68 ff.). The layers in Kløft II, Mellemkløft, Kløft III, and at Pâtorfik river in Nûgssuaq peninsula must also be referred to this horizon.

The horizon is characterized, as stated above, by the occurrence of *Pecten islandicus*. This lamellibranch occurs in great quantities as large well-grown shells, and it is thus a good characteristic. But it must further be emphasized that *Mytilus edulis* in this horizon for the first time appears in the marine Quaternary deposits of Greenland. This is also the case with many lamellibranchiata and gastropoda, but none of them can equal *Mytilus edulis* in size and abundance, and it ought to be mentioned together with *Pecten islandicus*, when the layer is to be characterized.

Contrary to the horizons deposited earlier, horizon E is exceedingly rich in species. Of lamellibranchiata occur: *Leda minuta*, *Yoldia hyperborea*, *Pecten islandicus*, *Lima subauriculata*, *Crenella decussata*, *Mytilus edulis*, *Modiolaria discors*, *Modiolaria discors* var. *substriata*, *Astarte borealis*, *Astarte montagui*, *Astarte montagui* var. *striata*, *Astarte sulcata*, *Axinopsis orbiculata*, *Thyasira flexuosa*, *Cyamium minutum*, *Cardium ciliatum*, *Serripes groenlandicum*, *Macoma calcaria*, *Saxicava arctica*, *Mya truncata*, *Mya truncata* forma *ovata*, *Mya truncata* forma *uddevallensis*, *Thracia myopsis*. Of gastropoda: *Chiton sp.*, *Scissurella crispata*, *Puncturella noachina*, *Acmaea rubella*, *Acmaea testudinalis*, *Lepeta coeca*, *Margarita groenlandica*, *Margarita helicina*, *Solariella obscura*, *Solariella obscura* var. *bella*, *Moelleria costulata*, *Littorina palliata*, *Littorina saxatilis* var. *groenlandica*, *Cingula castanea*, *Lunatia pallida*, *Natica clausa*, *Trophon clathratus*, *Trophon fabricii*, *Trophon truncatus*, *Bela tenuicostata*, *Onoba aculeus*, *Marsenina glabra*. Furthermore: *Hemithyris psittacea*, *Balanus balanus*,

Balanus hammeri, *Balanus crenatus*, *Strongylocentrotus drøbachiensis*, *Bryozoa sp.*, *Serpula sp.*, *Foraminifera sp.*

The shells contained in the horizon vary a good deal at the various localities. At the midmost bay at Lerbugten south of Claushavn *Pecten islandicus* has not been found in the layer which lies immediately over horizon D, and which cannot be referred to this on account of the absence of *Portlandia arctica*, for which reason it must be referred to horizon E. Nor has *Mytilus edulis* been found there by the present writer, but the species has formerly been taken there by JENSEN and HARDER. On the other hand *Mytilus edulis* has been found in great quantities in the overlying sand layer. At the southernmost bay JENSEN and HARDER have observed both *Pecten islandicus* and *Mytilus edulis*. At Maagefjeld *Pecten islandicus* has not been found in the layer over horizon D, but *Mytilus edulis* occurs here.

Pecten islandicus but not *Mytilus edulis* occurs at the classic locality of Zirphaeapynten. In the section of the streamlet at Orpigsûp tasia kitdleq neither *Pecten islandicus* nor *Mytilus edulis* occur in the sand bed under the *Zirphaea* layer. Both *Pecten islandicus* and *Mytilus edulis* occur in the deposits at Nivâq, Akúnâq, and on Hunde Ejland which are referable to horizon E. In the layers found at Agto which have been referred to horizon E, only *Pecten islandicus* occurs in the clay bed, whereas it occurs with *Mytilus edulis* in the sand bed. The layers of knolls 7 and 8 at Giesecke Sø have been referred, as stated, to horizon E. At this locality the writer found only *Pecten islandicus*. Both species mentioned occur in the layers at the head of Itivdleq. In Kløft II *Pecten islandicus* is found alone from 5.5 m. to 32.5 m., along with *Mytilus edulis* from 32.5 m. to 42.5 m. In Mellemkløft only *Pecten islandicus* occurs in the consolidated layer, whereas both species appear in the overlying sand. Both species occur in Kløft III.

As will be seen there are some places where *Pecten islandicus* occurs alone, and some places where it is accompanied by *Mytilus edulis*, and in that case generally in the upper parts of the deposits. This phenomenon appears chiefly at the localities where the stratification is best and most completely developed. This circumstance shows that *Pecten islandicus* must have immigrated before *Mytilus edulis* at a time when the temperature of the sea was lower than the average temperature of horizon E. This assumption agrees with the fact that *Pecten islandicus* to-day lives at greater and colder depths of sea than *Mytilus edulis* at the coasts of Greenland. *Pecten islandicus* occurs at about 200 fathoms, but *Mytilus edulis* has been taken at about 20 fathoms only (66). This fact is also suggested by DONS's report on the present distribution of *Pecten islandicus* along the coast of Norway where it is now only found from Trondheim and northwards, but in an earlier and colder period it lived farther south (14, p. 29).

The mutual appearence of the two species might suggest the possibility of sorting out still another horizon between the horizons D and E, so that a zone with *Pecten islandicus* alone was obtained, and a zone with both *Pecten islandicus* and *Mytilus edulis*. It appears, however, to the present writer, partly that too few observations have been made, partly that local conditions may come into play at the places where a distinction is apparently possible, so that for the present it will be a somewhat questionable affair to make a distinction like that mentioned above. But this is a point where a detailed investigation is desirable.

Petrographically the horizon is uniformly developed. The sediment is generally sand, but it may be somewhat clayey, especially at places where the deposition has taken place in quiet bays and the like.

The climatic conditions under which horizon E has been deposited are Arctic, and they hardly differ from the conditions prevailing in West Greenland to-day. It must, however, be emphasized that the lowermost layers of the horizon were deposited at a time when the temperature was hardly so high as at a later part of the period.

Horizon F.

Horizon F is characterized by the presence of boreal forms which do not occur in any of the other horizons (30, p. 403—404). The deposits referred to this horizon are nearly always layers of shelly gravel, where shells and shell fragments predominate in quite overwhelming quantities. This shows that horizon F has been deposited in shallow water.

Horizon F has earlier been found at Orpigsôq, partly on Zirphaeapynten, partly in the so-called "Engell's Profil" at Orpigsûp tasia kitdleq, and finally at Itivdlínguaq between Itivdleq and Søndre Strømfjord. Furthermore with reservation it has been reported at Kangersuneq and Lerbugten south of Claushavn. It has now with certainty been observed at Tasiussaq, Christianshaab district; Quilik at Christianshaab; Giesecke Sø knolls 1—4 (5—6); Muslingedal east- and west sections; Kuppelsletten; and Magnetsandsbugten at Holsteinsborg. Furthermore referable to this horizon are the earlier investigated localities of Igíniarfik (64, p. 333. 41, p. 35), Ikerasârssuk (36, p. 49), Aumat (64, p. 326. 29, p. 31), and Nipisat (36, p. 73). Localities possibly referable to horizon F are the layers at about 26 m. above sea level of the midmost bay of Lerbugten, and Egedesminde at 5 or 6 m. above sea level. The layer at Lerbugten resembles petrographically very much other layers of horizon F. The many shells and fragments of *Mytilus edulis*, taken at 26.30 m. above sea level, also makes the position probable. The occurrences at Egedesminde are also petrographically quite like the layers for instance at

Igíniarfik and Giesecke Sø, so that there is every reason to suppose that horizon F is the right position of these layers.

Horizon F is like the preceding one extraordinarily rich in shells. Of lamellibranchiata in horizon F have been found: *Leda pernula*, *Leda minuta*, *Anomia squamula*, *Pecten islandicus*, *Lima subauriculata*, *Crenella decussata*, *Mytilus edulis*, *Modiolaria discors*, *Modiolaria discors* var. *laevigata*, *Modiolaria discors* var. *substriata*, *Modiolaria nigra*, *Modiolaria faba*, *Astarte borealis*, *Astarte montagui*, *Axinopsis orbiculata*, *Cyamium minutum*, *Cardium ciliatum*, *Serripes groenlandicum*, *Cyprina islandica*, *Macoma baltica*, *Macoma calcaria*, *Panopaea norvegica*, *Saxicava arctica*, *Mya truncata*, *Mya truncata* forma *ovata*, *Mya truncata* forma *uddevallensis*, *Zirphaea crispata*, *Thracia myopsis*. Of gastropoda: *Chiton sp.*, *Scissurella crispata*, *Emarginula fissura*, *Puncturella noachina*, *Acmaea rubella*, *Acmaea testudinalis*, *Acmaea virginea*, *Lepeta coeca*, *Margarita groenlandica*, *Margarita helicina*, *Margarita cinerea*, *Margarita olivacea*, *Solariella obscura*, *Solariella obscura* var. *bella*, *Moelleria costulata*, *Littorina palliata*, *Littorina saxatilis* var. *groenlandica*, *Littorina obtusata*, *Cingula castanea*, *Alvania jan-mayeni*, *Alvania wyville-thomsoni*, *Alvania jeffreysi*, *Cerithiopsis costulata*, *Scalaria borealis*, *Amauropsis islandica*, *Lunatia pallida*, *Pyrene rosacea*, *Sipho togatus*, *Buccinum groenlandicum*, *Buccinum undulatum*, *Bela cinerea*, *Bela decussata*, *Bela nobilis*, *Bela pingeli*, *Bela pyramidalis*, *Bela violacea*, *Onoba aculeus*, and *Cylichna alba*. Further: *Hemithyris psittacea*, *Balanus balanus*, *Balanus hammeri*, *Balanus crenatus*, *Strongylocentrotus drøbachiensis*, *Serpula sp.*, *Bryozoa sp.*, *Foraminifera sp.*, Otoliths, vertebrae of fish.

Generally the horizon is uniformly developed all over the area investigated. Like horizon E it is distinguished by a great abundance of forms. The characteristic animals of the horizon are not found at nearly all localities, but at least one of them will, however, always occur. Originally the horizon was characterized solely by the occurrence of *Zirphaea crispata*, but other good boreal species have now been added, viz. *Cyprina islandica*, *Anomia squamula*, *Macoma baltica*, *Acmaea virginea*, *Emarginula fissura*, *Alvania jeffreysi*, and *Littorina obtusata*, which by their presence all decisively refer to horizon F. *Mytilus edulis* occurs in the horizon in so overwhelming quantities that one might be tempted to use the designation: the *Mytilus* layer, but as this would cause bewilderment by confusion with horizon E where *Mytilus edulis* also occurs in great numbers, this name ought not to be used. As the boreal forms are often scantily represented in the layers, it is necessary by collections to take big samples, because one may otherwise run up against the possibility that it cannot be determined which horizon, E or F, a layer is to be referred to. It is thus necessary by future investigations to take very big samples when one is confronted with a deposit with many shells of

Mytilus edulis, just as samples ought to be taken at several places in the layer.

The presence of the boreal species indicates that the climate at the time of the deposition of the horizon was warmer than it is at present at the coasts of West Greenland. Presumably the climate was as it is to-day at the coasts of Iceland.

As stated, there are some localities where it is difficult to ascertain which horizon is represented. Completely precluded from a determination of the horizon is Qôrorssuaq kitdleq where only *Mya truncata* has been found, and Akugdleq, northern branch, where *Axinopsis orbiculata*, *Macoma calcaria*, and *Mya truncata* are the only species found. The same applies to a long series of localities in the Ûmánaq Fjord area where only species like *Macoma calcaria*, *Saxicava arctica*, and *Mya truncata* occur in the deposit. At Eqalugsugssuit, and 4 localities in the Holsteinsborg district, viz. 2 in the settlement itself, and at Amerdloq, and at the southern branch of Akugdleq, and 4 localities at the settlement of Sukkertoppen the writer found i. a. *Pecten islandicus* and *Mytilus edulis*, either separately or together. The presence of these two species refer to horizon E or perhaps horizon F, as there is the possibility that one of the forms characteristic of horizon F may be present in the deposit, but has not, as it happens, been found, for it is here a question of comparatively small samples collected on a reconnaissance trip. The two lowest-lying localities at Sukkertoppen resemble to a high degree the localities at Egedesminde, Igíniarfik, and Giesecke Sø which have been referred to horizon F. But until further investigations have been made it will be impossible to determine the horizon with certainty.

ON ERRORS

In a previous paper (42) the present writer has given an account of some of the errors which are liable to occur in a work with the marine Quaternary layers.

In a treatise on the opistobranchiate gastropoda of East Greenland (47, p. 36 ff.) LEMCHE has reported some observations and has later stated that they may be of importance to the marine Quaternary geology (48, p. 145 ff.). According to RYDER (70), SPÄRCK (75), THORSON (79), and USSING (84) the hydrographical conditions of the big fjord complexes of East Greenland in spring and autumn are as follows: Uppermost is a layer of meltwater, derived from the melting of ice and snow. The saltness is small and will kill the bottom animals which may have survived the fatal influence of the ice movement at depths from 0 m. to about 3 m. Under the surface layer until a depth of about 23 m. is a layer of fjord water, which in summer warms to about 10° C in the upper layers, evenly decreasing downwards. Under about 23 m. is polar current water with a constant negative temperature all the year round. At depths about 300 m. and below are water layers which are somewhat warmer, uppermost in this layer below 0° C, at greater depths above 0° C.

From this follows, according to LEMCHE, that at depths less than about 23 m. there should be a fauna which is relatively warmth-loving, whereas a cold-loving fauna should appear under this depth. From this LEMCHE infers (48, p. 145), "If an uplift of the land takes place in such an area, part of the hitherto "high-arctic" bottom area will be raised to a depth of water where the warmth is greater, and southern forms can therefore exist. Consequently the uplift will apparently be accompanied by a change from a "high-arctic" to a warmer climate, without the macroclimatic conditions in the area being necessarily changed. As it is often seen in the literature that uplifts are stated as syncronous with rises in temperature, it is perhaps worth while to draw attention to this error."

It is not clear which areas LEMCHE alludes to with the sentence quoted last, just as he does not mention where in the literature he has found passages which erroneously state that rises in temperature are synchronous with an uplift of land.

