MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
BD. **184** · NR. **5**

DE DANSKE PEARY LAND EKSPEDITIONER
LEADER: EIGIL KNUTH

MARINE BIOLOGICAL INVESTIGATIONS OF JØRGEN BRØNLUND FJORD, NORTH GREENLAND

PHYSIOGRAPHICAL AND BATHYGRAPHICAL SURVEY, METHODS, AND LIST OF STATIONS

BY

JEAN JUST

WITH 18 FIGURES IN THE TEXT, 1 TABLE
AND 2 MAPS

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1970

Abstract

The topography, geology, and climatic conditions around Jørgen Brønlund Fjord, North Greenland are briefly outlined. The ice conditions as found in the summer of 1966 are described, together with a survey of observations on the ice since 1947.

Based on the bathygraphy and the different types of bottom sediments, the fiord is divided into five regions: estuary, inner basin, threshold, outer basin, and Kap Harald Moltke region.

Hydrographical data collected in 1966 are presented. The zonation of marine algae in the fiord is mentioned.

Methods discussed include the blasting of limited holes for sampling through sea ice 2.5 m. thick.

Lists of sampling stations from the First, Third, and Fourth Peary Land Expeditions are given.

JEAN JUST

Institute of Comparative Anatomy
University of Copenhagen
Universitetsparken 15
Dk–2100 København Ø
Denmark

Revised manuscript received April 15th, 1969

ISBN 87 421 0011 9

CONTENTS

INTRODUCTION

The coastal fauna of the northernmost regions of Greenland is known mostly from sporadic collections by expeditions on land, since sea ice prevents any normal approach by ship.

Jørgen Brønlund Fjord on the southern corner of Peary Land has long been known to offer a favorable opportunity for studying the high arctic coastal fauna, as, contrary to the rule in these regions, the fiord ice usually disappears for a short period during the summer, thus permitting the use of boats. A wintering station, Brønlundhus (82°10′ N 30°30′ W), was established there during the First Peary Land Expedition 1947–50. It has a small laboratory, a workshop, and other facilities.—The bathygraphy of the fiord is well known from echo soundings.

On the initiative of Count Eigil Knuth, who lead the Fourth Peary Land Expedition in the summer of 1966, it was therefore decided to carry out preliminary investigations of the benthic and planktonic fauna of Jørgen Brønlund Fjord. This work was entrusted to Max Andersen, B.Sc., and the author of this paper.

The expedition left Copenhagen on 7 May 1966, and began work in Jørgen Brønlund Fjord on 12 May. On arrival the fiord was covered by ice which, however, began to break up, as expected, in the latter half of June. In the first month and a half, therefore, biological samples had to be taken through holes in the ice, whereas dredging from a boat (and a specially constructed raft) became possible from mid-July.

In addition to samples taken by tow-net, grab, and dredging gear, helmint and crustacean parasites were collected from fish caught in nets or on lines, and from a single seal (*Phoca hispida*) shot on the fiord ice. Twenty nine samples were taken with the bottom grab, dredges were made at 46 different stations, together with 15 horizontal and 11 vertical plankton hauls. Temperature and salinity were measured on 43 occasions.

The expedition left Jørgen Brønlund Fjord on 20 August 1966.

A few samples occasionally taken by earlier expeditions will be treated together with the material brought back by the present expedition. Thus, P. JOHNSEN made 4 dredge hauls, took 4 bottom samples, and 10 vertical plankton hauls, 4 of which were taken in Independence Fjord, during the First Peary Land Expedition in 1947–50, while U. RØEN took 7 horizontal plankton hauls during the Third Peary Land Expedition in the summer of 1964. Part of these collections were studied by OCKELMANN (1958), whereas the marine algae collected by K. HOLMEN during the First Peary Land Expedition were reported by LUND (1951).

By summarizing the available knowledge (published and unpublished) regarding the marine milieu of Jørgen Brønlund Fjord, together with methods and lists of stations, the present paper aims at facilitating future marine biological investigations in that area, as well as work already in progress.

Names of snow and ice are brought into agreement with ARMSTRONG, ROBERTS, and SWITHINBANK (1966).

Topography and Geology

The country that surrounds Jørgen Brønlund Fjord has a considerable influence upon the conditions under which the marine flora and fauna develop. Since there is no protective covering of vegetation, the land is exposed to extreme erosion. Frost and wind are the main erosive factors, producing throughout the year (but mainly in the winter) large amounts of fine-grained material, that are transported by wind and melt water out into the fiord.

The immediate surroundings of the fiord consist for the most part of raised post-glacial sea bottom overlying moraines and eocambrian dolomite and sandstone, (TROELSEN 1949, LAURSEN 1954), except along the northern side of the innermost half of the fiord where Buen rises to a heigth of ca. 700 m. above sea level; its front is partially covered with talus.

The entire coast is characterized either by sandy or clayey sediments continuing uniformly into the fiord bottom, or by washed out pebbles and gravel that reach a shorter or longer distance out into the fiord depending on the declivity of the place in question.

Even though the prevailing winds and the local melting process around snowbeds carry considerable quantities of very fine material to the fiord, the major part of the conveyed sediments are transported to the fiord by some larger permanent water courses originating from thaws at isolated ice caps such as Chr. Erichsens Iskappe south of the fiord (Glaciologelv) and the glaciers around Nordkronen (Børglum Elv). But by far the largest of the transporting water courses is Midsommerelv, which empties into the head of the fiord and which dominates, as a result of the amount of material it carries, the innermost four to six kilometers of the fiord. The water in this river partly derives from Midsommersøerne that are located about twenty five kilometers farther west in Wandel Dalen, and partly from the inland ice (Hobbs Gletscher) at Inuiteq Sø, from which Ítukussuk Elv brings it to Midsommerelv.

Climatology

Jørgen Brønlund Fjord, which is situated about two hundred kilometers off the coast of Greenland towards Wandel Havet, is located in a high arctic region with an annual precipitation between 20 and 80 mm. (FRISTRUP, 1952). The country around the fiord is almost snow-free throughout the year, as the small amounts of snow that fall during the winter are blown together into more or less sizeable snow patches on the eastward slopes and in depressions in the terrain. When summer comes these patches thaw, and quite rapidly deliver masses of melt water that run towards the fiord from all directions.

As far as it is known, the yearly temperature curve indicates that the mean temperature in the coldest months of the year, viz. December, January, and February, is approximately −30° C, whereas the minimum temperature in the same period falls as low as −40 to −45° C. The continuous frost-free period—Peary Land's summer—varies in length, but lasts hardly more than from 60 to 70 days (66 days: KNUTH 1950), viz. from the latter half of June to the latter half of August. On exception temperature can rise during this period to 16–18° C, but the mean temperature in the warmest 30-day period, *i.g.* 14 July to 14 August, is about 5–7° C, (all data from FRISTRUP 1949 and 1952, and KNUTH 1950).

At Brønlundhus the hours of sunshine per year is estimated at about 2000, at least 1200 of which occur in the period 15 May to 15 August, as shown below.

Insolation at Brønlundhus
in the summer of 1966 (FRISTRUP, personal communication)

15–31/5:	$174^1/_4$ hours	(= c. $10^1/_4$ hours per day. One day without sun.)
1–30/6:	448 hours	(= c. 15 hours per day. No days without sun.)
1–31/7:	$450^1/_4$ hours	(= c. $14^1/_2$ hours per day. Two days without sun.)
1–15/8:	160 hours	(= $10^1/_2$ hours per day. Two days without sun.)
Total: 15/5–15/8: 1232 hours. Four days without sun.		

The local wind systems are another climatological factor that along with the intensive insolation significantly affect the ice movements in the fiord, and thereby the marine milieu.

Jørgen Brønlund Fjord forms the eastern end of Wandel Dalen, which cuts down through North Greenland from J. P. Koch Fjord to Independence Fjord. In its narrow eastern part Wandel Dalen acts in particular like a wind tunnel, with the result that throughout the summer strong winds blow into Jørgen Brønlund Fjord, either as katabatic foehns from the west with velocities up to 25–30 knots, or, more frequently, as chilly and moist east winds, whose velocity rarely exceeds 10 knots, (FRISTRUP 1952 and 1961, TRANS 1955 p. 16).

It is however, the persistency of these winds that is their major characteristic. As a rule, calm occurs in connection with change of wind direction, and usually lasts for minutes or a few hours only. These frequently changing winds are to a great extent responsible for the breaking up of the ice in Jørgen Brønlund Fjord.

Ice Conditions in Jørgen Brønlund Fjord

A report on the ice conditions in the summer of 1966, together with a survey of ice observations since 1947, is given below. This retrospective view will show that the breaking up and melting of the fiord ice varies to some extent. In consideration of the brief summer, this presumably has a certain influence upon the primary productivity of the area. A comparition with earlier observations gives the impression that the summer of 1966 was 'normal'.

Summer 1966: On arrival at Jørgen Brønlund Fjord on 12 May the entire fiord was covered by fast, unbroken ice, 2.5 m. thick. Smooth ice was observed at the outermost part of the fiord and outside Brønlundhus. The predominating part of the fiord ice was covered by oblong snowdrifts, $^1/_2$–$1^1/_2$ m. high, among which could be found a few sand drifts, both results of the winter's storms.

About 1 June the first narrow shore lead a few meters in width opened up in several places along the banks of the fiord, especially in connection with shallow water areas and off the outfall of the conveying streams that were now gradually beginning to thaw. The timing and intensity of the development of the shore lead is greatly dependent upon the supply of melt water from the surrounding area. Although the sun is above the horizont throughout 24 hours at this time of the year, the surface of the ice is still firm and hard, whereas the streams that have been frozen all winter long begin to thaw earlier.

In mid-June it was possible for the first time to use the boat in the shore lead that was now scarcely 10 m. wide. It was soon discovered that the innermost four to six kilometers of the fiord, comparable to the estuary (see p. 13) was totally ice-free. The reason for this must be the shallowness of the water, together with the considerable amounts of melt water already being conveyed by Midsommerelv and Glaciologelv.

From 1 July it was possible to navigate without difficulty in the shore lead from the head of the fiord to Botanikerelv, while from this point the ice was still in contact with the shore. Up till now there had been no sign of the fiord ice itself breaking up, but just about this time large cracks about 1 m. broad began to form all over the fiord, and on 5 July two leads more than 100 m. wide opened up outside Brønlundhus and Østmolen, from one coast to the other, from shore lead to shore

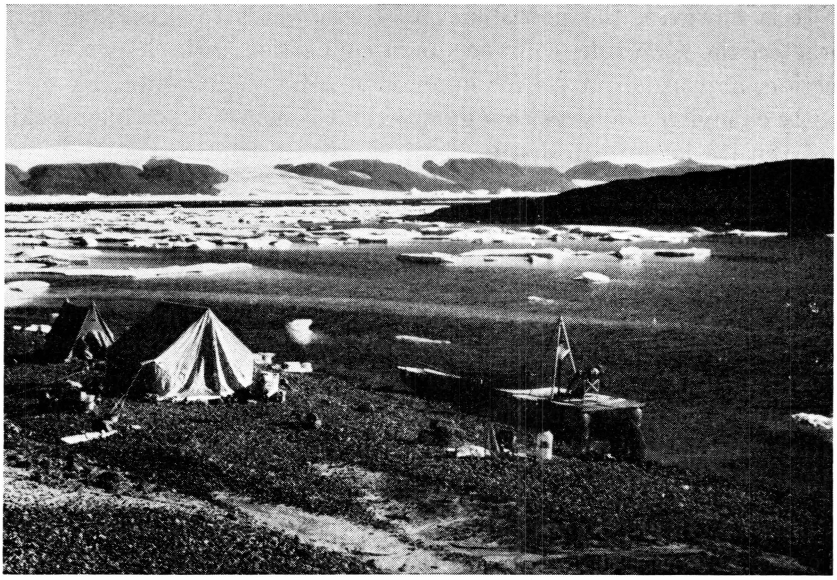


Fig. 1. Summer camp at Kap Harald Moltke, (1 July 1966). Floating ice between Kap Harald Moltke and Dråbeholm (middle right). MAX ANDERSEN phot.

lead. Wind and current then had their own way. The ice worked backwards and forwards as the wind blew east and west, was crushed when forced to the coast, and was slowly split up into smaller and smaller units, whereupon thawing could set in seriously.

Throughout this period the thickness of the ice decreased slowly from 2.5 m. to c. 2 m. Only immediately before the ice broke up did it in places decrease to about 1.5 m. As the thawing process went on, however, the quality of the ice began to change significantly. It gradually became more porous and watery; the melt water from the snowdrifts collected in puddles on the surface, and then commenced to drain off through thaw holes and cracks in the ice; and just before it became impossible to walk on the fjord ice it could be broken up by hand into crystals several decimeters in length and 1–2 cm. in thickness.

As from 15 July all ice in the fiord was broken up, and ice floes having a diameter of 1–10 m. now were steadily drifting longitudinally along the fiord under the influence of winds and currents, and since, as mentioned above, the west wind predominates with regard to force in the summer, the inner basin and the threshold (see p. 13) were almost always ice-free, while the outer basin was filled with drift ice.

Although the ice in Independence Fjord breaks up only extremely rarely, the west wind can open up an area off the mouth of Jørgen Brønlund Fjord. Accordingly, in the summer of 1966 there was open water with large amounts of floating ice in a curve stretching from Kap Harald

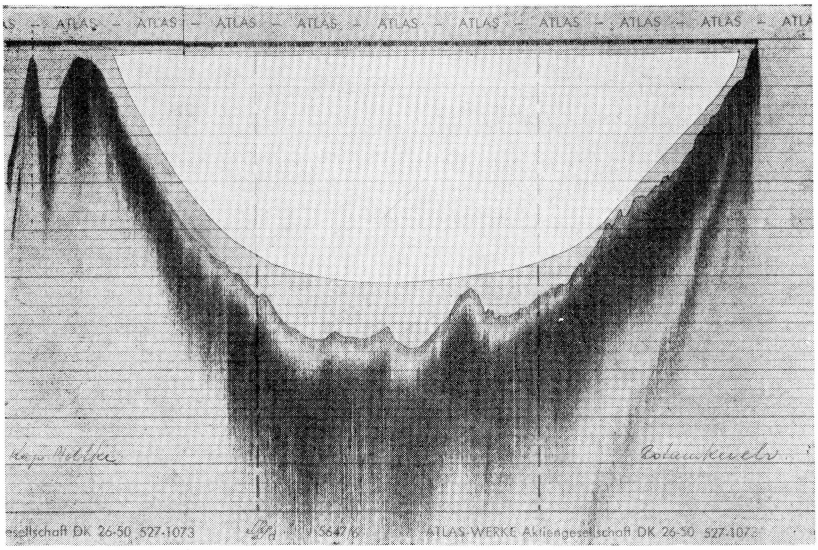


Fig. 2. Cross section from Kap Harald Moltke (left) to Botanikerelev (right) showing bottom disturbed by stranded icebergs.

Moltke (fig. 1) to Kap Knud Rasmussen, and to a minor extent north and south of these capes. The open water reached out to a maximum of one kilometer in the more than twenty kilometers wide Independence Fjord. During that summer these areas, as well as the outer parts of Jørgen Brønlund Fjord, could only be navigated with great care.

Finally, it should be mentioned that a considerable amount of icebergs that have been frozen into the fiord ice are released from the small part of Independence Fjord that breaks up; these icebergs float around in the mouth of Jørgen Brønlund Fjord, where they often strand at low tide at depths down to 50–60 m., only to be set free at high tide. As a result, the bottom of this area is greatly disturbed (fig. 2); see also Høy (1970).

When the expedition left Peary Land on 20 August there still were no signs of formation of new ice. Nor does this seem to have been the case when the area was flown over on 25 August.

Ice conditions in Jørgen Brønlund Fjord in the summers of 1947–66 (collocated from literature, expedition dairies (E. Knuth), photographs by Geodætisk Institut, København, and other photos):

1947: Fiord completely ice-free upon landing by Catalina 27/7.
Last flight by Catalina 21/8.
1948: Fiord ice-free 30/7 upon landing by Catalina.
New ice everywhere from 11/9.

1949: Threshold ice-free 2/7. The entire fiord ice-free following storm, 13/7.
New ice from 5/9 (1 inch thick 8/9).
1950: Threshold ice-free 5/7. Fiord ice-free 11/7.
1951: No observations.
1952: Fiord ice-free in mid-July.
1953: No observations from Jørgen Brønlund Fjord, but unusually intensive thawing around Nordostrundingen, in Danmark Fjord, and in Independence Fjord.
1954: This year, too, intensive thawing in Danmark Fjord and Independence Fjord.
Jørgen Brønlund Fjord almost completely ope n 8/7.
1955: Abnormally slight thawing in Hagen Fjord and Independence Fjord.
Observed from the air 24/8 Jørgen Brønlund Fjord was broken up but filled with floating ice.
1956: Landing by Catalina outside Brønlundhus 16/8.
1957: First half of August: outer basin and threshold (and presumably the rest of the fiord) ice-free.
1958: No observations.
1959: No observations.
1960: Threshold ice-free 9/7 and the major part of the inner basin presumably broken up and partially ice-free.
Entire fiord ice-free 27/7, according to air photograph.
Independence Fjord strongly broken up off Jørgen Brønlund Fjord, with open water c. ten kilometers north and south of the mouth of the latter 5/8.
1961: According to air photo 29/7: inner basin free from the middle of Buen and towards the head of the fiord.
No observations for the rest of the fiord.
Landing by Catalina outside Brønlundhus 26/8.
1962: Landing by Catalina outside Brønlundhus 14/8.
1963: 6/7 Navigation in shore lead still difficult.
25/7 Navigation eastwards from Brønlundhus practically impossible.
28/7 Navigation from Brønlundhus to Vandfaldsnæs extremely difficult.
8/8 Inner basin ice-free.
12/8 Unbroken ice and close pack ice on the threshold.
21/8 Landing by Catalina outside Brønlundhus.
1964: 11/7 A little open water around and north of Edderfugleholm; apart from this only a narrow shore lead.
28/7 Open water in the innermost half of the inner basin and

between Børglum Elv and Brønlundhus, as well as along the northern side of the threshold. Ice in the outer basin completely unbroken.

4/8 Landing by Catalina outside Brønlundhus given up because of floating ice.

9/8 Close pack-ice on the threshold.

21/8 Landing by Catalina outside Brønlundhus. Partially broken but continuous ice-cover in the outer basin south of Vendenæs–Kap Harald Moltke. Independence Fjord off Jørgen Brønlund Fjord unbroken.

1965: No observations.

1966: Open water on the western end of the threshold 5/7.
All ice in the fiord broken up 15/7.
(See p. 9).

Although the above survey gives but little basis for a generalization, the breaking up and melting of the ice in a "normal" year apparently takes place as follows: During the first week of July open water appears in the innermost four to six kilometers of the fiord, as well as to a considerable extent on the threshold. In mid-July all ice in the inner basin breaks up, and shortly after this the ice in the outer basin and in adjacent parts of Independence Fjord also breaks up. After the middle of July the inner basin and the threshold normally will be ice-free, while floating ice will move in and out of the outer basin. As a rule, new ice presumably will first begin to form about the first week of September.

Some years diverge sharply from the "norm" established here. In 1954 Jørgen Brønlund Fjord was open unusually early, and at the same time particularly intensive thawing was observed in the entire Independence Fjord area. Since this also was the case in the previous year, the conditions in Jørgen Brønlund Fjord in 1953 may also have been more favorable than normally.

In contrast, the ice conditions in the summers of 1963 and 1964 were unusually poor. The inner basin was not ice-free before the beginning of August, and apparently the ice in the outer basin broke up on a limited scale only.

Bathygraphy and Regional Division

On the basis of T. Høj's map (Maps I and II), and supplemented by information obtained in 1966, it is possible to divide Jørgen Brønlund Fjord into the following five regions: 1. Estuary, 2. Inner Basin, 3. Threshold, 4. Outer Basin, 5. Kap Harald Moltke Region (abb. below to KHM region).

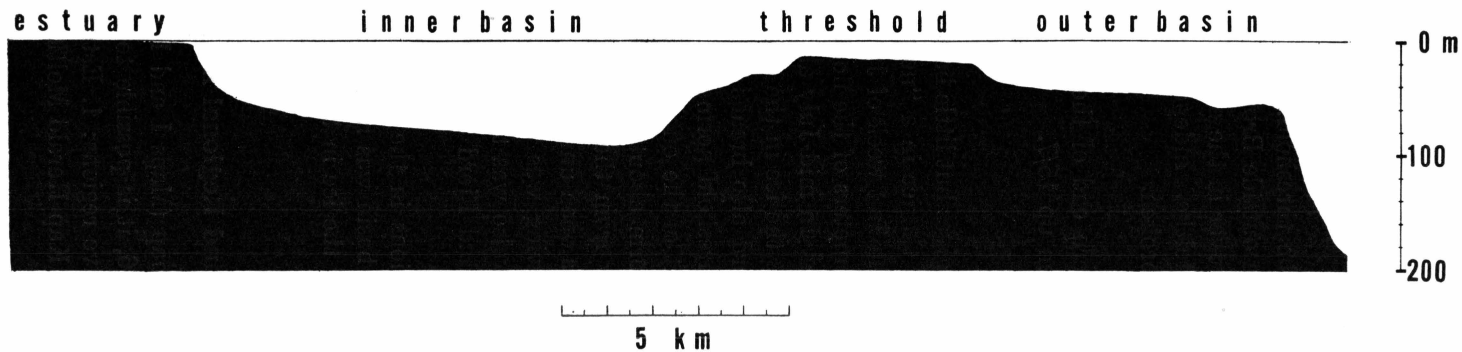


Fig. 3. Longitudinal section through the deepest parts of Jørgen Brønlund Fjord from Tappen to Independence Fjord.