In the case of West Greenland, JENSEN and HARDER (30, p. 406) have advanced their view of the level changes in the area around Disko Bugt, a view which unaltered has been adopted by HARDER, JENSEN, and LAURSEN (21). It appears from the mentioned paper that the rise in temperature which causes the climatic differences between horizons A and B is accompanied by a subsidence of the land, whereas the rise in temperature after the deposition of horizon D is accompanied by an uplift of the land, represented in the horizons E and F. From studies on the beach lines at Ûmánaq Fjord the present writer has pointed out that during periods with rises in temperature an uplift will be neutralized by the rise of the sea level that results from a greater supply of water on account of a greater melting away of ice. In the field this is expressed as very distinctly formed terrace edges as the sea at such places has for a long time had an opportunity of erosion.

In Denmark the subsidence of the northern part of the country was caused not only by the preceding pressure of the ice, but also by a transgression on account of the increased amount of water after the melting away of the ice sheet of the last glacial epoch. Further the rise in temperature in Atlantic time has been accompanied by a transgression.

According to LEMCHE the mentioned 23 m. limit in the fjords of East Greenland should appear as a demarcation line between two faunas: one relatively warmth-loving above and a cold-loving one below this level. According to fauna lists from the Scoresby Sund and Kejser Franz Josephs Fjord areas, found in THORSON (79 and 80 compared with 82) and LEMCHE (47), this state of things appears as follows, 25 m. here, as in LEMCHE, being reckoned as a boundary line.

Species found at depth of water	less than 25 m.	transition zone[1])	25—45 m.	deeper than 45 m.
Nucula tenuis[2])	+	+	+	+
Leda pernula	+	+	+	+
Portlandia arctica	+	+	+	+
Portlandia lenticula	+	..	+	+
Portlandia intermedia	+	..	+	+
Portlandia frigida	+	..	+	+
Arca pectunculoides	+	+	+	+
Arca glacialis	+	+	+	+
Pecten islandicus	+	..	+	+

[1]) Transition zone signifies an area on both sides of the boundary line, and from where material has been taken in 3 instances, viz. 10—30 m., 14—38 m., 25—27 m.

[2]) The latest terminology of the writers has been used.

	less than 25 m.	transition zone	25—45 m.	deeper than 45 m.
Pecten groenlandicus	+	+	+	+
Modiolaria laevigata	+	+	+	..
Modiolaria nigra	+	+	+	+
Dacrydium vitreum	+	+	+	+
Astarte borealis	+	+	+	..
Astarte elliptica	+	+	+	+
Astarte banksi	+	+	+	+
Astarte crenata	..	..	..	+
Axinus flexuosus	+	+	+	+
Cardium ciliatum	+	+	+	+
Cardium groenlandicum	+	+	+	+
Venus fluctuosa	+	+	..	..
Macoma calcaria	+	+	+	+
Macoma moësta	+	+	+	+
Tellina lovéni	+	..	+	..
Saxicava arctica	+	+	+	+
Mya truncata	+	+	+	+
Lyonsia arenosa	+	+	+	+
Neræa obesa	+	+	+	+
Pandora glacialis[1])	+	+	+	+
Thracia truncata[1])	+	+	+	+
Cyrtodaria kurriana[1])	+	+	+	+
Lepeta coeca	+	+	+	+
Margarita groenlandica	+	+	+	+
Margarita helicina	+	..	..	..
Margarita cinerea	+	..	..	..
Moelleria costulata	+	+	..	..
Alvania jan-mayeni	+	..	+	+
Trichopsis borealis	+	+	+	..
Lunatia pallida	+	+	+	+
Velutina laevigata	..	..	+	..
Buccinum hydrophanum	+	+	+	+
Buccinum micropoma	+	..	..	..
Bela tenuicostata	+	+	..	..
Bela bicarinata	+	..	..	..
Bela pyramidalis	+	..	..	..
Bela trevelyana	+	+	+	+
Bela violacea	+	+	+	+
Raphitoma amoena	..	..	..	+

[1]) Has only been found in the Scoresby Sund area.

	less than 25 m.	transition zone	25—45 m.	deeper than 45 m.
Retusa obtusata var. *pertenuis*	+	..	?	..
Cylichna alba	+	+	+	+
Cylichna solitaria	+	+	..	+
Cylichna magna	+	+	+	..
Philine lima	+	..	+	+
Philine finmarchia	..	..	+	+

By a consideration of the above mentioned list one does not get the impression that there is a difference as suggested by LEMCHE. Of the 54 species there are only 7 above the 25 m. boundary, 4 in the transition zone, and 4 solely occur below the 25 m. boundary, 2 of which do not appear above a depth of 45 m. The remaining 39 species occur in both areas. The material has been obtained from 41 stations, spread all over the area. If the transition zone, which comprises bottom areas somewhat above and somewhat below 25 m., is compared with the two other areas covering the same bottom area, the result is: 7 species are found only above the 25 m. boundary (13 per cent.), 4 species only below (7 per cent.), and 43 species are common to both areas (80 per cent.). LEMCHE has advanced his theory on the basis of an analysis of opisthobranchiate gastropoda (48, p. 146). Of these only one species exclusively occurs below the 25 m. boundary, and that is *Philine finmarchia*, but this species is not, according to LEMCHE, a definite fjord animal, as it lives especially on the coast shelf facing the Arctic Ocean (47, p. 22). It is not, however, on the basis of the occurrence of this species that LEMCHE sets forth his theory, but on the basis of *Cylichna magna* (47, p. 37). Yet this species has in three instances been found above the 25 m. boundary within the area in question, and once outside Uttentals Sund at Kangerdlugssuaq on the south coast at a depth of only 6—9 m. LEMCHE explains the cause of this rather high occurrence level by assuming that the polar current at this place forces its way into water more shallow than in the fjords. Altogether the species at East Greenland has been found at 15 localities from about Lat. 68°15′ to 74°35′ N, i. e. more 700 km. in a direct line, and at 4 of the 15 localities above the 25 m. than boundary. This occurs to the present writer to be a rather poor foundation on which to base a theory. When LEMCHE further states, "Personally I have only had the opportunity of making this analysis of opisthobranchiata, but what I have heard about the distribution of the species within other groups is suggestive of the same state of affairs with most of these, so that a general principle must be taken into account", then an analysis of lamellibranchiata and gastropoda, as the one carried

out above, seems with even greater weight to deny the existence of a distribution of species above and below the 25 m. boundary, as maintained by LEMCHE, and the theory is still less in keeping with reality. Moreover there may be a reason to state still other circumstances which ought to be taken into consideration when judging the plausibility of LEMCHE's theory. The various temperatures of the water layers, also quoted by LEMCHE, are only valid during the summer months. According to USSING the temperatures of the water layers from 0 m. to 50 m. (84, tab. I) are negative from January to June. During the subsequent months the fjord water warms, and the summer temperatures are reached in the months of July—August. During September—October the surface water will freeze up, and the fjord water layer will cool both from above and below (84, p. 12 ff.). Apparently nothing is known about November and December, but it may be assumed that conditions are like those shown on table I. It is thus only a short time of the year that the species are exposed to relatively high temperatures. As the quantity of food, as demonstrated by USSING (op. cit.), is most plentiful just at this time, the conditions of a greater metabolism are present, so the animals should be able to endure the somewhat higher temperature in the comparatively short time (33, p. 16). According to this it should be possible for several high-arctic stenothermal species to summer in the area above the 25 m. boundary, as is the case here for instance with *Portlandia arctica* and *Pecten groenlandicus*. There should not be any objection either to the supposition that this was also the case with *Cylichna magna*, even if this animal seems more susceptible to the warming than other high-arctic species met with.

Another question is whether a result achieved in East Greenland can be transferred then and there to conditions in West Greenland. It is hardly justifiable at the present moment to make a detailed comparison of the hydrographical conditions in East and West Greenland as the observation material is too scanty. RIIS CARSTENSEN gives some information from the northern part of the west coast (68), which seems to show conditions like those in East Greenland, but AD. S. JENSEN has published some observations, made by P. M. HANSEN, Ph.D., from the southern part of the coast which indicate that the conditions of this area are quite unlike those of the east coast (34). A. KIILERICH, M.Sc., who during the summer of 1948 as a member of one of the expeditions under the auspices of G.G.U. i. a. had the opportunity of carrying out hydrographical observations, has most willingly informed the writer that the results arrived at this year in Ûmánaq Fjord are not identical with those achieved by him at the same place in 1928 (68). This shows that it is not advisable to attach too much importance to a few years' observations. Also for this reason it is fair to take up a sceptical attitude

to LEMCHE's theory. Another thing is whether on the whole it is right to take for granted that the hydrographical conditions were the same then as now in the area where the shells which form the basis of the present work were deposited. This is certainly very doubtful, but the phenomenon can hardly ever become the subject of an examination.

With respect to the fundamental question: errors on account of an uplift of a deeper high-arctic bottom area to a warmer littoral (boreal) or sublittoral (Arctic) area, possible mistakes may influence the estimate of the past climate in fjords of similar hydrographical conditions as the present ones in East Greenland, if the uplift took place momentarily. The uplift will, however, after the knowledge of to-day be very slow. A sudden uplift of 25 m. at a bound, as LEMCHE seems to presuppose, with the result that the upper level of the distributional area of the high-arctic fauna in for instance the fjords of East Greenland in no time emerged above the surface of the sea, will hardly be possible. On the other hand if the bottom rises slowly, the high-arctic stenothermal species become extinct, but the eurythermal species will enter into the new community together with the more warmth-loving forms of the latter. The new community will be deposited on the high-arctic layer in immediate connection with the formerly deposited littoral layer. As it has been pointed out that the oldest marine Quaternary deposits in the case of Greenland are high-arctic and that a climatic improvement has taken place after the high-arctic period, then these high-arctic layers will always be superposed by layers of more warmth-loving animals, even if the bottom fauna below a certain depth has been high-arctic during the warmer period and not raised until later. This will also happen even if a boreal fauna migrates into the littoral areas. It will "press" the Arctic fauna element down to greater depths, and this again presses down a high-arctic one that may already exist. A possibly subsequent uplift will, as it is here supposed to develop, slowly bring the Arctic area into the boreal area, and the possibly high-arctic area into the Arctic one, but the stratification will always be the same: lowermost high-arctic, then Arctic, and uppermost boreal. As a stratification, like the one now set up for the marine Quaternary layers in West Greenland, has not been established on the basis of a single investigation of only one section, but on the contrary has resulted from a correlation of several localities with well-developed sequences of layers, it must be prevented that the error mentioned by LEMCHE appears in the stratigraphy now set up. Other errors have been considered, as already stated. The most difficult error appears where one at some place or other comes across a deposit in which relict forms occur, or if, as mentioned by AD. S. JENSEN (33, p. 16), forms should appear which are normally stenothermal, but owing to greater quantities of food are able to transgress the usual temperature boundaries.

Hydrographical conditions as the present ones in East Greenland may, however, explain the circumstance that *Portlandia arctica* re-immigrated so promptly at the climatic deterioration after the deposition of horizons B and C. It is an all but obvious conclusion that the climatic amelioration after the deposition of the high-arctic horizon A has only driven *Portlandia arctica* to the deeper parts of the waters of West Greenland, so that the succeeding deterioration of climate quickly procured life conditions for this species at the higher levels. On the other hand the subsequent amelioration of climate during the deposition of horizons E and F has entirely banished the species from the waters of West Greenland, and it has not later been able to immigrate.

FAUNISTIC REMARKS

In an earlier paper (41) the writer has given an account of the species until then found in the marine Quaternary deposits in the north-western part of Greenland. At the investigations on which the present work is based some species have been found which are not discussed in above paper, so they will be mentioned here along the same lines as formerly.

Lamellibranchiata.

Nucula delphinodonta MIGHELS and ADAMS.

The species has been found at Angujartorfik.

Recent occurrence: From the Murman Coast and Finmark along the Norwegian coast down into Kattegat on the Swedish side of this water. In the Atlantic Ocean around the Faroes. At the east coast of America it has been found down to New Jersey.

In Greenland it has only been taken in West Greenland as far north as Upernavik.

Fossil occurrence: Sicily.

Portlandia intermedia (SARS).

The species has been found at Angujartorfik.

Recent occurrence: Circumpolar: Svalbard, the Barents Sea, Novaja Zemlya, the Kara Sea, the Sibirian Arctic Sea, the Bering Strait, the Wellington Canal, Jan Mayen, the Shetland Islands. In Norway only found in Varangerfjord.

In West Greenland it has been found up to Upernavik.

In East Greenland on the south-east coast, the Scoresby Sund area, the Kejser Franz Josephs Fjord area.

Fossil occurrence: Norway.

Modiolaria discors (LINNÉ) incl. var. **laevigata** GRAY et var. **substriata** GRAY.

The species with varieties has been found at Lerbugten south of Claushavn, Orpigsôq, Hunde Ejland, Nivâq, Giesecke Sø. It must be

noted that where it is a question of fragments it has not always been possible to identify the varieties.

Recent occurrence: Along the whole of the European west coast to Madeira and possibly into the Mediterranean. The varieties are circumpolar in the Arctic seas north of Eurasia and America. Southwards they go down to the Lofoten Islands at the coast of Norway and to Cape Cod in America. In the Pacific Ocean it has been taken down to British Columbia and Japan. It is probable that, in the case of Greenland, it is solely a question of varieties.

In Greenland the species has not been found, but both varieties have.

Fossil occurrence: Denmark, Norway. The varieties: Scandinavia, England, America.

Modiolaria nigra (GRAY.)

The species has been found at Giesecke Sø.

Recent occurrence: Circumpolar in the Arctic seas north of Eurasia and America. To the south it goes into the Baltic, to the Dogger Bank, and Holland, the Faroes, and Iceland. In America to Cape Hatteras and Oregon.

In West Greenland it has been taken from Nanortalik to Prøven.

In East Greenland from the south-east coast to Kap Borlase Warren.

Fossil occurrence: Scandinavia, Scotland, Iceland, North America.

Modiolaria faba (MÜLLER) FABRICIUS.

The species has been found at Giesecke Sø.

Recent occurrence: At the coast of North America from the northernmost part to Labrador (Lat. 51°33′ N).

In West Greenland it has been taken from Ivigtut to Melville Bugt.

In East Greenland it has not been taken, as far as can be seen.