1. As mentioned above (p. 7) the transport of material by Midsommerelv dominates the innermost four to six kilometers of the fiord. From the outflow of the stream at Tappen to a point close to Glaciologelv there is a large estuary of flat extensive banks separated by a branching system of channels. At high tide it is possible to cross without difficulty the entire estuary by boat; at low tide, however, the banks are completely dry or covered by 5–15 cm. of water.

2. The boundary between the estuary and the inner basin is defined by a precipitous increase of depth shortly before the outflow of Glaciologelv. Roughly speaking, the inner basin is shaped like a bathtub with steep sides and sloping terminal surfaces, but the bottom is plane, sloping slightly eastwards. In the inner basin there are depths extending to as much as 85–90 m.

3. The inner and the outer basins are separated by a c. five kilometers long threshold with a maximal depth of 20 m. (boundaries to other regions see Map II). The threshold is between one and two kilometers wide, and is mainly composed of a northernly located shallow water region no more than 5 m. deep. In some places, and in particular north of Edderfugleholm, the fiord bottom passes quite smoothly into a distinct mud flat.

Parallel to the south side of the threshold the shallow water region is cut through by a 300–500 m. wide channel which, having depths from 14 to 20 m., is the actual connection between the inner and outer basins.

4. While the inner basin runs east-west, the outer basin turns in a north-south direction, and in contrast to the former there is no question of a "closed" basin. The northern end, as well as the eastern and western sides, decline towards a somewhat irregular bottom which slopes from north to south, from c. 40 m. to c. 60 m. At the mouth of the fiord the outer basin declines steeply into Independence Fjord.

This situation raises the question of the boundary of Jørgen Brønlund Fjord. Officially this boundary is drawn between Kap Harald Moltke and Kap Knud Rasmussen. But this is not fully satisfactory from a marine biological point of view, for the outermost part of the fiord, viz. the triangle Kap Harald Moltke–Kap Mylius-Erichsen–Kap Knud Rasmussen, should rather be considered a part of Independence Fjord. On a bathygraphical basis and following a preliminary study of the fauna in the outer basin and in the said triangle, the boundary between Jørgen Brønlund Fjord and Independence Fjord should more natural be drawn from Kap Harald Moltke to Kap Mylius-Erichsen.

But since the situation has yet to be thoroughly investigated, the question will not arise until Independence Fjord becomes subject of marine biological research.

5. While the largest part by far of the outer basin runs uniformly into Independence Fjord, there is a diverging region around Kap Harald Moltke, Dråbeholm, and Mundingsholm. In the strait between Kap Harald Moltke and Dråbeholm the depth reaches 32 m.; towards Independence Fjord as well as towards the outer basin this hole is enclosed by two narrow thresholds at a depth of 5–10 m. The area between and west of Dråbeholm and Mundingsholm likewise form a "threshold" between the two fiords. The depth here varies between 2 and 10 m.

The KHM region is well defined towards Independence Fjord by a sharp increase in depth; the transition into the outer basin is smoother, however, and presumably in this case a differentiation can most readily be made by a comparision of the different bottom types (see p. 19).

Distribution of Bottom Sediments in the Fiord

As might be expected on the basis of our knowledge of the surrounding country and the transport of material by melt water, the major part of the bottom of Jørgen Brønlund Fjord consists of clayey sediments covered by a thin layer of detritus. Deposits of coarser sediments are only to be found in the innermost part of the fiord, along the coasts, in the KHM region, and at Kap Knud Rasmussen. Neither rock nor stony bottom were found in any part of the fiord.

The Estuary: Flat sand banks, intersected by channels along whose sides there are some gravel deposits, are characteristic of the estuary. Near Midsommerelv's outflow coarse pebbles accumulate in oblong heaps parallel to the stream along the edges of the channels. In the outermost parts of the estuary, three to five kilometers beyond Tappen, where it reaches a breadth of scarcely two kilometers, the channels become less and less pronounced, and considerable amounts of clay are deposited along with the sand.

The coasts consist everywhere of pebbles and/or sand and clay.

Inner Basin: Gray clay dominates the inner basin. The fall from the estuary to the inner basin is fairly precipitous, and presumably the final part of the sand transported by Midsommerelv is deposited on this slope. Here and there, however, (demonstrated at a depth of 35–40 m. outside Brønlundhus), there are small "islands" of sand on the clay bottom. Their presence can be attributed to sand drifts (p. 9) that are blown together by the powerful west winds during the winter; they melt through the ice in the beginning of summer before the ice breaks up, and settle on the soft bottom.

The coasts still consist of a small border of beach pebbles with more or less, at times predominant, sand and clay.

The region between 0 and 15 m. in depth differ significantly from the rest of the bottom (fig. 4 a). The pebble belt stretches out into the fiord at a variable number of meters—most frequently less than 5 m.—and is replaced at a depth of about 2 m. by a zone, sometimes measuring several hundred meters in width, where the anchor ice has stood firmly at the bottom. It is quite plane, and consists of sand with a small

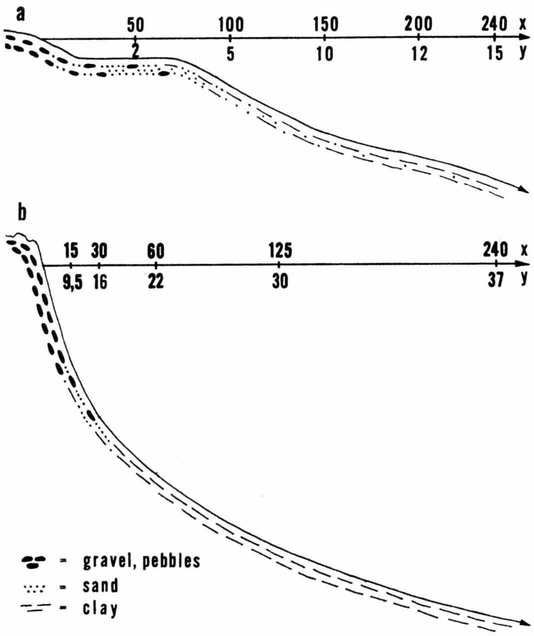


Fig. 4. Cross sections of the coastal areas, a: outside Brønlundhus, b: at the tip of Pileodde.

X: Distance from the shore in meters.
Y: Depth in meters.

amount of pebbles and clay. Between 2 and 10 m. there is a gradual transition from sand to clay, and from a depth of 10–15 m. the bottom is pure clay.

This pattern—'anchor' zone/transition zone/clay bottom—has developed in most places along the south coast of the inner basin (conditions along the north coast are unknown, for the most part). In connection with the somewhat undulating course of the coastal contours the width of the 'anchor' zone varies from max. 200–300 m. (*e.g.*, east of Østmolen), only to disappear completely around the tip of the largest capes, as at Pileodden on the north coast (fig. 4 b), where the pattern is completely broken. Here the bottom consists of coarse gravel and pebbles

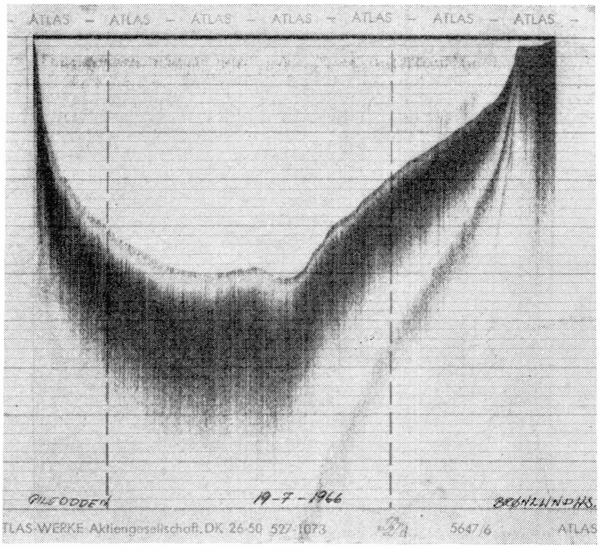


Fig. 5. Cross section of the inner basin from Brønlundhus (right) to Pileodden (left —The horizontal extension of the 'anchor' zone outside Brønlundhus is slightly out of scale (too broad) with the rest of the echogram.

which at an angle of scarcely 45° reaches the soft bottom at a depth of 18–20 m. (see aso fig. 5).

The sedimentation in connection with Børglum Elv's outflow has not been investigated.

The Threshold: From the outflow of Børglum Elv to the tip of Kængurunæs the north coast consists of coarse sediments, predominantly pebbles and gravel, that stand like a $1\text{–}1^1/_2$ m. high wall along the shore. To the east the north coast is quite flat and is covered by silt. This area runs about two kilometers eastwards, whereupon it is replaced by a mixed coast similar to that mentioned in connection with the inner basin. The northern shallow water region of the threshold seems to consist to a predominant degree of gray clay covered by grey-brown detritus having a maximum thicknes of 5 mm. The conditions are, however, known only outside of and directly west of Kængurunæs, and the bottom in this large area presumably varies somewhat. For example, it is possible that some sand and gravel from Børglum Elv is deposited in the western end.

Towards the south the shallow water is replaced by the connective channel. As a result of the relatively strong current that passes through here (see p. 25), the bottom and the lowest part of the sides of the channel consist of light gray clay without noteworthy superposition of ooze and detritus.

Along its southern side the channel is bounded by a reach of shallow water whose western end (east of Østmolen) forms a 200–300 m. wide 'anchor' zone composed of sand and a considerable amount of clay. To the east this zone declines in breadth, sand becomes predominant, and shortly before Vandfaldsnæs the channel runs so close to the coast that the true 'anchor' zone cannot form.

In the immediate vicinity of Østmolen, clay flats reach out as far as the water; the rest of the south coast of the threshold is dominated by pebbles and sand.

Outer Basin: Knowledge of the bottom types in the outer basin is limited to a series of samples taken between "Saltsøerne" and Vendenæs, showing depths from 10 to 45 m., as well as a few samplings in the mouth of the fiord. Visual observations made during navigation and on foot along the coasts of the basin do, however, indicate some divergence from conditions between 0 and 5–6 m. in the inner basin. The composition of the shores is similar, but the 'anchor' zone presumably is much narrower and far more clayey, and it must be assumed that here the clay bottom already is reached at a depth of 6–7 m. At but one place—off the outflow of Botanikerelv—considerable amounts of sand are deposited on shallow water.

In the rest of the outer basin the bottom consists of two types of clay. The grey clay of the inner basin and the threshold recurs at a depth of from 6–7 (?) m. to 30–35 m. At depth of more than 35 m. this type of bottom is replaced by fine red-brown clay which continues out into Independence Fjord.

KHM Region: Around Kap Harald Moltke, Dråbeholm, and Mundingsholm (fig. 6) coarse sediments dominate the bottom to a depth of 25–30 m. Kap Harald Moltke's southern coast consists of a 10–15 m. wide terrace of pebbles that continues directly into the water. From ca. 25 m., viz. near the bottom of the hole between Kap Harald Moltke and Dråbeholm, the bottom is clayey, with some sand. On the western side of the two islands the pebble and gravel belt runs far out into the fiord to a depth of c. 5 m. The surrounding bottom consists of gravel, sand, and clay out to a depth of c. 20 m., where the soft bottom of the outer basin begins.

(Kap Knud Rasmussen): From a marine biological point of view Kap Knud Rasmussen should be regarded as cape projecting out into Independence Fjord (p. 15). But since a long series of samples have been taken in the immediate vicinity of this cape, the special conditions that obtain here will also be explained (fig. 7). Along the northern side of the cape the bottom drops sharply, and here gravel and sand still

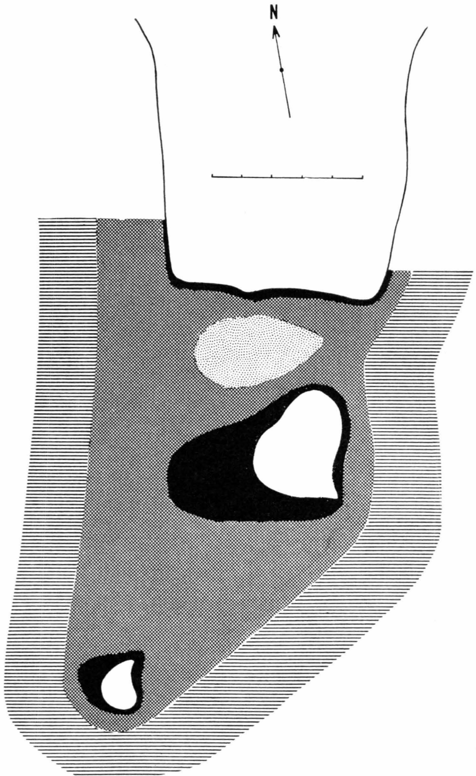


Fig. 6. The Kap Harald Moltke region. Bottom sediments.—Black: pebbles; dark shaded: gravel, sand, and clay; light shaded: clay with a little sand; horizontal striation: gray clay surrounding the KMH region. –
The scale represents 250 m.

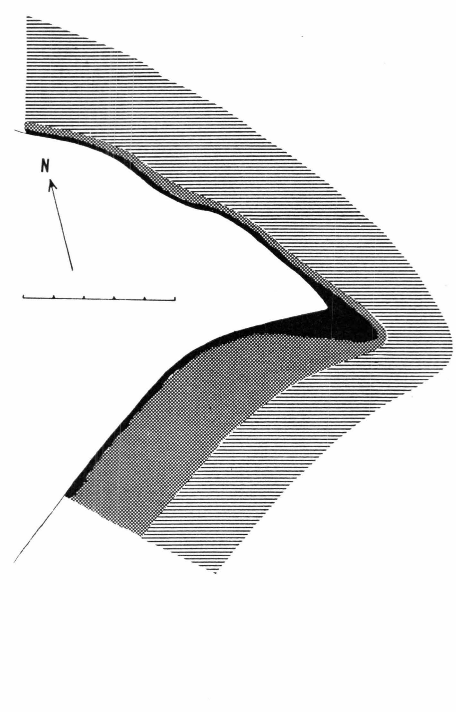


Fig. 7. Kap Knud Rasmussen. Bottom sediments.—Signatures as in fig. 6.

are to be found in the grey clay at a depth of 15–20 m. Off the point of the cape the clay and most of the sand are washed away, and from the coast-line down to c. 35 m. a steep slope of pebbles has formed. On the southern side of the cape the drop towards the depths of Independence Fjord is significantly less steep. Samplings taken at a depth of 9 m. revealed a bottom consisting of pebbles and some clay. At depths between 9 and 30 m. the clay becomes increasingly dominant, and the soft bottom proper is found at a depth of 30–35 m.

Hydrography

Our knowledge of the hydrographical conditions in Jørgen Brønlund Fjord is limited to 43 samples taken in the period 15 May–20 June 1966. Thus, the material is too scant to permit a proper comparison with other fiord systems in East Greenland. It seems reasonable, however, to submit the information obtained, and to point out some characteristic features.

A reversing water-bottle, 800 cm^3, together with two reversing thermometers was used for all samplings. All data are shown in Table 1.

Salinity

The specific gravity of the water was determined by means of a set of aerometers, and with respect to no. 1–16 (Table 1) this work took place in the open air at negative water and air temperatures, while the rest of the samples were brought indors to be measured at positive temperatures. Thus, because of possible formation of ice crystals in the cylinder glass employed, there may be minor errors in the first above mentioned samplings.

Fig. 8 gives the total measurements of salinity, and this shows how at depths down to c. 5.5 m. there is a brackish water layer whose salinity increases along with increasing depth from 13–14 ‰ to c. 30 ‰ (see also fig. 11). The low salinity in this layer is primarily attributable to the supply of fresh water from the conveying streams. As a result of the higher temperature (see below) and the lower specific gravity this water is forced in between the ice and the salt water masses of the fiord. The infiltration of salt in this layer presumably takes place both as a result of turbulent mixing from below and washing out at the bottom of the fiord ice.

At places in the fiord other than those shown in fig. 11, the salinity measured at a depth of 2.5–3 m. was considerably lower (13.5 ‰, 14.1 ‰, cf. Tab. 1). The salinity at the bottom (fig. 9) increases steadily from c. 30.5 ‰ at a depth of 7–10 m. to 33.1 ‰ at 105 m.

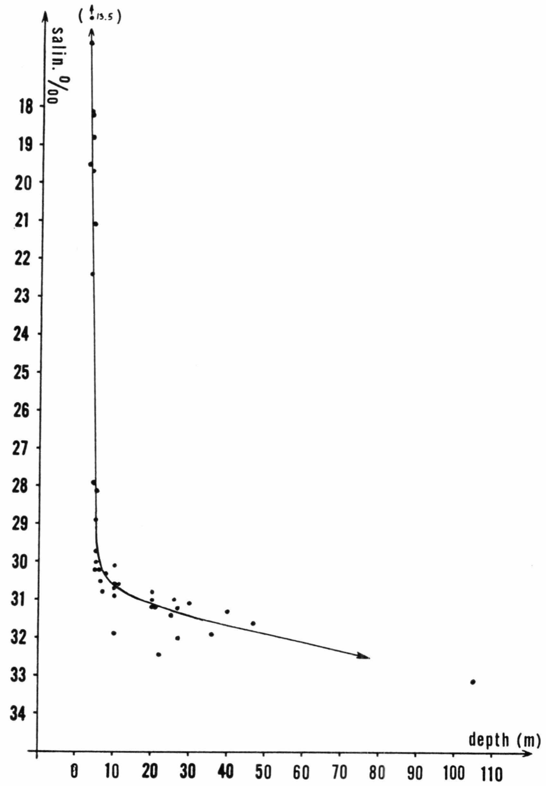


Fig. 8. Diagram showing all salinities measured during the Fourth Peary Land Expedition.

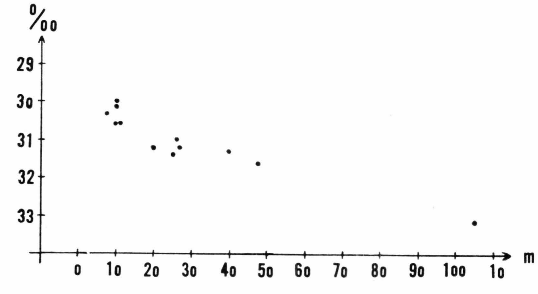


Fig. 9. Diagram showing salinities at the bottom.

Temperature

The temperatures given in Table 1 represent the mean between readings of the two reversing thermometers employed. The figures shown diverge max. 0.03°C from the read temperatures. In all cases the reversing thermometers were held at the desired depth for 10 minutes.

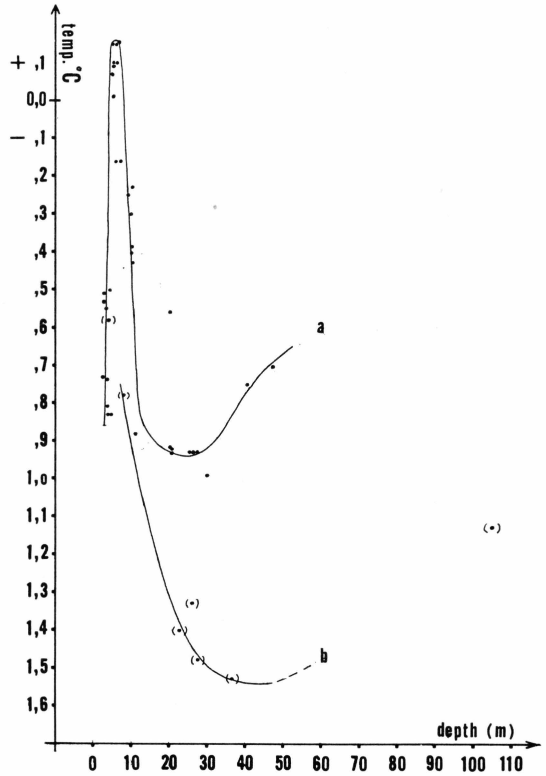


Fig. 10. Diagram showing all temperatures measured during the Fourth Peary Land Expedition.—Measurements, a: in the inner basin; b: in and around the Kap Harald Moltke region.

All temperature measurements are shown in fig. 10, and a distinction is here made between a: measurements in the inner basin and b: measurements in and southeast of the KHM region, as the temperatures in b apparantly are lower than those at equal depths in a.

In general, the lowest temperatures occur at a depth of 20–30 (40) m. (a: −1.0°C, b: −1.5°C), while the highest temperatures recorded were at depths of 4–6 m. Fig. 11 shows the temperatures in the uppermost layers of water; at the time the samples were taken the melt water from land reached the fiord with a temperature of approximately 5°C (Foged 1955 p. 14).

The bottom temperatures vary from c. −0.3°C at a depth of 10 m. (a) to −0.95°C (a) and −1.3°C (b) at a depth of 20–30 m. The lowest temperature, −1.53°C, was recorded at a depth of 36 m. (bottom: 105 m.) south of Mundingsholm.