Fossil occurrence: unknown.

Cyamium minutum (FABRICIUS).

The species has been found at Nivâq, Akúnâq, Hunde Ejland, Egedesminde, Giesecke Sø, and Ikerasârssuk.

Recent occurrence: Circumpolar. To the south it goes in Europe to the Mediterranean with certain interruptions. In America to South Carolina and California.

In West Greenland it has been found from Godthaab to Godhavn.

In East Greenland it does not seem to have been taken.

Fossil occurrence: Denmark, Norway, the Faroes, Iceland.

Cyprina islandica LINNÉ.

Literary record:

Cyprina islandica L. JENSEN (33, p. 25).

The species has been found at Itivdlínguaq, Søndre Strømfjord.

Recent occurrence: From the White Sea to the Bay of Biscay, Iceland, the Faroes. At North America it occurs from the southern part of the Gulf of Saint Lawrence to Cape Hatteras.

No recent occurrence at Greenland.

Fossil occurrence: Widely distributed in Europe, Asia, and America.

Thrasia myopsis (MØLLER).

The species has been found at Nivâq and in the Giesecke Sø area.

Recent occurrence: Circumpolar. To the south it goes in Europe to the southern part of Norway, the Faroes, Iceland, Jan Mayen. In America down to Grand Manan.

In West Greenland it has been taken from Julianehaab to Nûgssuaq.

In East Greenland from Tasiussaq to Sabine Ø.

Fossil occurrence: Norway, Greenock (England).

Emarginula fissura (LINNÉ).

The species has been found in the Giesecke Sø area.

Recent occurrence: From Hammerfest to the Mediterranean, the Faroes, Iceland.

It is now extinct at Greenland, and as it is a good boreal-lusitanian species its presence in the layers indicates a formerly higher temperature (cf. *Cyprina islandica* L.).

Fossil occurrence: Norway, Denmark, Ireland, England, Holland.

Acmaea testudinalis (O. F. MÜLLER).

The species has been found at Orpigsôq and in the Giesecke Sø area.

Recent occurrence: Circumpolar, with a wide distribution in the Arctic seas north of Europe and America, the Kara Sea, along the coast of Norway, Denmark, the British Isles, Spain to the Azores, Iceland, along the coast of America to the Antilles, the Bering Sea to Mexico and Japan.

In West Greenland it has been taken from Nanortalik to Melville Bay.

In East Greenland it has not been taken, as far as is known. (cfr. THORSON (82, p. 10)).

Fossil occurrence: Denmark, Norway, Iceland, Labrador.

Acmaea virginea (O. F. MÜLLER).

The species has been found in the Giesecke Sø area.

Recent occurrence: Along the coast of Europe from Varangerfjord to the Cape Verde Islands and St. Helena, the Mediterranean, Iceland, the Faroes.

At Greenland it is not found any more and its presence in the raised shell beds indicates a milder climate at the time when the layers were deposited (cf. *Emarginula fissura* (L.)).

Fossil occurrence: Denmark, Norway, Sweden, Iceland, the British Isles, Italy.

Solariella obscura (COUTHOY).

The species has been found at Nivâq, Hunde Ejland, Egedesminde, and in the Giesecke Sø area.

Recent occurrence: Circumpolar in the Arctic seas north of Eurasia and America. To the south it goes to the Lofoten Islands, Iceland, the Faroes, and New England.

In West Greenland it has been taken from Julianehaab to Godhavn.

In East Greenland it has been taken from Kap Dalton to Lat. 75°58,5′ N.

Fossil occurrence: unknown.

Littorina obtusata LINNÉ.

The species has been found at Orpigsôq, the Giesecke Sø area and Ikerasârssuk.

Recent occurrence: In Europe from Hammerfest to the British Isles, the Mediterranean, the Faroes, Iceland.

In West Greenland it has only been taken at Fiskenæsset and Hunde Ejland. Its typical boreal-lusitanian distribution makes it necessary to refer it to the species which indicate a milder climate than that now prevailing at the west coast (cf. *Acmaea virginea* (MÜLL.)). Its recent occurrence at Hunde Ejland seems a little doubtful. The statement comes from POSSELT (66), who cites SUTHERLAND who has taken it at 60—70 fathoms of water. This depth is quite abnormal for *Littorina obtusata*. THORSON states the vertical distribution of the species to be from 0 m. to 3 m. (81). It is most probable that there is a confusion with *Littorina palliata* (SAY), which supersedes *Littorina obtusata* in the Arctic regions. The vertical distribution of *Littorina palliata* is also more concordant with SUTHERLAND's statement, as it has been taken as far down as 80 fathoms at Greenland.

Fossil occurrence: Scandinavia, England, Ireland, the Faroes, Iceland.

Onoba aculeus (GOULD).

The species has been taken at Lerbugten south of Claushavn, Akúnâq, Hunde Ejland, and Ikerasârssuk.

Recent occurrence: At Iceland, Norway, Svalbard, the Russian Lappmark coast, the Sea of Okhotsh, East Port, New England, Boston.

In West Greenland it has been taken from Julianehaab to Godhavn.

In East Greenland it occurs on the south coast and in the Kejser Franz Josephs Fjord complex.

Fossil occurrence: Scandinavia.

Alvania wyville-thomsoni (FRIELE).

The species has been found in the Giesecke Sø area.

Recent occurrence: At Svalbard, in the sea between Svalbard and the Bear Island, Jan Mayen, Iceland, Norway.

It has not been found at West Greenland.

In East Greenland it is known from Scoresbysund to off Bessel Fjord.

Fossil occurrence: unknown.

Alvania jeffreysi WALLER.

The species has been found in the Giesecke Sø area.

Recent occurrence: Along the west coast of Norway from Vardø to Oslo Fjord, the British Isles, the Faroes, Iceland, the Bay of Biscay, the Mediterranean.

The boreal-lusitanian distribution of the species implies that its presence in the raised layers in Greenland indicates a milder climate during the time when the layers in question were deposited (cf. *Littorina obtusata* L.).

Fossil occurrence: Norway.

Cerithiopsis costulata (MØLLER).

The species has been found at Itivdlínguaq, Søndre Strømfjord.

Recent occurrence: Along the coast of Norway from Hammerfest, Bohuslän, west of Ireland, between the Hebrides and the Faeroes, the Faroes, Iceland, Jan Mayen. At the coast of America in the Gulf of St. Lawrence and the Bay of Fundy.

In West Greenland it has been taken at Sukkertoppen.

In East Greenland in the Scoresby Sund complex.

Fossil occurrence: Sweden, England.

Amauropsis islandica (GMLIN).

The species has been found at Magnetsandsbugt, Holsteinsborg.

Recent occurrence: From Vadsø in Norway to Belgium, the British Isles, the Faroes, Iceland, Jan Mayen, Svalbard, the Bear Island, the Murman Coast, Novaja Zemlya, the Kara Sea, the Russian Lappmark coast, the Arctic Sea north of Sibiria, the Bering Sea, Massachusetts, and New Foundland.

In West Greenland it has been taken from Søndre Strømfjord to Egedesminde.

In East Greenland from Naparsarssuaq on the south-east coast to Sabine Ø.

Fossil occurrence: Scandinavia, the Brisish Isles, Sibiria, Canada.

Velutina velutina (O. F. MÜLLER).

The species has been found in the Giesecke Sø area.

Recent occurrence: Circumpolar with a southern limit at the Mediterranean, Cape Hatteras and Vancouver.

In West Greenland it has been taken from Julianehaab to Upernavik.

In East Greenland from Qeqartaqsiaq (Qeqertarssuaq?) on the south coast to Danmark Havn.

Fossil occurrence: Norway, Sweden, England.

Marsenina glabra (COUTHOY).

The species has been found at Nivâq.

Recent occurrence: At Iceland, Northern Norway, Svalbard, the White Sea, the Arctic Sea north of Sibiria, Massachusetts, and East Canada.

In West Greenland it has been taken at Fiskenæsset, Frederikshaab, and Egedesminde.

In East Greenland in the Kejser Franz Josephs Fjord complex.

Fossil occurrence: unknown.

Pyrene rosacea GOULD.

The species has been found in the Giesecke Sø area.

Recent occurrence: Circumpolar with a southern limit from Bergen in Norway, north of the Hebrides, the Faroes, Iceland to Cape Cod, the Bering Sea, Alaska.

In West Greenland it has been taken from Fiskenæsset to Prøven.

In East Greenland on the south-east coast.

Fossil occurrence: Svalbard.

Buccinum tenue GRAY.

The species has been found at one locality in the Sarqaq valley.

Recent occurrence: Circumpolar with a southern limit from West Finnmark, Iceland to New Foundland.

In West Greenland it has been taken from Frederiksdal (Narssaq) to Melville Bugt.

In East Greenland it has not been found.

Fossil occurrence: Iceland, Canada, Labrador, Hudson Bay, Sibiria.

Bela pyramidalis (STRØM).

The species has been found in the Giesecke Sø area.

Recent occurrence: Circumpolar with a southern limit from the Lofoten Islands, north of the Hebrides, Iceland to Labrador.

In West Greenland it has been taken from Julianehaab to Upernavik.

In East Greenland from the south-east coast to Danmark Havn.

Fossil occurrence: Scandinavia, the British Isles, Labrador, Sibiria.

Bela decussata (COUTHOUY).

The species has been found in the Gieseckes Sø area.

Recent occurrence: At Finnmark, north of Scotland, Jan Mayen, Svalbard, the Arctic Sea north of Eurasia, Labrador, and New England.

In West Greenland it has been taken from Frederikshaab to Vaigat.

In East Greenland from the Scoresby Sund and the Kejser Franz Josephs Fjord complexes.

Fossil occurrence: Norway, Sweden, England, Ireland, Canada.

Bela cinerea (MØLLER).

The species has been found in the Giesecke Sø area.

Recent occurrence: At Finnmark, Svalbard, between Scotland and the Faroes, Iceland.

In West Greenland it has been taken from Skinderhvalen to Lat. 68°24′ N.

In East Greenland it has not been found.

Fossil occurrence: unknown.

LEVELS

In an earlier paper the writer gave an account of the level changes in the area around the Ûmánaq Fjord (41). Here he pointed out that the corresponding terraces lie at a somewhat higher level at the heads of the fjords than at the outer coast. He also demonstrated that the upper marine limit in contrast to former assumptions lies considerably higher, viz. 230 m. above sea level at Ûmánaq Fjord and 200 m. above sea level at Vaigat, so it must be supposed that the terrace altitudes diminish from north to south (op. cit. p. 98).

Within the area discussed in this report the upper marine limit has only been observed at a few places. At Atâ clayey sediment was found up to 185 m. above sea level, sand somewhat higher, so that the upper marine limit is supposed to lie at about 200 m. above sea level, which is in good accordance with the formerly established figure for the Vaigat coasts. At Qasortoq between Jakobshavns Isfjord and Claushavn terraces were measured to be up to 174 m. above sea level, and the upper marine limit was measured to be 185 m. above sea level. In the Orpigsôq area good marine sediments were found up to 93 m. above sea level in a side valley of the Ilulialik river. Above this altitude it was not possible to determine if the sediments were of marine origin. Altitudes up to 196 m. above sea level were investigated, but without result. The rocks were naked, all loose material had been washed away. On the other hand there were large systems of striae. This was also the case on a series of hills at about 175 m. above sea level which were investigated in the Egedesminde district. Here, however, on Manitsoq Pjetursson (64, p. 323) found the highest beach line in this island, at 108 m. above sea level. Pjetursson supposes that this altitude is the upper marine limit, an assumption which may very well be correct in the opinion of the present writer. It is for that matter extremely difficult to establish the upper marine limit in the archipelago of the Egedesminde district, as practically all loose material has been washed away at the higher levels, so that the naked rock constitutes the surface. On this no traces were found of a formerly higher water level. At Giesecke Sø terraces were observed at an altitude of about

175 m. Above this altitude there seemed to be no material of marine origin. Altitudes up to 200 m. were investigated. 175 m. above sea level as the upper marine limit harmonizes very well with the altitudes ascertained farther north. The upper marine limit is, however, expected to be found at a higher level in the big fjords. As stated already, Mr. ELLITSGAARD RASMUSSEN has observed terraces which may be marine up to 270 m. above sea level in Søndre Strømfjord, so that altitudes increasing towards the heads of the fjords are a feature which may also hold good of the fjords farther south.

After the investigations in the area around Ûmánaq Fjord it must be taken for granted that the layers, deposited in connection with the upper marine limit, have been high-arctic (41, p. 105). As they are the oldest postglacial marine deposits, it follows that they must belong to horizon A. Consequently they are the only layers found at the upper marine limit. As this, however, lies at a lower level at the outer coast than at the heads of the fjords, horizon A must be found at a relatively high level out there, at the same time as the A-layers appear as bottom layers in the coast cliffs. If A-layers are not found at the bottom in the coast cliffs, it must be a consequence of the fact that these layers have not yet been raised so much above the level of the sea that they have become visible, or the sea has not yet eroded the cliff so much that the layers have appeared.

It is in keeping with the find of the A-layers at the upper marine limit that these layers at this level have developed as sandy clay (41, p. 29), whereas the horizon in the lowest layers of the cliffs appear as fat clay. When the sediment at the locality in Depotbugt (70 m. above sea level) according to AD. S. JENSEN is "fine clayey mud" (33, p. 4). then this is a result of the fact that the layers here, as also stated by AD. S. JENSEN, have been deposited in calm water in a bay, so that great quantities of sand in the clay cannot be expected.

Horizon B, which superposes horizon A in the coast cliffs, consists of sandy clay. This shows that the layers have been deposited at a lower depth of water than the horizon A layers, or that there has been an increased turbulence in the water. At first sight the last-mentioned possibility is the most probable, as a rise in temperature will effect an increase of the meltwater discharge from inland ice and glaciers. It must in this connection be borne in mind that layers belonging to horizon B until this day have only been found in the neighbourhood of big river mouths. However, an uplift of the sea bottom must also have taken place, otherwise horizon A would not have been found as the highest-lying horizon in connection with the upper marine limit. This involves that deposits belonging to horizon B on the valley sides of the fjords must be found at a somewhat lower level than the horizon A layers.

Horizon C consists lowermost in the cliffs of sandy layers which upwards in the deposits become more fat. This suggests that a subsidence of the land must either have taken place during the deposition of horizon C, or that the alteration of the sedimentation is due to the incipient fall in temperature, which reaches its minimum in the succeeding high-arctic period, so that a comparatively small amount of material, which is also of a finer-grained nature, has been carried out into the sea on account of diminished supply of water from the glaciers. If a subsidence has taken place, then this has not exceeded the subsidence in connection with horizon A (upper marine limit). At the present moment it cannot be determined whether the subsidence has exceeded the upper limit of the B layers, as layers belonging to horizon C have not been found at greater levels. In the Giesecke Sø area horizon C seems to have been deposited at a time when the level of the sea at this place stood about 40 m. above the present water level. In the coast cliffs at Lerbugten south of Claushavn horizon C is probably found at an altitude from 16 m. to 20 m. above sea level, and at Orpigsôq about 10 m. above the sea. Farther south the horizon is met with almost on a level with the sea.

Horizon D appears partly on the surface partly in the coast cliffs. The greatest interest is attached to the localities on the surface. Among these localities are the cliffs at the lakelet on Lersletten between Pinguarssuk and Tasiussaq, which with their content of *Portlandia arctica* are obviously high-arctic and must be referred to horizon D (See p. 105). The surface of Lersletten is 50 m. above sea level, and clay plains north of Jakobshavn, at the outpost of Claushavn, and in the Orpigsôq area have been found at the same level. The level of the sea must have been somewhat higher than that of the plains. At the investigation of the terraces in the area north and south of Jakobshavns Isfjord it is reasonable to note the 2 delta cones found at Atâ with an outer edge at 60 m. above sea level and a top altitude at 70 m. above sea level. They correspond with a terrace flat with an outer edge at 55 m. and an inner edge at 58 m. above sea level. At Taserssuaq lake north of Atâ a terrace was measured to have an outer edge at 53.5 m. above sea level and an inner edge at 68.5 m. above sea level. At Qarsortup kûa was a terrace with an outer edge at 43 m. and an inner edge at 75 m. above sea level. If unavoidable inaccuracies of measurements are taken into consideration these terraces correspond very well, and it will hardly be amiss to estimate the level of the sea to be about 60 m. above the present water level at the time when the D layers were deposited in this area. In the Giesecke Sø area horizon D has been found at 33 m. above sea level, and the level of the sea must be fixed at this figure. It cannot have been over 34 m., as it then would have left traces in the deposits which are met with at this level.

Concerning horizon E it is at present very difficult to form an opinion of the level of the sea in connection with the deposition of the pertaining layers. The position of the layers in Muslingedal indicates that the uplift of the land in relation to horizon D has only been a very few metres. Conditions at Lerbugten south of Claushavn also point in that direction. If the level had been essentially higher than 47—48 m., then the E layers would have been found as surface formation on Lersletten and on the plains at Jakobshavn and Orpigsôq. At the inner edge of the terrace corresponding to "Engell's Profil" was a small, very even slope of only a couple of metres. There were no shells in it, only pure sand, and above the slope the characteristic clay surface appeared with clay circles separated by vegetation. In the area at Disko Bugt the level of the sea must therefore be estimated to be about 45 m. higher during the deposition of horizon E. At the coast the E layers appear at varying altitudes dependent on the distance from the outer coast and the intensity of the erosion of the sea.

No terrace notches have been found which may with certainty be correlated with the upper limit of horizon E. This may originate in the fact that the difference between the altitude of this and the next horizon has been so small that the solifluction has obliterated all traces of possible E terraces to the advantage of the more well-marked F line. It is also possible that no distinct terrace notches have formed in connection with horizon E.

Standing on the surface of the cliff at "Engell's Profil" and looking over Orpigsûp tasia kitdleq, one cannot avoid noticing the very well-marked terrace which is found all round the lake at about 4 m. above the level of this, which is at 36 m. above sea level. This terrace is obviously connected with the *Zirphaea* layers and must undoubtedly indicate the level of the sea at the time when the layer in question was being deposited. In other words it must be taken for granted that the land at this place was 40 m. lower in relation to the present level, when horizon F was being deposited. In support of this assumption the F layer at Tasiussaq is found at 35—40 m. above sea level. This locality lies only about 50 km. farther north. At almost the same level is the locality at Itivdlínguaq, which lies at an altitude of 35 m. At a somewhat lower level, viz. 24—30 m., are the F layers at Giesecke Sø, the distance of which from the outer coast is also a little less than the 3 above-mentioned localities. Along the outer coast is a series of localities with altitudes at about 10 m.

It is accordingly possible to establish as a fact that the uppermost layers of horizon F were deposited at a time when the level of the sea was about 40 m. higher than at present at Disko Bugt. In all probability horizon F farther south lies at a somewhat lower level, which is suggested by the locality at Itivdlínguaq at 35 m. above sea level. The layers have been deposited during the continuous uplift of the land up to a level,

which is very much the same as the present one. A series of terraces in the Disko Bugt area with inner edges at about 35–40 m. above sea level are undoubtedly referable to this period. This is the case with for instance Atâ and Atâ Taserssuaq with inner edges of the terraces at 34 m. and 39 m. respectively, Qasortoq at 36 m., and Igpik and farther south at 40 m. above sea level. The pronounced 10 m. terrace, found practically everywhere along the coast, must also have been formed during the deposition of horizon F, during its last phase.

AN ATTEMPT AT A CORRELATION WITH THE SCANDINAVIAN LATE- AND POSTGLACIAL LAYERS

Practically all recent writers, who have dealt with the postglacial marine deposits in the Arctic, have found that a temperature higher than at present was prevailing at a certain time in the polar region.

The first collections of shells in the Arctic region which indicate such a mild climate, were made by the Swedish expeditions, which worked on Svalbard under the leadership of Otto Torell and others towards the end of last century. The results have been published by Blomstrand (8), Chydenius (11), Heer (22), and Nathorst (51). Furthermore mention ought to be made of the Russian expeditions under Knipowitsch 1899—1901 (37). Later collections have been made on Svalbard by many other investigators.

In East Greenland Nathorst found *Mytilus edulis* in raised layers in the Kejser Franz Josephs Fjord area and stated that the occurrence of this species in these layers shows quite different conditions to those now present (52). Ad. S. Jensen was the first to formulate and propound the theory that a warmer period must have existed in Greenland at a certain time of the postglacial epoch (28, p. 392). The whole question of a postglacial climatic optimum was very much discussed in those days, and it was the main subject of the 11. International Geologist Congress in Stockholm in 1910. In the Congress reports the results so far achieved were presented, which showed that a climatic optimum could be demonstrated in Greenland (Jensen and Harder, 30, p. 397—407), Iceland (Bardarsson, 4, p. 345—52), and Svalbard (Andersson, 1, p. 409—418), whereas a similar optimum had not yet been ascertained in Canada (Tyrrell, 83, p. 389—391) and Alaska (McConnell, 13, p. 395). According to Washburn (86) a great many investigators i. a. Dall, Stefansson, O'Neill, and Nichols besides he himself have since that time made collections of shells and surveys of beach lines at the Arctic coasts of the continent of America and the numerous islands. None of them have, how-

ever, been able to demonstrate any climatic optimum, and the present writer was the first to establish evidence of the optimum in Canada on the basis of MATHIASSEN's and BIRKET-SMITH's collections on the 5. Thule Expedition in the area of Baffin Land, Melville Peninsula, Southampton Island, and the north-eastern part of Barren Grounds (42, p. 45).

In the mentioned report from the 11. Geologist Congress there is no discussion of Russia and the Asiatic Arctic Sea coast, but NANSEN had at an earlier time demonstrated the climatic optimum on Franz Joseph Land (50, p. 420), and NORDENSKIÖLD on Novaja Zemlya (54, p. 29). The occurrence of *Zirphaea crispata* and *Mytilus edulis* in raised layers at the Lower Yenisei points in the same direction (44; 72). Also in Scandinavia many investigators have demonstrated a climatic optimum, and that at a time which lies before the ascertainment of the Arctic one. It has been desirable to make a correlation of the postglacial layers in the area around the North polar basin, and several investigators among them JENSEN and HARDER (30, p. 40), NORDMANN (59, p. 154), and NOE NYGAARD (53, p. 25) have advanced the theory that the postglacial climatic optimum in the Arctic region coincides with the *Tapes* (*Littorina*) time in Scandinavia. With the knowledge now acquired of the marine Quaternary layers in Greenland it is possible to carry through such a correlation.

In Iceland THORODDSEN (78), PJETURSSON (65), and BARÐARSON (3; 4; 5; 6) have made a series of investigations. The results of these show that in Iceland it is possible to distinguish between the following periods within the postglacial epoch: 1) After the retreat of the ice a subsidence of the land took place, and a high-arctic fauna was deposited with i.a. *Portlandia arctica*. The subsidence at that time reached 40—45 m. above the present level of the sea. 2) By the further retreat of the ice the subsidence continued until the sea level stood about 80 m. above the present shore line. During this subsidence clay with an Arctic fauna was deposited. 3) After the maximum of the subsidence the land rose again, and sediment with an Arctic fauna was deposited during the first period. This sediment has been found at about 55 m. above sea level. 4) This layer is succeeded by a deposit characterized by *Pecten islandicus*. 5) Then follow littoral gravel deposits characterized by the presence of *Zirphaea crispata*, *Mytilus edulis*, *Cyprina islandica*, *Littorina rudis*, and *Buccinum undatum*. This deposit occurs up to 40—45 m. above sea level. 6) At about 15 m. above sea level *Purpura lapillus* and *Littorina obtusata* appear. 7) *Zirphaea crispata* and *Cyprina islandica* occur again at the lowest level.

If the epeirogenic conditions are left out of account, and attention is paid to the climatic conditions only, it is possible to find a certain

harmony between the layers in Greenland and Iceland, as shown in the table below:

Greenland	Iceland
Horizon F	Layers 5—7
— E	Layer 4
— D	— 3
— C	— 2
— B	
— A	— 1

The high-arctic layer A and 1 are immediately correlative, they have both been deposited in connection with the maximum expansion of the ice. The layers in horizon B and C and Layer 2 are all Arctic. In Iceland no detailed investigations of large areas have been made, as far as can be seen, so there is the possibility that a differentiation of layer 2 can be achieved. On the other hand the distinction between horizons B and C in Greenland is by no means so clear-cut that it will be inappropriate to correlate the layers, as done here. The high-arctic horizon D in Greenland is correlated with the Arctic layer 3 in Iceland. This is done from the consideration partly that it is possible that the climatic conditions at Iceland have not been so extreme during a deterioration of the climate, as is the case in Greenland, partly that the period in which the climatic deterioration took place was too short for *Portlandia arctica* to re-immigrate to Iceland. The nearest locality where this species may have lived is East Greenland. It was from here that the immigration should have started, but the current in Danmark Strædet has hardly been favourable to a possible immigration. Horizon E in Greenland is correlated with layer 4 in Iceland. Both of them are Arctic layers with more warmth-loving forms, and *Mytilus edulis* migrates into both layers. Horizon F is correlated with the layers 5—7. They are layers characterized by their content of boreal forms like *Zirphaea crispata*, *Cyprina islandica* and others. Furthermore *Purpura lapillus*, not yet found at Greenland, immigrated to the coasts of Iceland. That this species has not been found in Icelandic localities referable to layer 7, may be due to a mere accident, as systematic investigations are lacking. In recent time the species together with several other forms have immigrated to the northern coast as a consequence of the climatic amelioration prevailing at present in the seas farther north (2).

Conditions of uplift and subsidence are different in the two islands, but nothing can so far be said about the causes.

If a correlation with the layers in Scandinavia is now attempted, the result arrived as will be shown in the table below:

Greenland	Ice-land	Denmark		Norway (56)
Horizon F	7 6 5	*Littorina* Sea *Dosinia* Sea *Tapes* Sea	Beech Oak	*Ostrea* layer I—II *Trivia* layer *Tapes* layer
Horizon E	4	—	Pine	*Mactra-Pholas-Littorea* layer
Horizon D	3	—	Younger *Dryas*	*Portlandia* layer
Horizon B—C Horizon A	2 1	*Zirphaea* Sea *Yoldia* Sea	Allerød Older *Dryas*	Glaciated? [1]

[1]) Cf. 19 p. 82—83.

As appears from the table the high-arctic horizon A has been correlated with the younger *Yoldia* clay and the older *Dryas* in Denmark, the horizons B—C with the *Zirphaea* Sea layer and the desiccation horizons of the Allerød time, as a rise in temperature took place at that time, and ultimately horizon D with the younger *Dryas* clay, during the deposition of which a climatic deterioration again occurred. Southern Norway, included in the table, was probably glaciated during the first part of this time, but in the later period her coasts were washed by a sea in which *Portlandia arctica* lived. During the subsequent time, called "Fastlandstid" (the Ancylus Lake time) a great uplift takes place in Denmark. The *Mactra-Pholas-Littorea* layer in Norway indicates that the climate turned into a boreal one. This period in Scandinavia is correlated with horizon E, the first period in Greenland where a real increase of warmth set in. During the subsequent period in Scandinavia—the *Littorina* transgression—the climatic amelioration continued as in Greenland, where the layers belonging to horizon F were deposited. A number of lusitanian forms migrated into Denmark, and they reached their maximum distribution in the *Dosinia* Sea with forms like *Tapes edulis* L., *Psammobia vespertina* CHEMN., *Dosinia exoleta* L., and *Cypraea* (*Trivia*) *europaea* (MONT.). The present writer correlates this last period with the *Trivia* layer in Norway. During the last part of the *Littorina* Sea time a minor transgression occurred, which in Norway has been described by REKSTAD (67) on the basis of investigations made at Halden, and in Denmark by

the present writer on the basis of investigations made at Strandby in Vendsyssel (40). This temperature maximum probably coincided with the immigration of *Purpura lapillus* at Iceland. It will be natural according to the present data to correlate horizon F in Greenland with the *Littorina* time in Scandinavia.

The temperature has fallen a little in Greenland and in Scandinavia after the deposition of these layers, so that the conditions of today have been attained.

INDEX OF PLACE NAMES ON GREENLAND

Abbreviations.