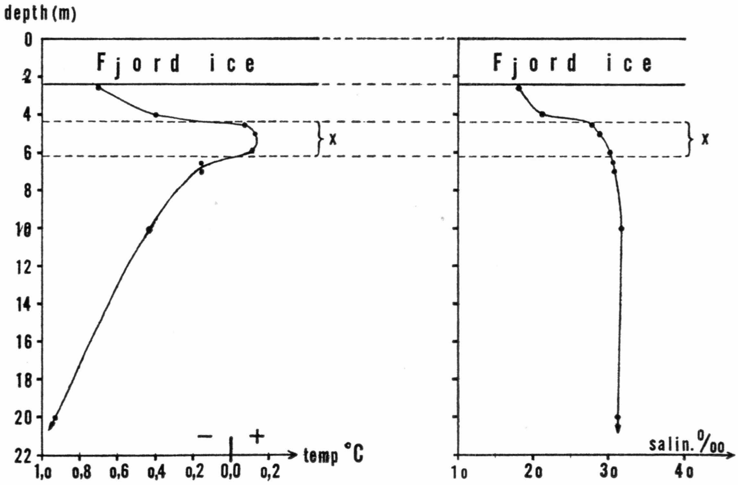


Fig. 11. Vertical section from the ice to the bottom of the fiord showing temperatures and salinities.—(Off Pileodden, hole no. 8, 14–15 June 1966).
X: Water layer with temperatures slightly above 0° C.

Hydrographical conditions after the breaking up of the ice:

No measurements are available for the ice-free period; but various observations show that after the ice is gone there is a 4 to 6 m. thick layer of melt water—the fiord water layer—all over the fiord. The boundary towards the underlying masses of water is well defined, as clearly indicated by echograms (fig. 12).

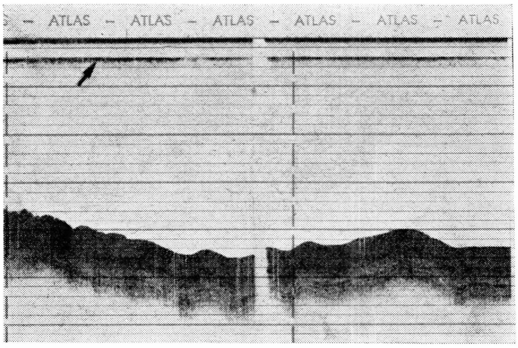


Fig. 12. Echogram showing springlayer. (West of Kap Harald Moltke, 1 July 1966.) —The reflection may be intensified by a dense concentration of plankton immediately below the fjord water layer.

Tide

Tidal movements in Jørgen Brønlund Fjord were not measured in the summer of 1966. But recordings made during the First Peary

Land Expedition show that the water level fluctuates at a maximum of 40 cm. (FRISTRUP 1949 p. 51: c. 30 cm., LUNDBAK 1952).

The calculated average velocity of the tidal wave is 15–18 m/sec. (LUNDBAK *loc. cit.* p. 22).

Current

Currents have not been measured in Jørgen Brønlund Fjord. It shall only be mentioned here that upon being pressed together on the threshold the incoming and outgoing tides cause a strong current in the channel. Observations of ice floes also revealed a powerful tidal current in the surface between Kap Harald Moltke and Dråbeholm.

Visibility

Only a few records of visibility in Jørgen Brønlund Fjord are available. The amount of suspended material spreading across the fiord along with the melt water has a decisive effect on light conditions in the fiord throughout the summer.

The following measurements were made (a white plankton net with a diameter of 30 cm. being used as a "Secci disc" in all cases): Inner basin, 20 July 1964, visibility 3.5 m.—17 August 1964, visibility 3.1 m. (both U. RØEN, in KNUTH 1965).—KMH region, 5 August 1966, visibility 3.8 m.

Since the major part of the suspended material is, however, transported along the coasts, visibility is here often close to nil along a border that is frequently several hundred meters wide.

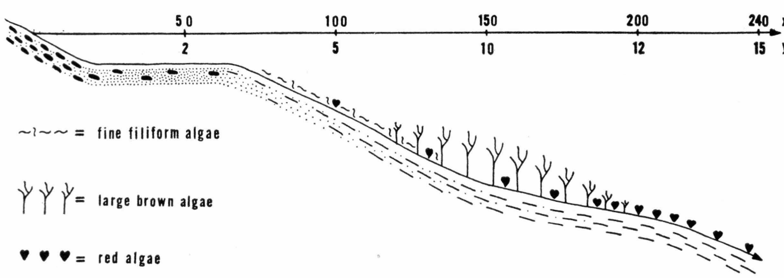


Fig. 13. The zonation of marine algae off Brønlundhus.
X: Distance from the shore in meters.
Y: Depths in meters.
Signature for bottom sediments as in fig. 4.

Zonation of Marine Algae

As mentioned in the introduction, marine algae collected during the First Peary Land Expedition by K. HOLMEN were studied by LUND (1951). In the summer of 1966 a considerable amount of algal material was collected for the purpose of determining the distribution of vegetational types in Jørgen Brønlund Fjord.

The zonation limits were determined with the greatest possible accuracy in the inner basin off Brønlundhus, on the northern and southern sides of the threshold off Kængurunæs, as well as on the southern side of the threshold off Vandfaldsnæs, but because of lack of time, along

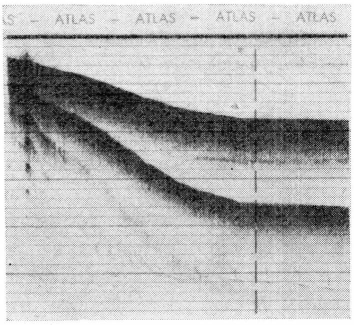


Fig. 14. Echogram taken off the point of Kængurunæs, 25 July 1966, showing vegetation at 5 m. depth.

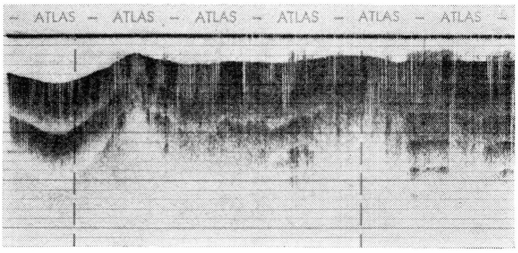


Fig. 15. Echo sounding along the five meter curve. Vegegation only appears at five meters. 25 July 1966.

with ice difficulties the collection of algae east of the threshold had to be limited.

Inner Basin: Three well defined belts of algae were found off Brønlundhus (fig. 13). 1. From a depth of 2–2.5 m. (viz. the edge of the 'anchor' zone) to a depth of c. 7 m. the bottom is covered by a carpet fine, tangled, filiform algae. 2. From 7 to 11–12 m. there is a sturdy growth of brown algae (*Desmarestia aculeata* (L.) Lamour, *Rhodomela lycopodioides* (L.) Ag., etc.). 3. Between 12 and c. 15 m. there is a belt of the red algae *Phyllophora brodiaei* (Turn.) Ag. f. *interrupta* (Grev.) Rosenv., that lies unattached to the bottom. (This algae is also found scattered among the abovementioned brown algae).

The Threshold: A rather narrow belt of large brown algae, as described above, was found at a depth of 5 m. along the northern border of the channel off Kængurunæs. The echograms, figs. 14 and 15, show the location of this belt. In the shallow water region within the 5 m. curve there is a thin layer of fine, filiform algae that disappears at depths less than c. 2 m.

The same belts recur at comparable depths on the southern side of the channel off Kængurunæs, where, in addition, a narrow belt of *P. brodiaei* f. *interrupta* is to be found at a depth of 8–10 m.

On the southern side of the threshold at Vandfaldsnæs the brown algae belt lies somewhat deeper, that is, between 8 and 10 m. As a result of the relatively strong current at this place, the innermost belt of filiform algae is feeble. No observations are available regarding a belt of red algae in this locality.

Outer Basin: Algal vegetation was found at only one place in the outer basin. At a depth of 10 m. off "Saltsøerne" there is a pure *Phyllophora* area.

KHM Region: Although this is one of the best investigated parts of the fiord, no form of vegetation could be found.

Kap Knud Rasmussen: At the tip of Kap Knud Rasmussen, at a depth of 15–35 m on the steep slope of pebbles, a few stones with encrusted pink algae of the *Lithothamnion-Lithophyllum* type were found (not previously recorded from Jørgen Brønlund Fjord).

Methods

Blasting of Work Holes

The use of explosives in blasting holes for marine biological investigations in high arctic had been proposed earlier (Thorson 1946), and on the Fourth Peary Land Expedition this method was successfully tested.

Experience shows that unskilled hands take at least one and most frequently two days to cut a hole of a suitable diameter (1–2 m.) in 2.5 m. of ice. By using the method to be described below, this job takes no more than from 2 to 3 hours.

It was planned in advance that the introductory work in the summer of 1966 was to take place through 15 holes distributed over the fiord; as the abovementioned figures indicate this would have required 3 to 4 weeks if done manually. But since a maximum of 8 to 10 weeks of work were at our disposal, it was quite obvious that such a time-consuming project was completely unacceptable; consequently it was decided to use explosives.

It was difficult to determine beforehand what the suitable charge should be for the anticipated thickness of ice. Available information regarding ice blasting under these conditions primarily refers to cases of ships in beset, and to the need for using explosives to hasten the breaking up of ice in and around harbor installations. These blasts had no bearing upon our desire to make strictly defined circular holes whose edges and immediate surroundings had to be firm and hard.

The explosive employed was trotyl (TNT); 100 kg. in units of 100, 200, and 500 gr. were brought along. After some few experiments off Brønlundhus a basis of calculation of 150–160 gr. per 10 cm. ice, viz. c. 4 kg. for ordinary sea ice 2.5 m. thick, was decided.

By means of an ice drill having a spoon-shaped blade and a cutting diameter of 22 cm. the charge was lowered into the ice at a depth of c. 1.75 m. Ordinary detonators, together with slow burning fuses, were used as ignition. To begin with the detonator was placed directly in the charge; later in the summer, however, when as a result of thawing the bore hole was filled with percolating water, a detonating fuse with a

Fig. 16. The last ice is removed from a hole blasted off Brønlundhus.

detonation speed of 9,000 m/sec. was used to connect the charge and the detonator.

The blast resulted in a hourglass-shaped hole filled with crushed ice. The dimentions of the hole were as follows: surface diameter c. 3 m., minimum diameter 1.5–2 m., bottom diameter 2–2.5 m. Accordingly a considerable amount of crushed ice had to be removed in order to clear the entire hole; but it was sufficient, by means of a shovel and a 3 m. long "tuk" to open a passages wide enough to operate the gear. The rest of the ice froze into a compact mass (fig. 16).

The blasts closest to the coast were made over 5 and 7.5 m of water, and the following samplings showed that the bottom presumably was quite undisturbed (unatached filiform algae and smaller creeping invertebrates on the surface of the bottom sample taken by the grab).

The van Veen Grab

As long as the fiord was icebound, samples of bottom fauna were exclusively taken by means of a van Veen grab ($^1/_{10}$ m^2) weighing 21 kg. During maximally effective samplings (10–12 liters of bottom material) the total weight was as much as 40–50 kg. Since the grab had to be operated manually, this weight verged on being practically possible, especially with respect to samplings at greater depths (50–100 m.). But since no more than 1–3 samplings per hole could come into question,

Fig. 17. Boat and raft at work near Brønlundhus. In the background Buen. (KNUTH phot., 14 August 1966).

it was important to avoid taking samples less than $^1/_{10}$ m^2. From this point of view the van Veen grab was absolutely suitable.