Chb. = Christianshaab district. Egm. = Egedesminde district. Fhb. = Frederikshaab district. Ghb. = Godthaab district. Ghv. = Godhavn district. Hbg. = Holsteinsborg district. Jhb. = Julianehaab district. Jhvn. = Jakobshavn district. Skt. = Sukkertoppen district. Th. = Thule district. Um. = Ûmánaq district. Up. = Upernavik district. ØGr. = East Greenland.

LITERATURE

Books marked with * have been used for the determination of the material, and for the inquiry into the conditions of distribution etc.

1. Andersson, Gunnar: Die jetzige und fossile Quartärflora Spitzbergens als Zeugnis von Klimaänderungen. Postglaziale Klimaveränderungen. 11. internationale Geologenkongress. Stockholm 1910.
2. Áskelsson, Jóhannes: Some Remarks on the Distribution of the Species *Zirphaea crispata* L. and *Purpura lapillus* L. on the North-Coast of Iceland. Videnskabelige Meddelelser fra Dansk naturhistorisk Forening. Bind 99. København 1935.
3. Bardarson, Guðmundur G.: *Purpura lapillus* L. i hævede Lag paa Nordkysten af Island. Videnskabelige Meddelelser fra Dansk naturhistorisk Forening. København 1907.
4. — Traces of Changes of Climate and Level at Hunaflói, Northern Iceland. Postglaziale Klimaveränderungen. 11. internationale Geologenkongress. Stockholm 1910.
5. — Mærker efter Klima- og Niveauforandringer ved Hunaflói i Nord Island. Videnskabelige Meddelelser fra Dansk naturhistorisk Forening. København 1911.
6. — Fossile Skalaflejringer ved Breiðifjörður i Vest-Island. Geologisk Förening i Stockholms Förhandlinger 1921. Stockholm 1921.
7. *Bertelsen, Eeik: Contributions to the Animal Ecology of the Fjords of Angmagssalik and Kangerdlugssuaq in East-Greenland. Meddelelser om Grønland. Bind 108. Nr. 8. København 1937.
8. Blomstrand, C. W.: Geognostiske iagttagelser under en resa till Spetsbergen år 1861. Kongliga Svenska Vetenskabs-Akademiens Handlinger. Ny Följd. Bind 4. Nr. 6. Stockholm 1864.
9. Bobé, Louis: se Niels Egede (16).
10. *Brøgger, W. C.: Om de senglaciale og postglaciale nivåforandringer i Kristianiafeltet. Norges geologiske Undersøgelse. Bind 31. Kristiania 1900 & 1901.
11. Chydenius, K.: Svenska expeditionen till Spetsbergen år 1861 under ledning af Otto Torell. Stockholm 1865.
12. *Collin, J.: Dijmphna-Togtets Zoologisk-botaniske Udbytte. Brachiopoder, Muslinger og Snegle fra Kara-Havet. København 1886.
13. Connel, R. G. Mc: Changes in Post-Glacial Temperatures in the Yukon. Postglaziale Klimaveränderungen. 11. internationale Geologenkongress. Stockholm 1910.
14. Dons, Carl: Norges Strandfauna. Muslinger 1—7. Det kongelige norske videnskabers selskab. Forhandlinger Bind IX. No. 42. — Bind X. No. 14. Trondheim 1937.

15. EGEDAL, J.: The Sinking of Greenland. Meddelelser om Grønland. Bind 134. Nr. 7. København 1947.
16. EGEDE, NIELS: Journal holden her ved Colonien Egedes Minde fra Aar 1759 til Aar 1761 d: 1ste Juli. Ved LOUIS BOBÉ. Det grønlandske Selskabs Aarsskrift. København 1943.
17.*FRIELE, H.: Mollusca I & II. The Norwegian North-atlantic Expedition 1876—1878. Christiania 1882—86.
18. FRODA, F.: Some Observations in North-Greenland 1923. Meddelelser om Grønland. Bind 59. Nr. 4. København 1925.
19. FÆGRI, KNUT: Quartärgeologische Untersuchungen im westlichen Norwegen. II. Zur spätquartären Geschichte Jærens. Bergens Museums Årbok 1939—40. Naturvidenskabelig rekke Nr. 7. Bergen 1940.
20. HAMMER, R. R. I.: Undersøgelser ved Jakobshavns Isfjord og nærmeste Omegn i Vinteren 1879—80. Meddelelser om Grønland. Bind 4. Nr. 1. København 1883.
21. HARDER, POUL†; AD. S. JENSEN and DAN LAURSEN: The Marine Quaternary Sediments in Disko Bugt. Meddelelser omGrønland. Bind 149. Nr. 1. København 1949.
22. HEER, OSVALD: Die miocene Flora und Fauna Spitzbergens. Kongliga Svenska Vetenskabs-Akademiens Handlingar. Ny Följd. Bind 8. Nr. 7. Stockholm 1870.
23.*HÄGG, R.: Mollusca und Brachiopoda gesammelt von der Schwedischen Zoologischen Polarexpedition nach Spitzbergen, dem nordöstlichen Grönland und Jan Mayen im Jahre 1900. Arkiv för Zoologi. Band 2. N:o 2 og 13. Utgifvet af Kungliga Svenska Vetenskabsakademien i Stockholm. Stockholm 1904—05.
24.*IVERSEN, JOHS.: En pollenanalytisk Tidsfæstelse af Ferskvandslagene ved Nørre Lyngby. Meddelelser fra Dansk Geologisk Forening. Bd. 10. Hefte 2. København 1942.
25.*JEFFREYS, J. G.: British Conchology. Vol. II—V. London 1863—69.
26.*JENSEN, AD. S.: Studier over nordiske Mollusker. I. *Mya.* Videnskabelige Meddelelser fra Dansk naturhistorisk Forening. København 1900.
27.* — Bemærkninger om Molluskfaunaen. (I PJETURSSON: (63)). Oversigt over det kongelige danske Videnskabernes Selskabs Forhandlinger. Bind 6. København 1904.
28. — On the Mollusca of East-Greenland. I. *Lamellibranchiata.* With an Introduction on Greenland's Fossil Mollusc-Fauna from the Quaternary Time Meddelelser om Grønland. Bind 26. København 1905.
29. — Studier over nordiske Mollusker. III. *Tellina* (*Macoma*). Videnskabelige Meddelelser fra Dansk naturhistorisk Forening. København 1905.
30. — og POUL HARDER: Post-Glacial Changes in Arctic Regions as Revealed by Investigations on Marine Deposits. Postglaziale Klimaveränderungen. 11. internationale Geologenkongress. Stockholm 1910.
31.* — *Lamellibranchiata*, Part I. The Danish Ingolf-Expedition. Vol. II. Part 5. København 1912.
32. — og R. SPÄRCK: Bløddyr II. Saltvandsmuslinger. Danmarks Fauna. Bind 40. København 1934.
33. — Two New West Greenland Localities for Deposits from the Ice Age and the Post-Glacial Warm Period. Det Kongelige Danske Videnskabernes Selskab. Biologiske Meddelelser, Bind XVII, Nr. 4. København 1942.
34. — Concerning a Change of Climate During Recent Decades in the Arctic and Subarctic Regions, from Greenland in the West to Eurasia in the East,

and Contemporary Biological and Geophysical Changes. Det Kongelige Danske Videnskabernes Selskab. Biologiske Meddelelser XIV, 8. København 1939.

35. JENSEN, J. A. D.: Beretning om en Undersøgelse af Grønlands Vestkyst fra 66°55′—68°30′ n. Br. Meddelelser om Grønland. Bind 2. København 1881.
36. — Undersøgelse af Grønlands Vestkyst fra 64° til 67° n. Br. Meddelelser om Grønland. Bind 8. København 1889.
37. KNIPOWITSCH, N.: Zoologische Ergebnisse der Russischen Expedition nach Spitzbergen. III & IV. Annales du Museum Zoologique de l'Académie Impériale des Sciences de Saint-Petersbourg. VII —VIII. St.-Petersbourg 1902 —1903.
38. KORNERUP, A.: Geologiske Iagttagelser fra Vestkysten af Grønland. (66°55′— 68° n. Br.) Meddelelser om Grønland. Bind 2. (2. Udgave). København 1916.
39.*KOBOLT, W.: Iconographia der schalentragenden europäischen Meereskonkylien. 1. Band. Cassel 1887.
40. LAURSEN, DAN: Et Profil gennem en Skalbanke fra *Dosinia*-Havet. Meddelelser fra Dansk geologisk Forening. Bind 9, Hefte 2. København 1937.
41. — Contributions to the Quaternary Geology of Northern West Greenland. Especially the Raised Marine Deposits. Meddelelser om Grønland. Bind 135. Nr. 8. København 1944.
42. — Quaternary Shells Collected by the Fifth Thule-Expedition 1921—24. Report of the Fifth Thule-Expedition 1921—24. Vol. I. No. 7. København 1946.
43. — ; HENNING LEMCHE m. fl.: Diskussion efter Dan Laursens Foredrag om Resultaterne af de kvartærgeologiske Undersøgelser paa 5. Thuleekspedition. Meddelelser fra Dansk geologisk Forening. Bind 11, Hefte 1. København 1946.
44. LEECHE, VILHELM: Öfversigt öfver de af svenska expeditionerne till Novaja Semlja och Jenissej 1875 och 1876 insammlede Hafs-Mollusker. Kongliga Svenska Vetenskabs-Akademiens Handlinger. Band 16. Nr. 2. Stockholm 1878.
45.*LEMCHE, HENNING: *Gastropoda Opisthobranchiata.* The Zoology of Iceland. Vol. IV. Part 61. København & Reykjavik 1938.
46.* — *Gastropoda Opisthobranchiata.* Meddelelser om Grønland. Bind 80. Nr. 7. København 1941.
47. — *Gastropoda Opisthobranchiata.* Meddelelser om Grønland. Bind 121. Nr. 7. København 1941.
48. — se Dan Laursen (43).
49. MADSEN, V. og V. NORDMANN: Kvartæret i Røgle Klint ved Lillebælt. Danmarks geologiske Undersøgelse. II. Række. Nr. 58. København 1940.
50. NANSEN, FRIDTJOF: The Oceanography of the North Polar Bassin. The Norwegian North Polar Expedition 1893—96. Scientific Results. Vol. III. No. 3. Kristiania 1902.
51. NATHORST, A. G.: Redogörelse för den tillsammans med G. de Geer år 1882 företagna geologiska expeditionen till Spetsbergen. Bihang til Kongliga Svenska Vetenskabs-Akademiens Handlinger. Band 9. Nr. 2. Stockholm 1884.
52. — Bidrag till Nordöstra Grönlands Geologi. Geologisk Förening i Stockholms Förhandlinger. Band 23. Stockholm 1901.
53. NOE-NYGAARD, ARNE: Remarks on *Mytilus edulis* L. in Raised Beaches in East-Greenland. Meddelelser om Grønland. Bind 95. Nr. 2. København 1932.

54. NORDENSKIÖLD, A. E.: se HEER (22).
55. — Redogörelse för en Expedition till Grönland år 1870. Öfversikt öfver Kongliga Svenska Vetenskabs-Akademiens Förhandlinger 1870. Nr. 10. Stockholm 1871.
56. NORDHAGEN, ROLF: De senkvartære Klimavekslinger i Nordeuropa og deres Betydning for Kulturforskningen. Oslo 1933.
57. NORDMANN, V.: Fra Nordre Strømfjord og Giesecke Sø. Det grønlandske Selskabs Aarsskrift 1912. København 1912.
58.* — *Anomia squamula* L. som Kvartær-Fossil paa Spitsbergen. Meddelelser fra Dansk geologisk Forening. Bind 4. København 1912.
59. — Klimaforandringer i de nordlige Polarlande. Naturens Verden Hefte 3 & 4. København 1925.
60.* — m. fl.: Oversigt over Danmarks Geologi. Danmarks geologiske Undersøgelse. V. Række. Nr. 4. København 1928.
61.*ODHNER, NIELS HJ.: Northern and Arctic Invertebrates. V. *Prosobranchia.* 1. *Diotocardia.* Kungl. Svenska Vetenskabs-Akademiens Handlingar. Band 48. N:o 1. Uppsala & Stockholm 1912.
62.* — Northern and Arctic Invertebrates. VI. *Prosobranchia.* 2. *Semiproboscidifera.* Kungl. Svenska Vetenskabs-Akademiens Handlingar. Band 50. N:o 5. Uppsala & Stockholm 1913.
65.* — Die Molluskenfauna des Eisfjordes. Kungl. Svenska Vetenskabs-Akademiens Handlingar. Band 54. N:o 1. Stockholm 1915.
64. PJETURSSON, HELGI: Geologiske Optegnelser. Meddelelser om Grønland. Bind 14. København 1898.
65. — Om Forekomsten af skalførende Skurstensler i Bulandshöfði, Sneefellsnæs, Island. Med Bemærkninger om Molluskfaunaen af AD. S. JENSEN. Oversigt over det Kongelige danske Videnskabernes Selskabs Forhandlinger. Bind 6. København 1904.
66. POSSELT, HENR. J.: Grønlands Brachiopoder og Bløddyr. Meddelelser om Grønland. Bind 23. 1. Afdl. København 1899.
67. REKSTAD, J.: Et profil fra de løse masser ved Frederikshald. Norsk geologisk Tidsskrift. Bind 1. Kristiania 1907.
68. RIIS-CARSTENSEN, EIGIL: The Godthaab Expedition. The Hydrographic Work and Material. Meddelelser om Grønland. Bind 78. Nr. 3. København 1936.
69. ROSENKRANTZ, A.; A. NOE-NYGAARD; H. GRY; S. MUNCK and DAN LAURSEN: A Geological Reconnaissance of the Southern Part of the Svartenhuk Peninsula, West Greenland. Meddelelser om Grønland. Bind 135. Nr. 3. København 1942.
70. RYDER, C.: Den østgrønlandske Ekspedition udført i Aarene 1891—92. Hydrografi. Meddelelser om Grønland. Bind 17. København 1895.
71.*SARS, G. O.: Bidrag til Kendskaben om Norges arktiske Fauna. I. Mollusca Regionis arcticae Norvegia. Kristiania 1878.
72. SCHMIDT, FREDERICH: Wissenschaftlische Resultate der zur Aufsuchung eines angekündigten Mammuthcadavers vor der Kaiserlichen Akademie der Wissenschaften an der unteren Jenissei ausgesannten Expedition. Mémoires de l'Akadémie Impériale des Sciences de Saint-Petersbourg. VII[e] Série. Tome XVIII. No. 1. Saint-Petersbourg 1872.
73.*SOOT-RYEN, T.: Some Pelecypods from Franz Josef Land, Victoriaøya and Hopen collected on the Norwegian Scientific Expedition 1930. Norges Svalbard- og Ishavs-Undersøgelser. Nr. 43. Oslo 1939.
74.*SPARRE SCHNEIDER, J.: Undersøgelser af dyrelivet i de arktiske fjorde. III.

Tromsøsundets molluskfauna. Tromsø Museums årshefter VIII. Tromsø 1886.

75. SPÄRCK, R.: Contributions to the Animal Ecology of the Franz Joseph Fjord and Adjacent East Greenland Waters. I—II. Meddelelser om Grønland. Bind 100. Nr. 1. København 1933.

76. STEENSTRUP, K. J. V.: Bidrag til Kjendskab til de geognostiske Forhold i en Del af Nord-Grønland. Meddelelser om Grønland. Bind 4. København 1883.

77.*STEPHENSEN, K.: Account of the *Crustacea* and *Pycnogonidae*. Meddelelser om Grønland. Bind 51. Nr. 4. København 1915.

78. THORODDSEN, TH.: Postglaciale marine Aflejringer, Kystterrasser og Strandlinier i Island. Geografisk Tidsskrift. Aargang 1891—92. København 1892.

79. THORSON, G.: Investigations on Shallow Water Animal Communities in the Franz Joseph Fjord (East Greenland) and Adjacent Waters. Meddelelser om Grønland. Bind 100. Nr. 2. København 1933.

80. — Contributions to the Animal Ecology of the Scoresby Sound Fjord Complex (East Greenland). Hydrography by H. USSING. Meddelelser om Grønland. Bind 100. Nr. 3. København 1934.

81.* — Marine *Gastropoda Prosobranchiata*. The Zoology of Iceland. Vol. IV. Part 60. København & Reykjavik 1941.

82. — Marine *Gastropoda Prosobranchiata*. The Zoology of East Greenland. Meddelelser om Grønland. Bind 121. Nr. 13. København 1944.

83. TYRRELL, J. B.: Changes of Climate in North-western Canada Since the Glacial Period. Postglaziale Klimaveränderungen. 11. internationale Geologenkongress. Stockholm. 1910.

84. USSING, H.: The Biology of some Important Plankton Animals in the Fjords of East Greenland. Meddelelser om Grønland. Bd. 100. Nr. 7. København 1938.

85.*VIBE, CHRISTIAN: Preliminary Investigations on Shallow-Water Animal Communities in the Upernavik- and Thule-Districts (Northwest Greenland). Meddelelser om Grønland. Bind 124. Nr. 2. København 1939.

86. WASHBURN, A. L.: Reconnaissance Geology of Portions of Victoria Island and Adjacent Regions Arctic Canada. The Geological Society of America. Memoir 22. New York 1947.

87.*WESENBERG-LUND, E.: Brachiopods from the Waters West of Greenland. Meddelelser om Grønland. Bind 80. Nr. 6. København 1940.

88.* — The Zoology of East-Greenland. Brachiopoda. Meddelelser om Grønland. Bind 121. Nr. 5. København 1940.

Færdig fra trykkeriet den 15. marts 1950.

PLATES

Plate 1.

Table 1. Map showing the situation of the localities where terraces have been surveyed or shells have been collected.

Jakobshavn district.

1. Kûgssuaq, Sarqaq.
2. Igdluluarssuk.
3. Kangerdluarssuk.
4. Ikorfat.
5. Oqaitsoq.
6. Oqaitsoq river.
7. Arnâ.
8. Langebugt.
9. Ritenbenk.
10. Kangeq.
11. Quvnerssuaq.
12. Igdluluarssuit.
13. Taserssuaq, Atâ.
14. Atâ.
15. The island in Kangerdluarssuk.
16. Kûgssuaq, s. o. Kangerdluarssuk.
17. Kangârssuk.
18. Nordre Næs.
19. Sermermiut.

Christianshaab district.

20. Qarsortoq.
21. Claushavn.
22. Sandbugten.
23. Lerbugten.
24. Maagefjeld.
25. Tasiussaq.
26. Quilik, Christianshaab.
27. Orpigsôq.
28. Orpigsûp tasia kitdleq.

Egedesminde district.

29. Nivâq.
30. Akúnâq.
31. Hunde Ejland.
32. Egedesminde.
33. Aumat.
34. Naternaq.
35. Igíniarfik.
36. Agto.
37. Giesecke Sø.
38. Depotbugt, Nordre Strømfjord.
39. Nagssugtôq river.

Holsteinsborg district.

40. Eqalugsugssuit qínguat.
41. Qôrorssuaq kitdleq.
42. Holsteinsborg.
43. Magnetsandsbugten.
44. Amerdloq.
45. Akugdleq.
46. Ikerasârssuk.
47. Itivdleq.
48. Itivdlínguaq.

Sukkertoppen district.

49. Angujartorfik.
50. Nipisat.
51. Sukkertoppen.

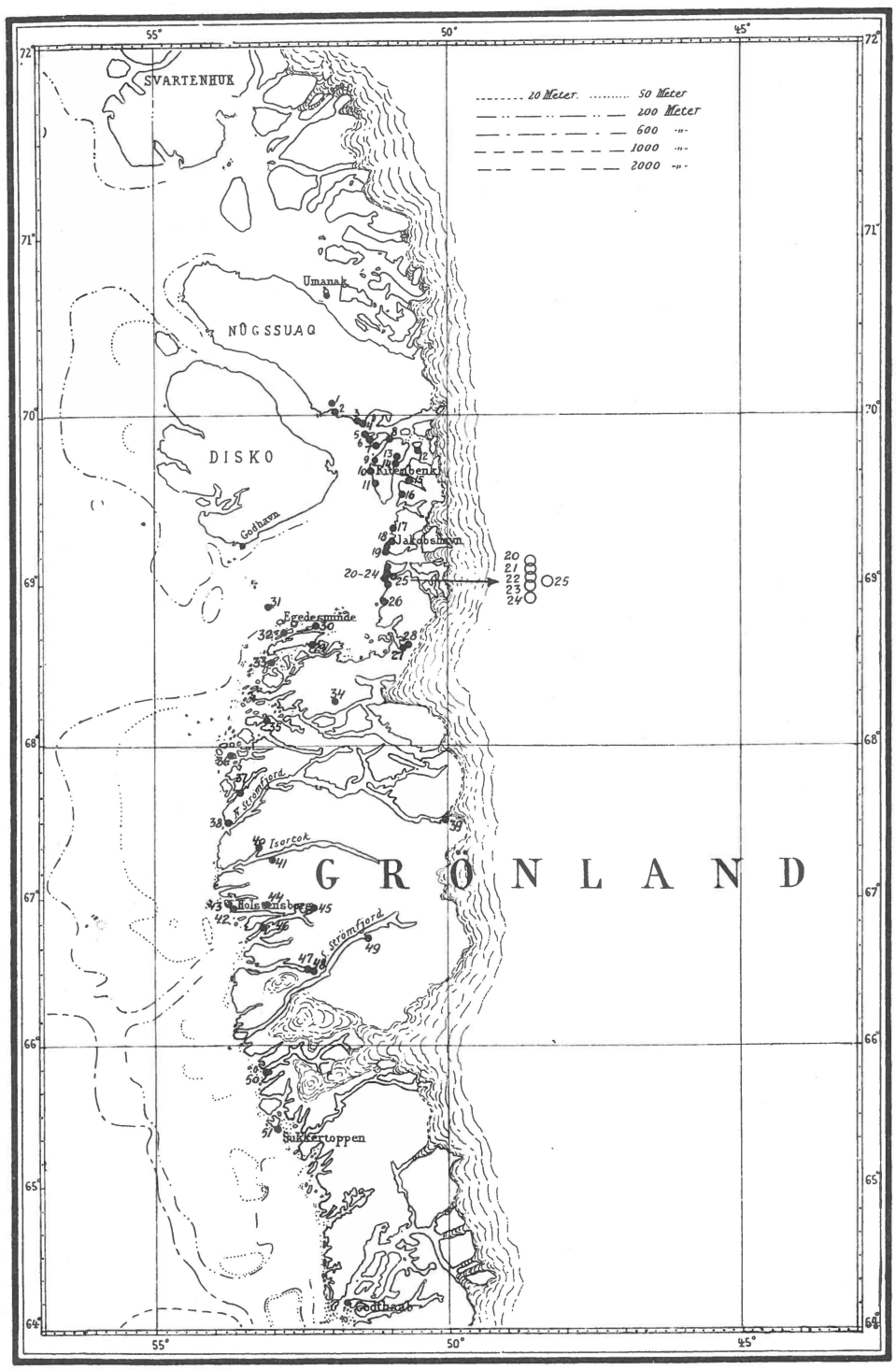

55°
50°
45°
72°
71°
70°
69°
68°
67°
66°
65°
64°
SVARTENHUK
20 Meter.
50 Meter
200 Meter
600 -"-
1000 -"-
2000 -"-
Umanak
NÜGSSUAQ
DISKO
Godhavn
Jakobshavn
Egedesminde
Isortok
Holsteinsborg
Sukkertoppen
Godthaab
GRØNLAND

Table 1. List of Lamellibranchiata, Brachiopoda, Cirripedia, Echinoidea and various other fossils with statement of finding places.

	Mud volcano, Sarqaq valley	Oqaitsoq, 6—7 m.	Kangeq, Ritenbenk	Sermermiut, clay, 4 m.	Sermermiut, sandy clay, 15 m.	S. f. Qarsortup kûa, 2—10 m.	N. f. Qarsortup kûa, 5—15 m.	Sandbugten, Claushavn	Lerbugten I, 10 m.	Lerbugten I, 15 m.	Lerbugten II, 2,5 m.	Lerbugten II, 4,0 m.	Lerbugten II, 9,5 m.	Lerbugten II, 15,0 m.	Lerbugten II, 16,2 m.	Lerbugten II, 19,8 m.	Lerbugten II, 22,4 m.	Lerbugten II, 23,4 m.	Lerbugten II, 25,25 m.	Lerbugten II, south, hardly 26 m.	Lerbugten II, south, 26,3 m.	Lerbugten II, north, 26 m.	Lersletten I, lower clay, 4—5 m.	Lersletten I, sandy clay	Lersletten II, little lake, 46 m.	Tasiussaq, 35—40 m.	Maagefjeld, clay, 20 m.	Maagefjeld, sand, 26 m.	Quilik	Zirphaeahalvøen, lower clay
Lamellibranchiata.																														
Nucula tenuis (Mont.) var. expansa Reeve	..	..	..	..	..	×	..	..	..	×	×	..	..	×	..	..	×	×	×	..	..	..	..	..	..	..	×	..	..	×
Nucula delphinodonta Migh. & Ad.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda pernula (Müll.)	..	..	..	..	..	×	..	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda minuta (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
Yoldia hyperborea Lovén	..	..	..	..	..	×	..	..	..	..	×	..	..	×	..	..	..	×	..	..	..	..	×	×	..	..	..	..	..	..
Portlandia arctica (Gray)	..	..	..	×	..	×	×	×	×	..	×	×	×	..	..	×	×	..	..	..	..	..	×	×	×	..	×	..	..	×
Portlandia lenticula (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Portlandia intermedia (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arca glacialis Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anomia squamula L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pecten islandicus Müll.	..	×	×	..	..	..	(×)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Pecten groenlandicus Sow. var. major Collin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lima subauriculata (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crenella decussata (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mytilus edulis L.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..	..	..	..	..	×	×	..
Modiolaria discors (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..
Modiolaria discors (L.) var. laevigata Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria discors (L.) var. substriata Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria nigra (Gray)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria faba (Müll.) Fabr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte borealis (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte montagui (Dill.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte montagui var. striata (Leach) Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte sulcata da Costa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Axinopsis orbiculata Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thyasira flexuosa (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyamium minutum (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardium ciliatum Fabr.	×	..	..	..	..	×	×	..	×	×	×	..	×	..	..	..	..	..	..	..	..	×	×	..	..	..	×	..	..	..
Serripes groenlandicum (Chemn.)	×	×	..	..	×	..	..	×	..	×	×	×	..	×	..	..	..	×	×	×	×	×	..	..	×	..	..	×	..	..
Cyprina islandica L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macoma baltica (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..
Macoma calcaria (Chemn.)	×	×	×	×	×	×	×	×	..	×	×	×	×	×	×	×	×	×	×	×	..	×	×	..	×	×	×	×	×	..
Panopaea norvegica (Spgl.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saxicava arctica (L.)	..	..	×	..	×	×	×	..	..	×	×	×	..	..	..	..	..	×	×	×	×	×	×	×	×	..	..	..	×	..
Mya truncata (L.)	×	×	×	..	×	×	×	..	..	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	..	..	..	×	×	..
Mya truncata (L.) forma ovata Jensen	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	×	..	×	..	..
Mya truncata (L.) forma uddevallensis Hanc.	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Zirphaea crispata (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyonsia arenosa (Møll.)	..	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thracia myopsis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brachiopoda.																														
Hemithyris psittacea (Gml.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cirripedia.																														
Balanus balanus da Costa	..	×	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	×	..
Balanus hammeri (Ascan.) Brown	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Balanus crenatus Brug.	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Echinoidea.																														
Strongylocentrotus drøbachiensis (Müll.)	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Variae.																														
Pisces	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Otolith	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophiura sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Serpula sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bryozoa sp.	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
Foraminifera sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pearls	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..