The Detritus Sledge

As soon as ice conditions permitted, the only gear used for collecting bottom fauna was a detritus sledge (modified from OCKELMANN 1964 by H. LEMCHE) equipped with a 5 mm. lip. During all samplings the mesh width of the dredge net was less than 0.5 mm.

Except for some difficulties in keeping the sledge at the bottom at the greatest depths, 150–200 m., this light and effective tool was particularly useful under the somewhat difficult circumstances.

The Work Raft

Since it almost could be taken for granted that it would be possible to work on open water, preparations were made for using the limited time as effectively as possible. Because of the transportation situation, the only possibility was to bring along an eleven foot aluminium boat with an outboard motor. This could, of course, be used by itself, but it

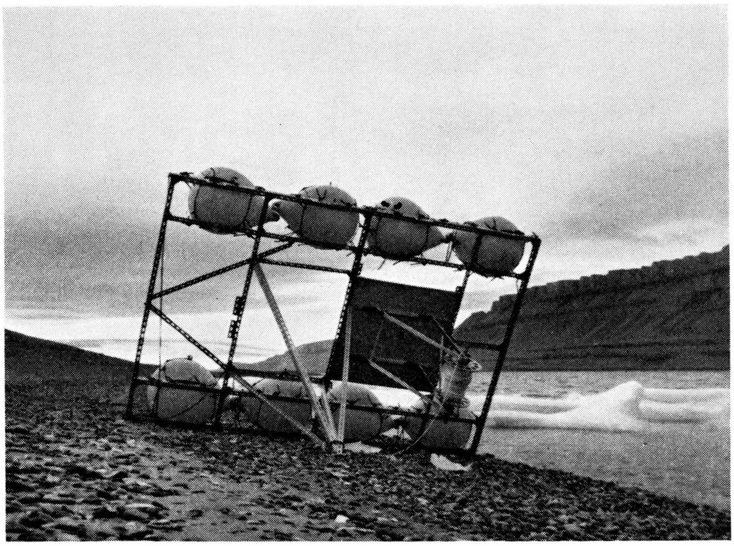


Fig. 18. The raft.—Plywood deck plates removed to show construction.

was decided in addition to construct a raft that could be towed by the boat and serve as a work platform.

The raft was made of perforated angle bars; its dimentions were 2×3 m. The angle bar construction was held together by galvanized bolts, and its deck was composed of 18 mm. thick waterproof plywood; but a hole measuring 80×90 cm. was left in the center of the raft, over which a 2 m. high four legged gallows, topped by a block, was built. A collapsible hand winch which, since it was made of duraluminium, combined strength with light weight was placed behind the gallows. As it proved most practical to bring wire (4.6 mm.) and nylon log line (5 mm.) in lengths of 220 m., the hand winch was set up in such a way that the wire drums could easily be replaced, and the pieces of wire could be joined while work was in progress. The mechanism whereby the replacement was done was principally constructed in such a way that the swivel axel rested in two bearings of self-lubricating nylon that could be opened and closed by a split pin. When a drum had to be replaced the axel was lifted from the bearing, the empty drum was removed, and a new drum was inserted into the axel.

The hand winch had but two minor faults, both of them caused by weak material; the hinges in the collapsible winch were made of brass, and cracked immediately the first time the winch was used in the field. They were replaced by bend flat bars. The split pins of the bearings were made of nylon, and also proved to be too weak, since the great pressure deformed them. Instead steel spikes were used.

Eight 60–70″ balloons made of heavy nylon (normally used as long-line buoys and ship fenders) were mounted as carrying elements for the raft and its gallows and hand winch. These raised the deck to 20–30 cm. over the surface of the water.

The whole construction proved to be exceptionally seaworthy, for even the worst strains were unable of bringing it to the verge of capsizing. When towed by the boat it was an excellent work platform. The gallows was an invaluable help, as gear could be lifted to a height from which it readily could be brought in on the deck.

Raft with gallows, deck plates, hand winch, and carrying balloons weighed a total of 130 kg. This may seem like a great deal, but when transported by air, all could be taken apart and packed in practical parcels.

Sorting and Treatment of Material

Hand sieves having a minimum mesh width of 0.5 mm. were used to screen the collected samples. All samples taken by means of the van Veen grab were screened through this mesh size. Larger animals were sorted out, and were fixed in neutralized formalin in sea water, along with the rest of the contents.

In principle the samples obtained by the detritus sledge were treated in the same way. In this case, however, more weight was placed on sorting out the collected fauna, whereas the remnants of the screening process only were brought home to a representative extent (in regard to discarding of collected fauna see list of stations).

Acknowledgements

We owe many thanks to Count EIGIL KNUTH, the leader of the expedition, for having made it possible for us to carry out these investigations, for his readiness in complying with our wishes during the preparations for the expedition, and for his never failing interest during our field work.

We also wish to express warm thanks to H. LEMCHE, D.Sc., Zoological Museum, University of Copenhagen, and to U. RØEN, D.Sc. and J. LÜTZEN, Ph.D., Institute of Comparative Anatomy, University of Copenhagen, for their untiring help during our preparatory work and following our return.

Professor K. G. WINGSTRAND, Fil.dr., Institute of Comparative Anatomy, kindly gave us working facilities, for which we are most grateful.

We are thankful to B. FRISTRUP, Ph.D., Geographical Institute, University of Copenhagen, for enabling us to include in the present paper notes on a yet unpublished material on the insolation at Brønlundhus collected by heliograph in 1948–50 and in 1966.

The Zoological Museum and the Marine Biological Laboratory (Helsingør), University of Copenhagen, the Meteorological Institute, Copenhagen, and the Danish Institute for Fishery and Marine Research, Charlottenlund, have with great readiness placed at our disposal the necessary instruments and various working gear.

The Danish State Research Foundation, 'JAPETUS STEENSTRUP's Bequest, and 'Dr. MEINERTZ AND HUSTRU's Bequest are thanked for their support.

Lists of Stations

A. Plankton hauls:

HD = haul direction. H = horizontal. V = vertical. S = surface haul. BS = bottom to surface haul.

I. Samples collected by P. JOHNSEN in 1949.

Jour. No.	Incl.[1] jour. No.	Date	HD	Depth of haul in m.	Position	Remarks
510	511–12	23/5	V	75–0 (BS)	Independence Fjord some kilometers E of Kap Harald Moltke	
542	543	28/5	V	13–0 (BS)		2 x
544		–	V	5–0	W of Kænguru-næs	Fry do not belong to the sample
587		1/6	V	28.5–0 (BS)	SE of islet. (*I.g.* off Midternæs)	Sampling through crack in the ice
588		–	V	20–0	–	–
589		–	V	10–0	–	–
590		–	V	5–0	–	–
659		10/6	V	60–0	Independence Fjord, c. 7 km off Astrup Fjord towards Kap Knud Rasmussen	–
660		–	V	5–0	–	–
784		–	V	20–0	–	–

[1]) Numbers in this column represent items sorted out from the main sample.

II. Samples collected by U. RØEN in 1964.

St.No.	Date	Mesh width in μ	HD	Depth of haul in m.	Position	Remarks
1	17/8	60	H		Off Brønlundhus	Haul over the bottom along the shore
2	–	–	H	S	–	
3	–	–	H	S	–	
4	–	–	H	20	–	
5	–	–	H	20	–	
6	–	–	H	40	–	
7	–	–	H	40	–	

III. Samples collected by M. ANDERSEN and J. JUST in 1966.

Pl. No.[1]	Date	Mesh width in μ	HD	Depth of haul in m.	Position[2]	Remarks
1	22/5	150	V	45–0 (BS)	H 2	
2	–	–	V	30–0	–	
3	–	–	V	10–0	–	
4	23/5	–	V	26–0 (BS)	H 3	
5	–	–	V	–	–	
6	2/6	–	V	25–0 (BS)	H 5	Black fouling in the sample
7	3/6	–	V	–	–	
8	–	–	V	105–0 (BS)	H 6	
9	8/6	–	V	–	–	
13	20/6	–	V	15–0 (BS)	H 9	
14	21/6	–	H	0.5	Between Kedelkrogelv and Vestmolen	Sampling in tide-channels running parallel to the shore —Closed at LW, open at HW—Max. depth 1 m.
15	28/6	–	V	10–0 (BS)	H 12	
16	–	–	H	c. 1.0	Vandfaldsnæs	About 75 m. haul along the shore.—Max. depth of water about 2.5 m.
27	16/7	–	H	0–1	Off Brønlundhus about 500 m. from the shore	About 150 m. haul
28	–	–	H	c. 5	–	–
29	–	–	H	c. 15	–	–
30	–	60	H	–	–	About 100 m. haul
31	–	–	H	0–1	–	–
32	24/7	150	H	0–0.5	Off Brønlundhus	About 100 m. haul along the shore—Max. depth of water 0.5 m
33	–	–	H	–	–	–
34	–	–	H	0–0.5	Off Brønlundhus About 500 m. from the shore	About 150 m. haul
37	5/8	–	H	0–2	W of Kap Harald Moltke	About 150 m. haul —Springlayer at 4 m. depth
38	–	–	H	5–6	–	–

(continued)

[1]) Missing numbers represent freshwater samples.

[2]) Positions indicated by letter and number refer to holes blasted in the ice as shown on Map II.

III (continued)

Pl.No.	Date	Mesh width in μ	HD	Depth of haul in m.	Position	Remarks
39	25/8	150	H	10–12	W of Kap Harald Moltke	About 100 m. haul —Springlayer at 4 m. depth.
40	–	–	H	about 20	–	About 175 m. haul —Springlayer at 4 m. depth
41	19/8	–	H	0–10	Off Brønlundhus	

B. Bottom samples

I. Samples collected by P. JOHNSEN in 1948–49.

a. Birge-Ekman bottom grab ($^1/_{44}$ m^2).

Jour. No.	Incl.[1]) Jour. No.	Date	Depth in m.	Bottom	Position	Remarks
1	1986–94	27/8–48	11	Fat grey clay	400–500 m. N of Brønlundhus	$1 \times {}^1/_{44}$ m^2
545–46	547 1962–77	28/5–49	13	Clay	W of Kænguru-næs	$2 \times {}^1/_{44}$ m^2
591	592–93 1978–85	1/6–49	28.5	Clay	SE of islet (*I.g.* off Midternæs)	–
596	597 1955–61	–	–	–	–	–
			b. Dredge hauls.			
No no.	1444 2005–13	8/8–48	c. 20	Clay	Off Brønlundhus	Coarse net
1619	1628–30	Aug–49	c. 30		W of Brønlundhus	
1632	1627 1940–47 1999–2004	12/8–49	21–46			
1633	1947–54	–	c. 13			
			c. Others.			
134		10/11–48	50		Mouth of the fiord	Brittle-star caught on walrus skin lowered to the bottom
135		11/11–48			–	Amphipods caught in the same way
585		1/6–49			Off Midternæs	1 *Cyanea* sp. caught through crack in the ice
586		–			–	1 Medusa caught in the same way

[1]) Items sorted out from the main sample.