	Zirphaeahalvøen, clay below *Pecten*-layer	Zirphaeahalvøen, *Pecten*-layer	Zirphaeahalvøen, *Zirphaea*-layer	Zirphaeahalvøen, *Portlandia*-noses	Zirphaeahalvøen, *Balanus*-horizon	Zirphaeahalvøen, *Zirphaea*-layer, behind *Balanus*-horizon	Zirphaeahalvøen, valley section, north	Zirphaeahalvøen valley section, south	Opposite *Zirphaea*-section	Orpigsûp tasia kitdleq, *Zirphaea*-layer, "Engell's Profil"	Orpigsûp tasia kitdleq, *Zirphaea*-layer, above the terrace	Orpigsûp tasia kitdleq, cliff at the streamlet	Orpigsûp tasia kitdleq, streamlet section, sand	Orpigsûp tasia kitdleq, streamlet section, clay	Orpigsûp tasia kitdleq, streamlet section, *Zirphaea*-layer	Orpigsôq fjord, the little cove	Nivâq, clay	Nivâq, shell-gravel	Akúnâq, upper shell horizon	Akúnâq, lower shell horizon	Akúnâq, the harbour, 16 m.	Akúnâq, the harbour, 5 m.	Hunde Ejland, 20 m.	Hunde Ejland, 16 m.	Egedesminde, behind the "Efterskolen", 6 m.	Egedesminde, the Meadow behind the "Efterskolen", 5 m.	Naternaq	Agto, clay	Agto, sand	Giesecke Sø, the "Elvdalen"
Lamellibranchiata.																														
Nucula tenuis (Mont.) var. expansa Reeve	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nucula delphinodonta Migh. & Ad.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda pernula (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda minuta (Müll.)	×	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×
Yoldia hyperborea Lovén	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia arctica (Gray)	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..
Portlandia lenticula (Møll.)	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia intermedia (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arca glacialis Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anomia squamula L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pecten islandicus Müll.	×	×	×	..	..	×	..	..	..	×	..	..	..	..	×	..	×	×	×	×	..	×	×	×	×	×	..	×	×	×
Pecten groenlandicus Sow. var. major Collin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lima subauriculata (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	×
Crenella decussata (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×
Mytilus edulis L.	..	..	×	..	..	×	..	..	..	×	×	×	..	..	×	..	×	×	×	×	×	×	×	×	×	×	..	..	×	..
Modiolaria discors (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..	×
Modiolaria discors (L.) var. laevigata Gray	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria discors (L.) var. substriata Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..
Modiolaria nigra (Gray)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria faba (Müll.) Fabr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte borealis (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Astarte montagui (Dill.)	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	×	..	..	..	..	..	..	..	×
Astarte montagui var. striata (Leach) Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..
Astarte sulcata da Costa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Axinopsis orbiculata Sars	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Thyasira flexuosa (Mont.)	×	×	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyamium minutum (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	..	×	×	×	..	..	..	..	..
Cardium ciliatum Fabr.	×	×	×	×	×	×	×	×	×	..	..	..	..	×	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..
Serripes groenlandicum (Chemn.)	..	×	×	..	..	×	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Cyprina islandica L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macoma baltica (L.)	..	..	×	..	..	×	..	..	..	×	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macoma calcaria (Chemn.)	×	×	×	×	..	×	..	×	×	..	..	..	..	×	..	×	×	×	..	..	..	..	..	..	..	..	×	..	×	×
Panopaea norvegica (Spgl.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saxicava arctica (L.)	×	×	×	×	×	..	..	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	..	..	×	×
Mya truncata (L.)	×	×	×	×	×	×	..	×	×	×	×	×	×	×	×	×	×	×	×	..	×	×	..	..	×	..	..	×	×	×
Mya truncata (L.) forma ovata Jensen	..	..	×	×	..	×	×	×	×	×	..	..	×	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mya truncata (L.) forma uddevallensis Hanc.	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Zirphaea crispata (L.)	..	..	×	..	..	..	..	..	..	×	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyonsia arenosa (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thracia myopsis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Brachiopoda.																														
Hemithyris psittacea (Gml.)	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	×	×
Cirripedia.																														
Balanus balanus da Costa	..	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	×	×	×	×	×	..	..	×	×
Balanus hammeri (Ascan.) Brown	..	×	×	..	×	×	..	..	×	×	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..	..	..	×	×	..
Balanus crenatus Brug.	×	..	×	..	..	..	..	..	..	×	×	×	..	×	×	..	×	×	..	×	×	×	×	×	×	×	..	..	×	..
Echinoidea.																														
Strongylocentrotus drøbachiensis (Müll.)	×	×	×	..	..	×	..	..	..	×	×	..	..	..	×	..	×	×	×	×	×	×	×	×	×	..	..	..	×	×
Variae.																														
Pisces	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Otolith	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
Ophiura sp.	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Serpula sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	×	×	×	×	×	..	..	..	×	..
Bryozoa sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	×	..	..	..	..	..	..	×	..
Foraminifera sp.	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Pearls	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	..	..	..

	Giesecke Sø, Knoll 1, 22 m.	Giesecke Sø, Knoll 1, 22,5 m.	Giesecke Sø, Knoll 1, 23,0 m.	Giesecke Sø, Knoll 1, 24,0 m.	Giesecke Sø, Knoll 2, 22,5 m.	Giesecke Sø, Knoll 2, 23,0 m.	Giesecke Sø, Knoll 2, 26,0 m.	Giesecke Sø, Knoll 3, 22,5 m.	Giesecke Sø, Knoll 3, 23,0 m.	Giesecke Sø, Knoll 3, shell gravel. 1	Giesecke Sø, Knoll 3, transition layer	Giesecke Sø, Knoll 3, shell gravel. 2	Giesecke Sø, Knoll 3, 27,5 m.	Giesecke Sø, Knoll 4, 22,5 m.	Giesecke Sø, Knoll 4, 23,0 m.	Giesecke Sø, Knoll 4, 24,5 m.	Giesecke Sø, Knoll 4, 28,0 m.	Muslingedal, Knoll 7, 29,0 m.	Muslingedal, Knoll 8, 32,0 m.	Muslingedal, Knoll 9, 33,0 m.	Muslingedal, Knoll 10, 34,0 m.	Muslingedal, Knoll 11, 35,0 m.	Muslingedal, Knoll 12, 35,0 m.	Muslingedal, Knoll 13, 36,0 m.	Muslingedal, Knoll 14, 36,0 m.	Muslingedal, western section	Muslingedal, eastern section	Kuppelsletten, loc. 1	Kuppelsletten, loc. 2, sand	Kuppelsletten, loc. 2, shell concentration
Lamellibranchiata.																														
Nucula tenuis (Mont.) var. expansa Reeve	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nucula delphinodonta Migh. & Ad.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda pernula (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Leda minuta (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Yoldia hyperborea Lovén	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia arctica (Gray)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
Portlandia lenticula (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia intermedia (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arca glacialis Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anomia squamula L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pecten islandicus Müll.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	..	×	×	×	×	×	×	×	×	×	×
Pecten groenlandicus Sow. var. major Collin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lima subauriculata (Mont.)	..	×	×	×	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×	×	×	×	×
Crenella decussata (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	×	×	×	×	×
Mytilus edulis L.	×	×	×	×	×	..	..	×	×	×	×	×	×	×	×	×	×	..	..	..	..	..	..	..	..	..	×	×	×	×
Modiolaria discors (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Modiolaria discors (L.) var. laevigata Gray	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Modiolaria discors (L.) var. substriata Gray	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Modiolaria nigra (Gray)	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria faba (Müll.) Fabr.	..	..	..	×	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte borealis (Chemn.)	..	..	..	..	..	..	..	×	..	..	..	×	×	×	..	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte montagui (Dill.)	×	×	..	..	×	×	..	..	×	..	..	..	..	×	..	..	×	..	×	..	..	×	..	..	×	×	..	×	×	×
Astarte montagui var. striata (Leach) Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Astarte sulcata da Costa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Axinopsis orbiculata Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	×
Thyasira flexuosa (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyamium minutum (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardium ciliatum Fabr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Serripes groenlandicum (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyprina islandica L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macoma baltica (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macoma calcaria (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	×	..	×	×	..	×	..	×	×	..
Panopaea norvegica (Spgl.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saxicava arctica (L.)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Mya truncata (L.)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Mya truncata (L.) forma ovata Jensen	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mya truncata (L.) forma uddevallensis Hanc.	..	..	..	..	×	..	×	..	×	..	×	..	..	..	..	..	..	×	..	..	×	..	..	..	..	..	..	×	..	×
Zirphaea crispata (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyonsia arenosa (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thracia myopsis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Brachiopoda.																														
Hemithyris psittacea (Gml.)	..	..	..	..	×	..	×	..	×	×	×	..	..	..	..	..	..	×	×	..	×	×	×	×	×	..	×	×	×	×
Cirripedia.																														
Balanus balanus da Costa	×	×	×	×	..	×	×	×	×	×	×	×	×	×	..	×	×	×	..	..	×	×	..	×	×	×	×	×	×	×
Balanus hammeri (Ascan.) Brown	×	×	×	×	×	×	×	×	×	×	×	×	..	×	×	×	×	×	..	..	×	..	×	×	×	..	..	..	..	..
Balanus crenatus Brug.	..	..	×	×	..	..	..	×	..	×	×	×	×	×	×	×	×	×	..	..	..	..	..	..	..	..	×	..	..	×
Echinoidea.																														
Strongylocentrotus drøbachiensis (Müll.)	×	×	×	×	×	×	×	×	×	×	..	..	×	×	×	..	×	×	..	..	×	..	..	..	..	×	×	×	×	×
Variae.																														
Pisces	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Otolith	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophiura sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Serpula sp.	..	×	..	×	..	×	×	..	×	×	×	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	×	..	×	×
Bryozoa sp.	..	..	..	..	..	..	..	..	×	..	×	..	..	..	..	..	..	..	..	..	×	..	×	..	..	..	×	..	×	×
Foraminifera sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Pearls	×	×	..	×	..	..	..	×	..	×	..	..	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	Kuppelsletten, loc. 3, clay	Kuppelsletten, loc. 3, shell concentration	Eqalugssuit	Qôrorssuaq kitdleq	Holsteinsborg, 70 m.	Holsteinsborg, the cemetery	Magnetsandsbugten, 6 m.	Magnetsandsbugten, 7 m.	Amerdloq	Akugdleq, south	Akugdleq, north	Itivdleq, bottom	Itivdlínguaq, sand	Itivdlínguaq, gravel	Angujartorfik, 2 m.	Angujartorfik, 2—15 m.	Sukkertoppen, harbour, 2,5 m.	Sukkertoppen, valley, 3,0 m.	Sukkertoppen, old cemetery, 20 m.	Sukkertoppen, new cemetery, 12 m.	Niaqornaq	Aumat	Igíniarfik	Lersletten, Depotbugt	Nagssugtôq river	Ikerasârssuk	Itivdleq	Nipisat
Lamellibranchiata.																												
Nucula tenuis (Mont.) var. expansa Reeve	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..
Nucula delphinodonta Migh. & Ad.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Leda pernula (Müll.)	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Leda minuta (Müll.)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	×	..	..
Yoldia hyperborea Lovén	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia arctica (Gray)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	×	..	..	×	..	..	..	..
Portlandia lenticula (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portlandia intermedia (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Arca glacialis Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..
Anomia squamula L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	×
Pecten islandicus Müll.	×	×	×	..	×	×	×	×	×	×	..	×	×	×	..	..	×	×	×	..	..	×	×	..	×	×	×	×
Pecten groenlandicus Sow. var. major Collin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Lima subauriculata (Mont.)	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	..
Crenella decussata (Mont.)	×	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	..
Mytilus edulis L.	..	×	..	..	×	×	×	×	..	×	..	×	..	×	..	..	×	..	×	×	..	×	×	..	..	×	..	..
Modiolaria discors (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria discors (L.) var. laevigata Gray	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria discors (L.) var. substriata Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria nigra (Gray)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modiolaria faba (Müll.) Fabr.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Astarte borealis (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..
Astarte montagui (Dill.)	×	×	..	..	..	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Astarte montagui var. striata (Leach) Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..	..	..	×	..	..	..
Astarte sulcata da Costa	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Axinopsis orbiculata Sars	..	..	..	..	..	..	×	..	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thyasira flexuosa (Mont.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyamium minutum (Fabr.)	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Cardium ciliatum Fabr.	..	..	×	..	..	..	..	..	..	..	..	×	..	..	×	..	..	..	..	..	..	..	..	..	×	×	×	..
Serripes groenlandicum (Chemn.)	..	..	..	..	..	..	..	×	×	..	..	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Cyprina islandica L.	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Macoma baltica (L.)	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..
Macoma calcaria (Chemn.)	×	..	×	..	×	..	..	..	..	×	×	×	..	..	×	×	×	×	..	..	×	..	×	..	×	×	..	..
Panopaea norvegica (Spgl.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Saxicava arctica (L.)	×	×	..	..	×	×	×	×	..	..	..	×	×	×	×	..	×	×	×	×	×	×	×	..	×	×	×	..
Mya truncata (L.)	×	×	×	×	×	×	..	×	×	×	×	×	×	..	×	×	×	×	×	×	×	..	×	..	×	×	×	×
Mya truncata (L.) forma ovata Jensen	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Mya truncata (L.) forma uddevallensis Hanc.	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Zirphaea crispata (L.)	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyonsia arenosa (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thracia myopsis (Møll.)	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brachiopoda.																												
Hemithyris psittacea (Gml.)	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Cirripedia.																												
Balanus balanus da Costa	×	×	×	..	×	×	..	×	..	×	..	×	..	×	..	..	×	×	×	×	..	..	×	..	..	×	..	?
Balanus hammeri (Ascan.) Brown	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..	..	..	..	..	..	..	..	×	..	..	..	×	..
Balanus crenatus Brug.	..	..	..	..	×	..	×	..	..	×	..	×	..	×	×	..	×	..	×	×	..	..	×	..	..	..	..	..
Echinoidea.																												
Strongylocentrotus drøbachiensis (Müll.)	×	×	..	..	×	×	×	×	..	×	..	×	..	×	..	..	×	..	×	×	..	..	×	..	..	×	..	×
Variae.																												
Pisces	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Otolith	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophiura sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Serpula sp.	×	×	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
Bryozoa sp.	×	..	..	..	×	×	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
Foraminifera sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pearls	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table 2. List of Gastropoda with statement of finding places.

	Mud volcano, Sarqaq valley	Oqaitsoq, 6—7 m.	Kangeq, Ritenbenk	Sermermiut, clay, 4 m.	Sermermiut, sandy clay, 15 m.	S. f. Qarsortup kûa, 2—10 m.	N. f. Qarsortup kûa, 5—15 m.	Sandbugten, Claushavn	Lerbugten I, 10 m.	Lerbugten I, 15 m.	Lerbugten II, 2,5 m.	Lerbugten II, 4,0 m.	Lerbugten II, 9,5 m.	Lerbugten II, 15,0 m.	Lerbugten II, 16,2 m.	Lerbugten II, 19,8 m.	Lerbugten II, 22,4 m.	Lerbugten II, 23,4 m.	Lerbugten II, 25,25 m.	Lerbugten II, south, hardly 26 m.	Lerbugten II, south, 26,3 m.	Lerbugten II, north, 26 m.	Lersletten I, lower clay, 4—5 m.	Lersletten I, sandy clay	Lersletten II, little lake, 46 m.	Tasiussaq, 35—40 m.	Maagefjeld, clay, 20 m.	Maagefjeld, sand, 26 m.	Quilik	Zirphaeahalvøen, lower clay
Gastropoda.																														
Chiton sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scissurella crispata Flem.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Emarginula fissura (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Puncturella noachina (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea testudinalis (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea virginea (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea rubella (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lepeta coeca (Müll.)	..	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita groenlandica (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita helicina (Phipps)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita cinerea (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita cinerea var. juvenilis Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita olivacea (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.) var. bella Verk.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moelleria costulata (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Littorina saxatilis (Olivi) var. groenlandica Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Littorina obtusata L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Littorina palliata Say	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cingula castanea (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Onoba aculeus (Gould)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jeffreysi (Waller)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jan-mayeni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania wyville-thomsoni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Turritella erosa (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cerithiopsis costulata (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scalaria borealis Beck	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Amauropsis islandica (Gml.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lunatia pallida (Brod. & Sow.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Natica clausa Brod. & Sow.	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..
Velutina velutina (Müll.) var. schneideri Fr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Marsenina glabra (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon clathratus (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon fabricii Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon truncatus (Strøm)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pyrene rosacea Gould	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sipho togatus (Mørch)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undatum L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum Chemn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum var. patula Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum tenue Gray	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undulatum Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Admete viridula (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pyramidalis (Strøm)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pingeli (Beck)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela cinerea (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela nobilis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela violacea (Migh.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela tenuicostata (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela decussata (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cylichna alba (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..

	Zirphaeahalvøen, clay below *Pecten*-layer	Zirphaeahalvøen, *Pecten*-layer	Zirphaeahalvøen, *Zirphaea*-layer	Zirphaeahalvøen, *Portlandia*-noses	Zirphaeahalvøen, *Balanus*-horizon	Zirphaeahalvøen *Zirphaea*-layer, behind *Balanus*-horizon	Zirphaeahalvøen valley section, north	Zirphaeahalvøen valley section, south	Opposite *Zirphaea*-section	Orpigsûp tasia kitdleq, *Zirphaea*-layer, "Engell's Profil"	Orpigsûp tasia kitdleq, *Zirphaea*-layer, above the terrace	Orpigsûp, tasia kitdleq, cliff at the streamlet	Orpigsûp tasia kitdleq, streamlet section, sand	Orpigsûp tasia kitdleq, streamlet section, clay	Orpigsûp tasia kitdleq, streamlet section, *Zirphaea*-layer	Orpigsôq fjord, the little cove	Nivâq, clay	Nivâq, shell-gravel	Akúnâq, upper shell horizon	Akúnâq, lower shell horizon	Akúnâq, the harbour, 16 m.	Akúnâq, the harbour, 5 m.	Hunde Ejland, 20 m.	Hunde Ejland, 16 m.	Egedesminde, behind the "Efterskolen", 6 m.	Egedesminde, the Meadow behind the "Efterskolen", 5 m.	Naternaq	Agto, clay	Agto, sand
Gastropoda.																													
Chiton sp.	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	..	..	..	×	×	..	..	..	×
Scissurella crispata Flem.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Emarginula fissura (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Puncturella noachina (L.)	..	×	×	..	..	×	..	..	..	..	..	×	..	..	×	..	×	×	×	..	..	×	..	×	×	..	..	..	×
Acmaea testudinalis (Müll.)	..	..	×	..	..	×	..	..	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea virginea (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Acmaea rubella (Fabr.)	..	..	..	..	..	..	..	..	..	×	..	..	..	×	×	..	..	×	×	×	..	×	×	×	..	..	..	..	×
Lepeta coeca (Müll.)	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×
Margarita groenlandica (Chemn.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Margarita helicina (Phipps)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	×	..	..	..	..	..	..	..	..	..
Margarita cinerea (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita cinerea var. juvenilis Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita olivacea (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	×	×	×	..	..	..	..
Solariella obscura (Couth.) var. bella Verk.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Moelleria costulata (Møll.)	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..
Littorina saxatilis (Olivi) var. groenlandica Møll.	×	..	×	..	..	..	..	..	..	×	×	×	..	..	×	..	..	×	×	×	..	..	×	×	×	..	..	..	..
Littorina obtusata L.	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Littorina palliata Say	..	×	..	..	..	×	..	..	..	×	×	×	..	..	×	..	..	×	×	..	..	..	×	×	×	..	..	..	..
Cingula castanea (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	×	×	×	..	..	..	..
Onoba aculeus (Gould)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	..	..	..
Alvania jeffreysi (Waller)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jan-mayeni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania wyville-thomsoni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Turritella erosa (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cerithiopsis costulata (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scalaria borealis Beck	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Amauropsis islandica (Gml.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lunatia pallida (Brod. & Sow.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Natica clausa Brod. & Sow.	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Velutina velutina (Müll.) var. schneideri Fr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Marsenina glabra (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Trophon clathratus (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon fabricii Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	×	..	..	×
Trophon truncatus (Strøm)	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	×	×	×	..	..	..	..
Pyrene rosacea Gould	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sipho togatus (Mørch)	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undatum L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum Chemn.	..	..	×	..	..	..	..	..	..	×	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum var. patula Sars	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum tenue Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undulatum Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Admete viridula (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pyramidalis (Strøm)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pingeli (Beck)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela cinerea (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela nobilis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela violacea (Migh.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela tenuicostata (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Bela decussata (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cylichna alba (Brown)	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..

	Giesecke Sø, the "Elvdalen"	Giesecke Sø, Knoll 1, 22 m.	Giesecke Sø, Knoll 1, 22,5 m.	Giesecke Sø, Knoll 1, 23,0 m.	Giesecke Sø, Knoll 1, 24,0 m.	Giesecke Sø, Knoll 2, 22,5 m.	Giesecke Sø, Knoll 2, 23,0 m.	Giesecke Sø, Knoll 2, 26,0 m.	Giesecke Sø, Knoll 3, 22,5 m.	Giesecke Sø, Knoll 3, 23,0 m.	Giesecke Sø, Knoll 3, shell gravel. 1	Giesecke Sø, Knoll 3, transition layer	Giesecke Sø, Knoll 3, shell gravel. 2	Giesecke Sø, Knoll 3, 27,5 m.	Giesecke Sø, Knoll 4. 22,5 m.	Giesecke Sø, Knoll 4, 23,0 m.	Giesecke Sø, Knoll 4, 24,5 m.	Giesecke Sø, Knoll 4, 28,0 m.	Muslingedal, Knoll 7, 29,0 m.	Muslingedal, Knoll 8, 32,0 m.	Muslingedal, Knoll 9, 33,0 m.	Muslingedal, Knoll 10, 34,0 m.	Muslingedal, Knoll 11, 35,0 m.	Muslingedal, Knoll 12, 35,0 m.	Muslingedal, Knoll 13, 36,0 m.	Muslingedal, Knoll 14, 36,0 m.	Muslingedal, western section	Muslingedal, eastern section	Kuppelsletten, loc. 1
Gastropoda.																													
Chiton sp.	×	..	×	..	×	×	×	×	×	..	×	×	..	..	..	..	..	×	×	..	..	×	..	..	..	..	..	×	×
Scissurella crispata Flem.	×	..	×	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	×	..	..
Emarginula fissura (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Puncturella noachina (L.)	×	×	..	×	×	×	..	..	×	×	×	..	×	..	×	×	×	×	×	×	..	×	×	..	..	..	×	×	×
Acmaea testudinalis (Müll.)	×	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Acmaea virginea (Müll.)	..	×	×	..	..	..	..	..	×	..	..	..	×	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Acmaea rubella (Fabr.)	..	..	..	..	×	×	×	..	×	..	×	×	×	..	×	×	×	×	×	×	..	..	..	..	..	..	..	×	×
Lepeta coeca (Müll.)	..	..	..	..	..	..	..	..	..	×	..	×	..	..	..	..	..	..	×	×	..	×	..	..	..	..	×	..	×
Margarita groenlandica (Chemn.)	×	×	..	..	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita helicina (Phipps)	..	×	×	..	..	×	..	..	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×	..	..
Margarita cinerea (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Margarita cinerea var. juvenilis Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita olivacea (Brown)	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.)	..	..	×	..	×	..	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×	×	..
Solariella obscura (Couth.) var. bella Verk.	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moelleria costulata (Møll.)	..	×	..	..	×	..	..	..	×	..	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	×	×	×
Littorina saxatilis (Olivi) var. groenlandica Møll.	..	×	×	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..
Littorina obtusata L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Littorina palliata Say	..	..	..	..	..	..	..	..	×	..	..	..	×	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..
Cingula castanea (Møll.)	×	..	..	..	×	×	..	..	×	..	×	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	×	..	×
Onoba aculeus (Gould)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jeffreysi (Waller)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jan-mayeni (Friele)	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Alvania wyville-thomsoni (Friele)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Turritella erosa (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Cerithiopsis costulata (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scalaria borealis Beck	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..
Amauropsis islandica (Gml.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lunatia pallida (Brod. & Sow.)	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	×	×	..
Natica clausa Brod. & Sow.	×	..	..	..	×	×	..	×	..	..	..	..	..	..	×	..	..	×	×	×	..	..	..	..	..	..	..	..	..
Velutina velutina (Müll.) var. schneideri Fr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Marsenina glabra (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon clathratus (L.)	×	..	..	..	×	..	..	..	..	×	..	..	..	..	×	..	×	×	..	..	..	..	..	..	..	×	..	..	×
Trophon fabricii Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Trophon truncatus (Strøm)	×	×	..	×	×	×	..	..	×	×	×	..	×	..	×	..	..	×	×	×	..	×	..	..	..	..	×	×	×
Pyrene rosacea Gould	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sipho togatus (Mørch)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undatum L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum Chemn.	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum var. patula Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum tenue Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undulatum Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Admete viridula (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pyramidalis (Strøm)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pingeli (Beck)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela cinerea (Møll.)	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela nobilis (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Bela violacea (Migh.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Bela tenuicostata (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela decussata (Couth.)	×	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..
Cylichna alba (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..

	Kuppelsletten, loc. 2, sand	Kuppelsletten, loc. 2, shell concentration	Kuppelsletten, loc. 3, clay	Kuppelsletten, loc. 3, shell concentration	Eqalugsugssuit	Qôrorssuaq kitdleq	Holsteinsborg, 70 m.	Holsteinsborg, the cemetery	Magnetsandsbugten, 6 m.	Magnetsandsbugten, 7 m.	Amerdloq	Akugdleq, south	Akugdleq, north	Itivdleq, bottom	Itivdlínguaq, sand	Itivdlínguaq, gravel	Angujartorfik, 2 m.	Angujartorfik, 2—15 m.	Sukkertoppen, harbour, 2,5 m.	Sukkertoppen, valley, 3,0 m.	Sukkertoppen, old cemetery, 20 m.	Sukkertoppen, new cemetery, 12 m.	Niaqornaq	Aumat	Igíniarfik	Lersletten, Depotbugt	Nagssugtôq river	Ikerasârssuk	Itivdleq	Nipisat
Gastropoda.																														
Chiton sp.	×	×	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	..	..
Scissurella crispata Flem.	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Emarginula fissura (L.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Puncturella noachina (L.)	×	×	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	..	×	..	..	..	..	..
Acmaea testudinalis (Müll.)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea virginea (Müll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acmaea rubella (Fabr.)	..	×	×	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	..
Lepeta coeca (Müll.)	..	×	×	×	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	×	..	..	..	..	×	..	..	..	..	..
Margarita groenlandica (Chemn.)	..	×	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita helicina (Phipps)	×	..	..	×	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Margarita cinerea (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Margarita cinerea var. juvenilis Sars	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Margarita olivacea (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.)	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Solariella obscura (Couth.) var. bella Verk.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Moelleria costulata (Møll.)	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Littorina saxatilis (Olivi) var. groenlandica Møll.	..	..	..	..	..	..	×	..	..	..	..	..	..	×	×	×	..	..	×	..	..	×	..	×	×	..	..	×	..	..
Littorina obtusata L.	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Littorina palliata Say	..	..	..	..	..	..	×	..	..	..	..	..	..	×	..	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..
Cingula castanea (Møll.)	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	..
Onoba aculeus (Gould)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Alvania jeffreysi (Waller)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania jan-mayeni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alvania wyville-thomsoni (Friele)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Turritella erosa (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cerithiopsis costulata (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scalaria borealis Beck	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Amauropsis islandica (Gml.)	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lunatia pallida (Brod. & Sow.)	..	..	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Natica clausa Brod. & Sow.	×	..	×	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	..	..	..	..	..
Velutina velutina (Müll.) var. schneideri Fr.	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Marsenina glabra (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon clathratus (L.)	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	×	..	..	..	..	×	..	..	×	..	..
Trophon fabricii Møll.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trophon truncatus (Strøm)	×	×	×	×	..	..	..	..	×	..	..	..	..	..	..	×	..	..	..	..	×	..	..	..	×	..	..	..	..	..
Pyrene rosacea Gould	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sipho togatus (Mørch)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
Buccinum undatum L.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum Chemn.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum groenlandicum var. patula Sars	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum tenue Gray	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Buccinum undulatum Møll.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Admete viridula (Fabr.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Bela pyramidalis (Strøm)	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela pingeli (Beck)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Bela cinerea (Møll.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela nobilis (Møll.)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela violacea (Migh.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Bela tenuicostata (Sars)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bela decussata (Couth.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cylichna alba (Brown)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..