II. Samples collected by M. Andersen and J. Just in 1966.

a. van Veen grab ($^1/_{10}$ m^2).

St.no.	Date	Depth in m.	Bottom	Position[1])	Effect[2])
1	15/5	10.5	Fine clay with some sand	H 1	A
2	18/5	–	Fine clay with some sand	H 1	B
3	19/5	47.5	Clay	H 2	A
4	21/5	–	–	–	A
5	24/5	27.5	–	H 3	B
6	–	–	–	–	A
7	25/5	11.5	Clay with sand and stones	H 4	B
8	–	–	–	–	A
9	2/6	25.0	Clay with many small stones and some larger	H 5	B
10	–	–	–	–	A
11	4/6	105	Fine clay	H 6	A
12	7/6	7.5	Sandy clay and gravel	H 7	A
13	–	–	–	–	A
14	13/6	22.0	Clay	H 8	C
15	14/6	–	–	–	A
16	16/6	16	Sandy clay with some stones	H 9	B
17	–	–	–	–	B
18	20/6	9.5	Gravel	H 10	Indeterminable
19	21/6	5.5	Sand and clay	H 11	A
20	22/6	–	–	–	A
21	26/6	11.5	Clay	H 12	C
22	27/6	–	Clay with a little sand	–	A
23	28/6	5.5	Clay with sand (some algae)	H 13	A
24	–	–	–	–	A
25	29/6	2.75	Sandy clay	Off Vandfaldsnæs	A
26	(Dredge haul, see below).				
27	30/6	19.0	Clay	H 14	B
28	–	–	–	–	B
29	–	–	–	H 15	B

[1]) Positions indicated by letter and number refer to holes blasted in the ice as shown on Map II.

[2]) A = > 10 liters of bottom with good surface.
B = 5–10 liters of bottom with good surface.
C = < 5 liters of bottom, or sample with tilted bite.

b. Dredge hauls (Ockelmann-detritus sledge).

St.no.	Date	Depth in m.	Bottom	Position	Remarks[1])
26	29/6	1.5–2.0	Sand, gravel, some clay	Vandfaldsnæs	50 m. dredge
30	1/7	8–10	Clay	–	25 m. dredge
31	–	8–9	Clay with dense vegetation	–	25 m. dredge
32	15/7	about 10	Clay with dense vegetation	Off the Station	75 m. dredge
33	–	max. 2	Sand and gravel	–	50 m. dredge
34	17/7	about 15	Clay with some red algae and many empty shells	–	–
35	18/7	12–13	Clay with many red algae	–	
36	–	2–2.5	Sand	–	
37	20/7	about 3	Sand with some clay and algae	–	35 m. dredge
38	19/7	2–2.5	Sand and clay with a little algae	–	50 m. dredge
39	–	5.0	Clay with some sand, dense vegetation	–	40 m. dredge
40	21/7	30.0	Clay and sand	–	100 m. dredge
41	–	52–50	?	–	Poor effect
42	–	85–90	Dark, muddy clay	Off Lersø	100 m. dredge
43	–	20	Clay with a little sand	Off the Station	75 m. dredge many *Ophioch.*
44	25/7	17–18	Clay	Off Kængurunæs	75 m. dredge 15 *Strongyl.* many *Myriotr.* and *Ophioch.*
45	–	10.0	–	–	50 m. dredge 1 *Strongyl.*
46	–	5.0	Clay with dense vegetation	–	30 m. dredge extremely many young *Portlandia* and *Hiatella.*

(continued)

[1]) If nothing else is mentioned, the 5 mm.-lip has been used on the detritus sledge. —Animals mentioned in this column were not brought home:

Ophioc. = *Ophiochten sericeum* (FORBES)
Strongyl. = *Strongylocentrotus drøbachiensis* (O. FR. MÜLLER)
Myriotr. = *Myriotrochus* ssp.
Uraster. = *Urasterias lincki* (MÜLLER et TROSCHEL)

II (continued)

St.no.	Date	Depth in m.	Bottom	Position	Remarks[1])
47	25/7	3.0	Clay with a little sand and sparse vegetation	Off Kængurunæs	50 m. dredge
48	27/7	2.5	Clay	Opposite Kængurunæs	30 m. dredge
49	–	5–6	Clay with dense vegetation	–	30 m. dredge 2 *Uraster.*
50	–	10.0	Clay, a few red algae	–	30 m. dredge 12 *Myriotr.* 1 *Strongyl.* 2 *Ophioch.*
51	–	18.0	Clay	–	30 m. dredge 1 *Uraster.* 10 *Strongyl.* 13 *Myriotr.* 21 *Ophioch.*
52	29/7	180–160	Fine red-brown clay	Off Kap Knud Rasmussen	No lip on the dredge
53	30/7	8.0	Clay with coarse gravel	N of Dråbeholm	30 m. dredge 10 *Myriotr.* 14 *Strongyl.* about 225 *Ophioch.*
54	–	15–20	Clay and fine gravel	E of Dråbeholm	1 *Strongyl.* about 50 *Ophioch.*
55	–	80–90	Fine red-brown clay	S of Mundingsholm	50 m. dredge
56	–	190–200	–	NE of Kap Knud Rasmussen	
57	31/7	8–10	Sand and clay with some fine gravel	N of Kap Knud Rasmussen	20 m. drede 4 *Myriotr.* 8 *Strongyl.* 30 *Ophioch.*
58	–	20.0	Clay with fine gravel	–	40 m. dredge 14 *Strongyl.* about 50 *Ophioch.*
59	–	9–10	Gravel, clay, and many empty shells	Independence Fjord, S of Kap Knud Rasmussen	20 m. dredge 5 *Myriotr.* about 150 *Ophioch.* 185 *Strongyl.* of all sizes
60	–	20.0	Clay with some gravel	–	30 m. dredge 8 *Strongyl.* about *Ophioch.* 200

(continued)

II (continued)

St.no.	Date	Depth in m.	Bottom	Position	Remarks¹)
61	1/8	25–30	Sandy clay with gravel	Kap Harald Moltke	25 m. dredge 76 *Strongyl.* about 300 *Ophioch.*
NB! labels marked 5 m.					
62	1/8	10.0	Gravel, clay, and many empty shells	–	50 m. dredge 15 *Myriotr.* 85 large *Hiatella* 156 *Strongyl.*, all sizes about 450 *Ophioch.*
63	–	5.0	Clay with gravel	–	50 m. dredge 16 *Strongyl.* 21 *Myriotr.* 65 *Ophioch.* 61 *Portlandia* (large) and many small
NB! labels marked 25–30 m.					
64	2/8	35–15	Gravel	The tip of Kap Knud Rasmussen	Many juv. *Strongyl.*
65	–	30.0	Clay and gravel	Independence Fjord, S of Kap Knud Rasmussen	Many *Propeamussium groenl.*, many small *Ophioch.*, a few *Strongyl.*
66	–	10.0	Clay and gravel	–	
67	–	40–50	Clay	N of Kap Knud Rasmussen	Many smaller *Ophioch.*
68	–	10–15	Clay, gravel, and many empty shells	–	25 *Strongyl.* about 400 *Ophioch.*
69	3/8	40–45	Fine, red-brown clay	Off Vendenæs	Many smaller *Ophioch.*
70	–	–	–	–	
71	–	30.0	Clay	Off "Saltsøerne"	about 100 *Ophioch.*
72	–	10.0	Clay with some gravel and dense vegetation of red algae	–	8 *Myriotr.* 12 *Strongyl.* about 50 *Ophioch.*
73	9/8	30.0	Clay with sand	Off the Station	
74	–	10.0	–	–	

Table I. *Temperature and Salinity Measurements in J. B. F. 1966*

No.[1]	Date	Depth	Position[2]	Temp. °C[3]	Salin. ‰
1 (B)	15/5	10.5	no. 1	−0.30	30.6
2 (B)	18/5	10.5	– 1	−0.30	30.0
3 (B)	19/5	47.5	– 2	−0.70	31.6
4	19/5	3.6	– 2	−0.81	18.2
5 (B)	22/5	26.0	– 3	−0.93	31.6
6	22/5	3.5	– 3	−0.83	18.8
7 (B)	25/5	11.0	– 4	−0.88	30.6
8	25/5	3.5	– 4	−0.73	19.7
9 (B)	2/6	25.0	– 5	−1.33	31.4
10	2/6	3.5	– 5	−0.58	22.4
11 (B)	3/6	105.0	– 6	−1.13	33.1
12	3/6	36.0	– 6	−1.53	31.9
13	3/6	27.0	– 6	−1.48	32.0
14	3/6	22.0	– 6	−1.40	32.4
15 (B)	7/6	7.5	– 7	−0.78	30.3
16	7/6	3.0	– 7	−0.55	19.5
17	10/6	2.5	– 1	−0.53	16.3
18	10/6	5.0	– 1	0.09	30.2
19 (B)	10/6	10.0	– 1	−0.23	30.1
20	10/6	2.5	– 3	−0.51	13.5
21	10/6	5.0	– 3	0.01	30.0
22	10/6	10 0	– 3	−0.40	30.7
23	10/6	20.0	– 3	−0.56	30.8
24 (B)	11/6	27.0	– 3	−0.93	31.2
25	11/6	3.0	– 2	−0.73	14.1
26	11/6	5.0	– 2	0.15	28.9
27	11/6	10.0	– 2	−0.39	30.9
28	11/6	20.0	– 2	−0.92	31.0
29	11/6	30.0	– 2	−0.99	31.1
30 (B)	11/6	40.0	– 2	−0.75	31.3
31	14/6	2.5	– 8	−0.73	18.2
32	14/6	5.0	– 8	0.15	29.7
33	14/6	10.0	– 8	−0.43	31.9
34 (B)	14/6	20.0	– 8	−0.92	31.2
35	15/6	4.0	– 8	−0.40	21.1
36	15/6	4.5	– 8	0.07	27.9
37	15/6	5.0	– 8	0.09	28.1
38	15/6	6.0	– 8	0.10	30.2
39	15/6	6.5	– 8	−0.16	30.5
40	15/6	7.0	– 8	−0.16	30.8
41 (B)	15/6	20.0	– 8	−0.93	31.2
42	20/6	5.0	– 10	−0.10	
43	20/6	9.0	– 10	−0.25	

[1]) Stations marked (B) show temperature and salinity close to the bottom.

[2]) Numbers in this column refer to numbers given to holes blown in the ice as shown on Map II.

[3]) Mean temperature between two reversing thermometers. The present figures have a maximal difference of 0.03°C from the original readings.

Literature

ARMSTRONG, ROBERTS, and SWITHINBANK, 1966:—Illustrated Glossary of Snow and Ice.—Scott Polar Research Institute, Special Publication Number 4. Cambridge.

FOGED, N., 1955:—Diatoms from Peary Land, North Greenland, Collected by Kjeld Holmen.—Meddr Grønland Bd. **128**, Nr. 7.

FRISTRUP, B., 1949:—Peary Land. En foreløbig redegørelse for det geografiske arbejde på Dansk Peary Land Expedition.—Geogr. Tidsskr., **49**.

— 1952:—Physical Geography of Peary Land. I. Meteorological Observations for Jørgen Brønlund Fjord.—Meddr Grønland Bd. **127**, Nr. 4.

— 1961:—Climatological Studies of some High Arctic Stations in North Greenland.—Folia Geographica Danica, **IX**, pp. 67–78.

*HØY, TH., 1970:—Surveying and Mapping in Southern Peary Land, North Greenland.—Meddr Grønland Bd. **182** Nr. 3.

KNUTH, E., 1950:—Dansk Peary Land Expedition. Sidste års meteorologi og topografiske overblik.—Geogr. Tidsskr., **50**.

— 1965.—Den 3die Peary Land Expedition. Rapport. København.

LAURSEN, D., 1954:—Emerged Pleistocene Marine Deposits of Peary Land (North Greenland).—Meddr Grønland Bd. **127** Nr. 5.

LUND, S., 1951:—Marine Algae in Jørgen Brønlund Fjord in Eastern North Greenland.—Ibid., **128**, 4.

LUNDBAK, A., 1962:—Arctic Tidal Problems with Special Regard to Northeast Greenland.—Ibid., **126**, 5.

OCKELMANN, W. K., 1958:—The Zoology of East Greenland. Marine Lamellibranchiata.—Ibid., **122**, 4.

— 1964:—An Improved Detritus-Sledge for Collecting Meiobenthos.—Ophelia, **1**, pp. 217–22.

THORSON, G., 1946:—Technique and Future Work in Arctic Animal Ecology.—Meddr Grønland Bd. **144** Nr. 4.

TRANS, P., 1955:—Report from the Weather Service (on Danish Peary Land Expedition.)—Ibid., **127**, 6.

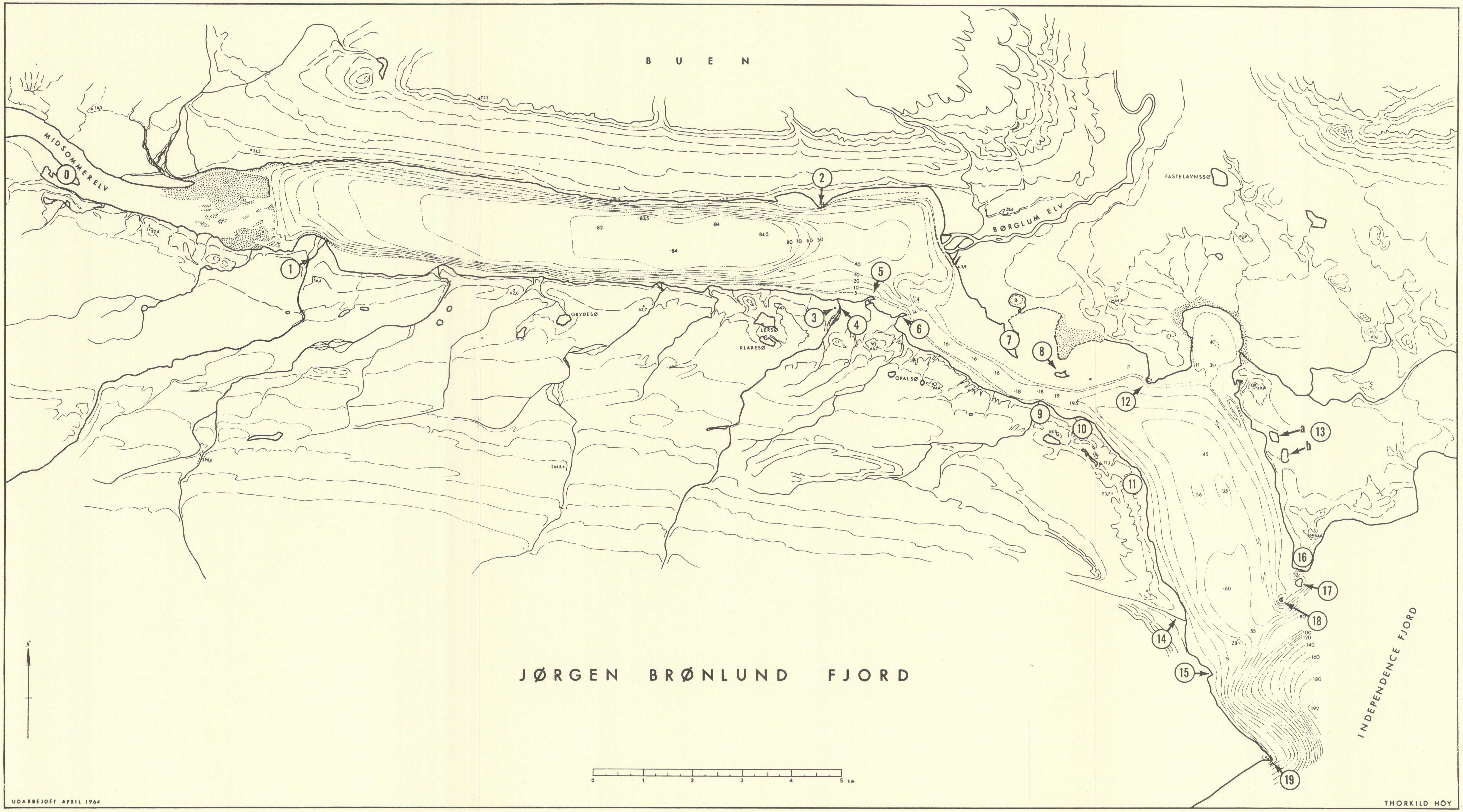
TROELSEN, J. C., 1949:—Contributions to the Geology of the Area around Jørgen Brønlund Fjord, Peary Land, North Greenland.—Ibid., **149**, 2.

* HØY's paper appeared after the present paper went to press. Pp. 23–26 deal with the bathymetric work done by HØY in 1948–50 and in 1963, (figs. 5–7 are echograms showing cross sections of the fiord). With regard to the 3 or 4 major furrows in the outer basin (HØY fig. 7, present paper fig. 2) HØY is most probably right when saying that furrows and ridges in that basin represent the original configuration.

The appendix, pp. 38–48, deals with the hydrology of the area, and with the drainage into the fiord.

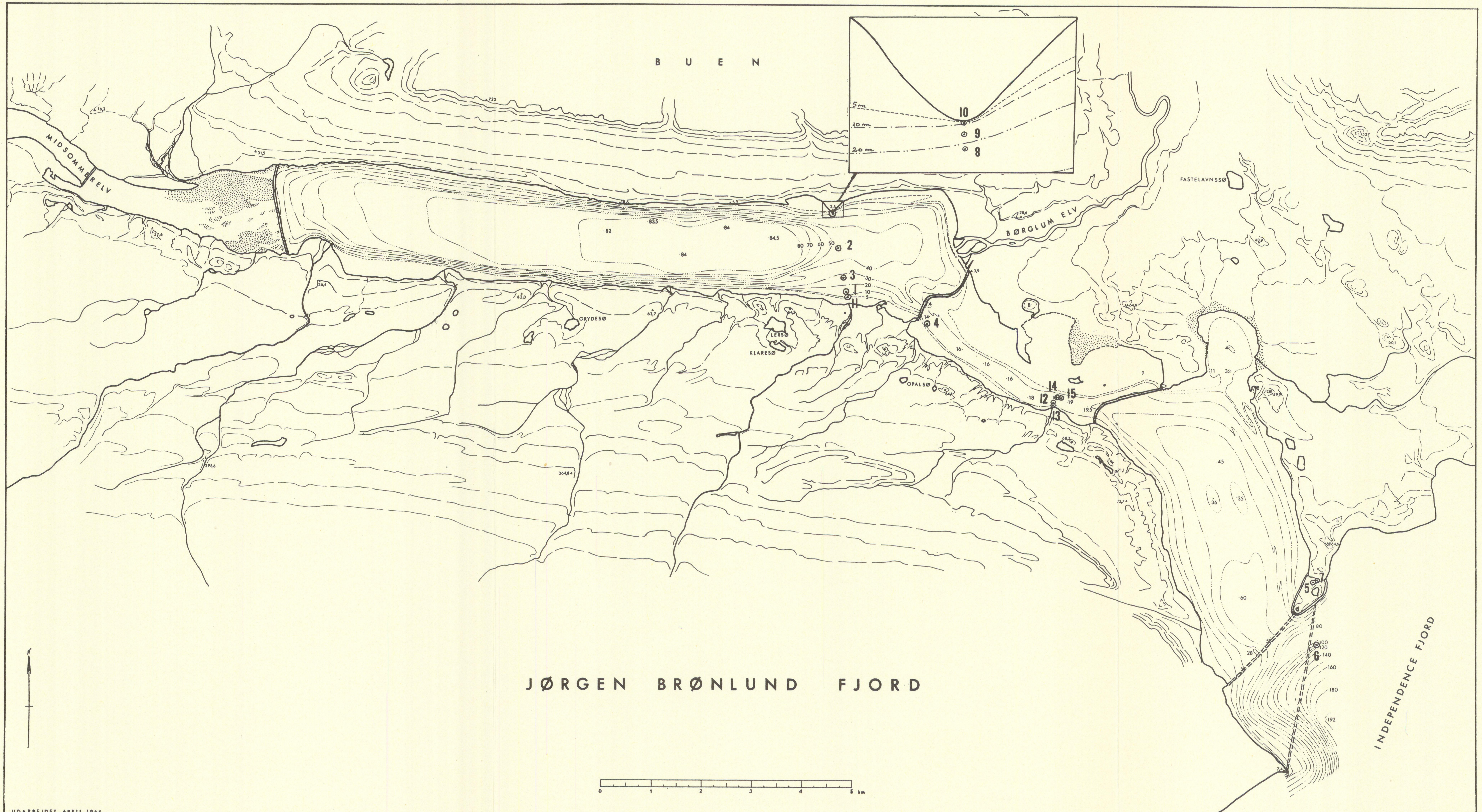
Pl. 4 is an excellent new map of Jørgen Brønlund Fjord.

Færdig fra trykkeriet den 19. juni 1970.



Place names mentioned in the text.

0. Tappen 1. Glaciologelv 2. Pileodden 3. Brønlundhus 4. Kedelkrogelv 5. Vestmolen 6. Østmolen 7. Kængurunæs 8 Edderfugleholm 9. Vandfaldsnæs 10. Midternæs 11. Vendenæs 12. Kap Michael Rottbøll 13 a. Nordre Saltsø b. Søndre Saltsø 14. Botanikerelv 15. Kap Mylius-Erichsen 16. Kap Harald Moltke 17. Dråbeholm 18. Mundingsholm 19. Kap Knud Rasmussen



The Regions of Jørgen Brønlund Fjord.—Heavy parallel lines full or stippled: regional borders.—Nos. 1–15: position of holes blasted for sampling with the van Veen grab.